TRANSACTIONS

OF THE

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM,

AND

NEWCASTLE-UPON-TYNE.

(New Series.)

VOL. V.

LONDON:

WILLIAMS AND NORGATE,

14, HENRIETTA STREET, COVENT GARDEN.

1918-1921.

c

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(New Series).

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REPORT ON THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1913.

READ MARCH 18TH, 1914, BY MR. EDWIN BURNUP, CHAIRMAN OF THE FIELD MEETINGS' COMMITTEE FOR 1913.

MR. CHAIRMAN, LADIES AND GENTLEMEN,—When your Committee a year ago elected me chairman of the Field Section of the Natural History Society I felt they had conferred upon me an honour I little deserved, and it was with very great diffidence I undertook the responsibility of presiding at your Field Meetings. In presenting my report of the six meetings held during 1913 (all of which I was able to attend) I am able to state that we were favoured on the whole by fine weather; the attendance of members was fairly good, but I should have liked to have seen a larger number of the younger ones present, because it is upon them we have to depend to carry on the work of this Society in after years. On Saturday, July 12, by the kindness of the Vale of Derwent Field Club, our members were invited to join their meeting at Blanchland, and six of our members were present. Unfortunately I have no report of the proceedings.

From October to February five informal evening meetings have been held at the Museum for the examination and discussion of interesting specimens, &c. These meetings have not been as well attended by the members as was hoped.

The FIRST FIELD MEETING of the season was held at Mitford on Saturday, May 3rd. It was a half-day excursion and was favoured with fine weather. A party of 24 in all (including seven members of the Vale of Derwent Field Club) met at Morpeth Station and walked by way of the Stanners to Springhill. Here, through the kindness of Mr. Geo. Renwick, they were permitted to inspect the gardens and also the ruins of Newminster Abbey. Founded about 1139, this abbey was frequently raided by the Scots, and in 1335 the monastery was dissolved and the buildings almost entirely destroyed. After having spent some time in examining the ruins and extensive excavations which are at present being carried out, the party proceeded to follow the beautifully wooded banks of the Wansbeck, where many of the plants of spring and early summer were in bloom; amongst them being lesser celandine, garlic, water avens, butterbur, white and red dead-nettle, common arum, ground ivy, sweet cicely, adoxa moschatel, coltsfoot, wood anemone, wood sorrel, wood sanicle, dog mercury, primrose, cowslip, dog violet, lesser spearwort, herb caris, barren strawberry, greater stitchwort, cuckoo flower, golden saxifrage, horsetail, marsh marigold, gorse, blackthorn and wild cherry. The following birds were seen or heard: tawny owl, jackdaw, mallard, curlew, cuckoo, sandpiper, dipper, house martin, swallow, missel thrush, song thrush (with young and eggs), willow warbler, whitethroat, wren (nesting), blue and great titmouse, tree sparrow and chaffinch. Arriving at Mitford, the Vicar, Rev. R. C. MacLeod, most kindly conducted the members over the church, its fine Norman nave, early English chancel, old sedilia and aumbry being greatly admired. By permission of Captain Mitford the Jacobean Manor House and the ruins of the Castle were visited. After a refreshing tea provided at the Plough Inn, and a short stroll up the Pont, the members returned by road to Morpeth in time for the 7.46 p.m. train to Newcastle, having spent a pleasant and instructive afternoon.

The SECOND FIELD MEETING was held on Wednesday, June 4th, at Rothley. Having to make a rather early start on a dull grey morning only nine members were present. On arriving at Scots Gap and leaving the train the party proceeded by the beautifully wooded road to Rothley. Permission having been kindly granted by Mrs. Clayton, they then struck over the moors. Beds of wild hyacinths were most luxuriant just below the crags. The outcrops of the Whinsill, the lower carboniferous deposits and the coarse Inghoe grits make the district of much geological interest. Gradually climbing the crag, we eventually arrived on the top, the site of Rothley Castle, from which on a clear day a most extensive view of the country is obtained. Unfortunately, owing to heat haze and threatened thunderstorms, the view was much curtailed. A kestrel's nest was pointed out just below the edge of the crag. After resting for some time and partaking of lunch, a move was made across the moors, where numbers of golden plovers were seen, evidently with young. Following what is known as "The Lady's Walk" we proceeded to the lower Rothley Lake, along the edge of which large beds of bulrushes were noted and a water hen's nest with eggs was found. Arrived at the upper lake the members were cordially received by Mr. and Mrs. Herbert Coxon and hospitably entertained to tea. After having thoroughly explored the woods bordering the lake, the party were most reluctantly compelled to proceed to Longwitton Station in order to join the last train, due about five o'clock, to return to Newcastle.

The following plants were found : water avens, winter-green, yellow pimpernel, tormentil, wild strawberry, germander and common speedwell, milkwort, gorse, broom, dog violet, pansy, primrose, cowslip, lady's smock, bugle, marsh marigold, pasture lousewort, marsh valerian, eyebright, knotted figwort, bulrush, mouse-eared chickweed, lesser spearwort, forget-me-not, field scorpion grass and wild hyacinth. The birds noted were : kestrel, snipe, curlew, golden plover, willow wren, swallow, stock dove, wagtail, cuckoo, whinchat, stonechat, corncrake, black-headed gull, water hen (nest and eggs), mallard, great and blue titmouse, thrush, blackbird, grouse, redstart, heron and swan.

It is with great regret I have to report that our kind friend Mr. Herbert Coxon, after a short illness, passed away in

September, and I am sure our deepest sympathy is with Mrs. Coxon and her family.

The THIRD FIELD MEETING was held in Upper Teesdale on Tuesday, Wednesday and Thursday, 24th, 25th and 26th of June. On Monday evening the party, consisting of 10 members, all having assembled at our head-quarters, Langdon Beck Hotel, the proposed excursions were carefully considered and decided upon. They were successfully carried out as follows :—

TUESDAY, Cronkley Fells.—A wet morning, but when the party started it looked like clearing up, which unfortunately it did not do until well on in the afternoon. Following the road towards High Force for about two miles and crossing the river by Cronkley Bridge (the river then being very low) we turned up the Tees-side and along the swampy ground. Here curlew, sandpipers and whinchats were seen, and large beds of mountain pansy, red rattle, early and purple orchis, viviparous bistort were noted. Sheltering here and there from the heavy showers of rain and taking our time, we gradually worked up the steep side of Cronkley Scar, until we arrived on the top. Here our lunch was demolished, although under difficulties, owing to the heavy rain and strong wind. Afterwards, intent on finding the sandy patch where some of the rarities grow, we tramped the moor hither and thither until the search was crowned by success. In the grey sand, the beautiful rosette of the mountain avens, and in close proximity the white-twisted whitlow grass, vernal sandwort, rock rose and shrubby cinquefoil were found. Striking across the deep heather and swampy bogs of the moor, a very steep and rough track was followed which led down to the banks of the Tees, now in full flood, roaring and dashing over the boulders in its rocky bed. Keeping along the rugged base of Cronkley Scars and passing the old Pencil Works and again crossing Cronkley Bridge, we returned to our head-quarters, decidedly wet, but well pleased with the finds we had made.

Wednesday was a perfect day for Cauldron Snout. A start was made up Harwood Beck, where in a tuft on the banks a pied wagtail's nest with five eggs was found. The meadows all round were most beautiful, owing to the quantities of *Geranium sylvaticum*, globe flowers, orchis, birdsfoot trefoil and earthnut, &c., which were growing in such wonderful profusion. Crossing the beck, the course of a small stream was now followed, a happy hunting ground for the botanist. Unfortunately the flowering time of the *Gentiana verna* was over. *Primulu farinosa* was still in bloom, yellow mountain saxifrage, Scotch asphodel, alpine bartsia, butterwort, orchis, blue, purple and white milkwort, all growing most luxuriantly. Over the swampy ground, curlew, golden and green plovers were circling, and a redshank's nest and three eggs was found by one of the party. Crossing the lower spur of Widdybank Fell, we followed the track alongside the Tees, until the impressive basaltic cliffs of Falcon Clints loomed high above our heads. There the path was very rough and required careful walking. Passing round the screes the meeting of the Maize Beck with the Tees came in sight. A dull thundering noise now greeted our ears, and as we rounded the bend, Cauldron Snout was seen, where the Tees plunges with sudden leaps, dashing from point to point and descending some 200-ft. in about half a mile. We rested at the foot of the fall for some time, admiring the grand effect of falling water and fine formations of the surrounding rocks. After lunch, having climbed to the top of the falls, we obtained beautiful views over the Weel and higher stretches of the Tees and mountains around—Cross Fell, Dufton Fell, Mickle Fell, &c. As time was now getting on we crossed Widdybank Fell and rejoined the stream we had followed earlier in the day, and thus returned to our temporary home.

Thursday.—Unfortunately some of our party were obliged to leave. The remainder decided to visit the Tees above the High Force and down as far as Winch Bridge. Crossing Cronkley Bridge and following down the meadows and then striking across the heather, the White Force was visited, but unfortunately there being little water in the Merrigal Beck it was not seen at its best. Here green spleenwort and brittle fern were found, and in crossing the moor some white rattle. It was a warm day with bright sunshine, and on arrival at the side of a clear little stream overshadowed by juniper bushes we were glad to rest and enjoy our lunch; after which, following the course of the Tees, we soon came in sight of High Force, always grand and impressive, with its 60-ft. clear drop and imposing cliffs finely wooded. Passing through the fir plantations, a path was taken along the lower meadows. Quantities of shrubby cinquefoil were noticed on an island, and on the banks of the river many of the other plants before seen. Arriving at Winch Bridge a halt was made to admire the fine falls just above and the grand formation of the rocks and bed of the river. Returning by retracing our steps to the bridge near High Force, a friendly lift bore us to Langdon Beck in the neighbourhood of which the evening was spent. On Friday morning Harwood Beck was explored, and after an early lunch the party most reluctantly broke up, having spent a most successful and enjoyable time.

Amongst the plants and ferns found during the meeting were :—

Globe Flower, *Trollius Europæus.*
Marsh Marigold, *Caltha palustris.*
Hairy Rock Cress, *Arabis hirsuta.*
Scurvy Grass, *Cochlearia officinalis.*
Twisted Whitlow Grass, *Draba incana.*
Vernal ,, *Draba verna.*
Rock Rose, *Helianthemum vulgare.*
Mountain Pansy, *Viola tricolor.*
Dog Violet, *Viola arenaria.*
Sundew (round-leaved), *Drosera rotundifolia.*
Milk Wort, *Polygala vulgaris.*
Red Campion, *Lychnis diurna.*
Ragged Robin, ,, *flos-cuculi.*
Vernal Sandwort, *Arenaria verna.*
Small St. John's Wort, *Hypericum pulchrum.*
Square ,, ,, *quadrangulum.*
Wood Cranesbill, *Geranium sylvaticum.*

Shining Cranesbill, *Geranium lucidum.*
Herb Robert ,, *Robertianum.*
Bird's Foot Trefoil, *Lotus corniculatus.*
Lady's Fingers, *Anthyllis vulneraria.*
Horse Shoe Vetch, *Hippocrepis comosa.*
Milk ,, *Astragalus glycyphillos.*
Mountain Avens, *Dryas octopetala.*
Water ,, *Geum rivale.*
Herb Bennett, *Geum urbanum.*
Cloudberry, *Rubus Chamæmorus.*
Dog Rose, *Rosa canina.*
Shrubby Cinquefoil, *Potentilla fruticosa.*
Tormentil, *Tormentilla officinalis.*
Biting Stonecrop, *Sedum acre.*
Hairy Stonecrop, *Sedum villosum.*
Yellow Mountain Saxifrage, *Saxifraga aizoides.*
Mossy Saxifrage, ,, *hypnoides.*
Golden Saxifage, *Chrysosplenium oppositifolium*
Masterwort, *Peucedanum Ostruthium.*
Sweet Cicely, *Myrrhis odorata.*
Earth Nut, *Bunium flexuosum.*
Woodruff, *Asperula odorata.*
Marsh Valerian, *Valeriana dioica.*
Marsh Hawk's Beard, *Crepis paludosa.*
Mountain Cudweed, *Antennaria dioica.*
Scorpion Grass, *Myosotis arvensis.*
Forget-me-not, *Myosotis palustris.*
Knotted Figwort, *Scrophularia nodosa.*
Eyebright, *Euphrasia officinalis.*
Foxglove, *Digatalis purpurea.*
Red Rattle, *Pedicularis palustris.*
Yellow Rattle, *Rhinanthus Crista-galli.*
White Rattle.
Alpine Bartsia, *Bartsia alpina.*
Cow Wheat, *Melampyrum pratcuse.*
Wild Thyme, *Thymus serpyllum.*
Bugle, *Ajuga reptans.*
Bog or Buck Bean, *Menyanthes trifoliata.*
Butterwort, *Pinguicula vulgaris.*
Yellow Pimpernell, *Lysimachia nemorum.*
Thrift, *Armeria maritima.*
Bird's Eye Primrose, *Primula farinosa.*
Snakeweed, *Polygonum bistorta.*

Viviparous Bistort, *Polygonum viviparum.*
Spotted Orchis, *Orchis maculata.*
Marsh ,, ,, *latifolia.*
Purple ,, ,, *mascula.*
Sweet-scented Orchis, *Gymnadenia Conopsea.*
Twayblade, *Listera ovata.*
Scottish Asphodel, *Tofieldia palustris.*
Blue Grass, *Sesleria cærulea.*

Ferns.

Adder's Tongue, *Ophioglossum vulgatum.*
Moonwort, *Botrychium lunaria.*
Common Spleenwort, *Asplenium trichomanes.*
Wall ,, ,, *Ruta-muraria.*
Green ,, ,, *viride.*
Brittle Bladder Fern, *Cystopteris fragilis.*
Oak Fern, *Polypodium Dryopteris.*
Beech ,, ,, *pheyopteris.*
Polypody Fern ,, *vulgare.*
Blechnum, *Blechnum spicant.*
Shield Fern, *Aspidium aculeatum.*
Male ,, ,, *filix-mas.*
Female ,. *Asplenium filix-foemina.*
Bracken, *Pteris aquilina.*
Parsley Fern, *Allosorus crispis.*

The following were among the birds seen or heard:—kestrel, curlew, snipe, golden plover, green plover, redshank and nest, sandpiper, dipper, king ousel, wheatear, whinchat, meadow pipet and young, wren and young, pied wagtail and nest, yellow and grey wagtail, spotted flycatcher, swallow, house martin, grouse and young.

The FOURTH MEETING was held on Saturday, July 26th, at Edlingham. On arrival at Edlingham Station the party were met by Mr. J. H. Holmes, who most kindly acted as guide. Leaving the station and proceeding a short distance along the road towards Rothbury, a good view of Edlingham village, Norman Church and ruined Pele Tower was obtained; then striking up a rough track through luxuriant growth of heather and bracken we made our way across the moors to Black Lough, a small sheet of water in the wild moorland, on which numbers of gulls and wild ducks were disporting. Here the stumps of an old birch forest are still to be seen rooted in the ground at the edge of the water. In the surrounding boggy ground fine specimens of sundew and bog asphodel were found, and on the moor some white bell heather. After resting some time, the party proceeded to the high ground above Corby Crags, from which splendid views of the surrounding country, the distant ranges of Cheviot and Simonside Hills, Dunstanborough Castle and the coast line were obtained. Descending and crossing the deep railway cutting, which was beautifully clothed with foxglove, willow herb, and heather, and much admired, we passed through the pine woods and fine beech avenue and wooded ground, to Glen Allen, where the members were hospitably received by Mr. and Miss Holmes and entertained to tea.

A fine gnarled oak was seen on the lawn, one of the survivors of an ancient forest. Much too soon a move had to be made for Whittingham Station to catch the last train to Newcastle.

The following plants were found :—Bog asphodel, sundew, white bell heather, fine-leaved heath, ling, tormentil, red-rattle, eyebright, foxglove, milkwort, ragwort, selfheal, birdsfoot trefoil, greater trefoil, meadow sweet, purple, spotted, and white orchis, ragged robin, large valerian, honeysuckle, enchanter's nightshade, brooklime, agrimony, red and white campion, willow herb, rose bay willow herb, meadow vetchling, bitter vetch, red bartsia, meadow cranesbill, wood sanicle, square St. John's wort, herb Robert and germander speedwell.

Birds seemed scarce, only the following being particularly noticed :—wild duck, black-headed gull, curlew, golden plover, lapwing, wheatear, and whinchat.

The FIFTH MEETING was held on Wednesday, Sept. 3rd, at Howick. Making another early start, nine members arrived at Alnmouth Station, where conveyances were awaiting to drive the party to Howick. Rain was then falling heavily. After consultation it was decided to carry out the programme, with a slight alteration. Crossing the river Aln at Lesbury, and passing through the picturesque village of Longhoughton, a fine display of roses and other plants was noticed in the cottage gardens. Skirting the Howick woods for the east gate of the park, the party left the conveyances and were gladdened by clearing and brightening weather. Entering the woods, by the kind permission of Earl Grey, the church was first visited; then the route followed was by way of the "Long Walk," skirting the burn to the sea. In the glen were many fine specimens of beech, elm, oak and pine, while the luxuriant growth of mercury, lesser periwinkle and enchanter's nightshade was remarked upon and carefully examined. A welcome halt was made at the mouth of the burn, where lunch was partaken of under difficulties, owing to the kind attentions of wasps; after which, moving north along the beach and cliffs towards Cullernose point and returning by the road to Howick we joined our conveyances and were soon driven into Alnmouth, where tea was provided. We returned to Newcastle by 5.35 p.m. train.

The following plants were found :—great hairy willow herb, rose bay willow herb, smooth-leaved willow herb, lesser periwinkle, dog mercury, enchanter's nightshade, figwort, meadow cranesbill, common persicaria, wild cornel, grass of Parnassus, purple sea rocket, hemp agrimony, sow thistle, hairy St. John's wort, hemlock, storksbill, hairy mint, great reed mace, red campion, white bladder campion, small flowered gentian, purple spiked loosestrife, celery-leaved crowfoot and common mallow.

Amongst tbe birds noted were : herring and black-headed gull, redshank, dipper, waterhen, carrion crow, wood pigeon, pied and yellow wagtail, wheatear, blue tit and spotted fly-catcher.

The Sixth and Last Field Meeting of the season was held at Marsden on Wednesday, October 8th. Unfortunately owing to the very wet morning and unsettled state of the weather only five members met at South Shields Station (but were joined at Trow Rocks by seven student members of the Ryhope Secondary School). Leaving the station and passing along Ocean Road, the Marine Park was entered ; here the fine effect of massed pentstemon, gladioli, sedums, &c., although their best was over, was still very beautiful. The party followed the coast road to Trow Rocks and then along the base of the cliffs. Dr. D. Woolacott of Armstrong College acted as guide, and in his interesting and instructive manner pointed out and explained the contorted and dislocated strata and general geology of the coast. On arriving at Frenchman's Bay, being unable to round the next point, we ascended the cliff and crossed over by the footpath to the north end of Marsden Bay. Descending to the beach, we followed along to the extreme end of the bay, noticing that several very heavy falls had taken place both at the rock itself and also of the cliffs. Returning to the "Grotto" and having enjoyed a refreshing tea, a hearty vote of thanks was accorded to Dr. Woolacott for his kindness in conducting the party. The members then made their way, some to Marsden Station and others to Sunderland, to return home after having spent a pleasant and instructive afternoon. Owing to the stormy weather, bird life was scarce, only a few gulls being seen in the distance; and so late in the season nothing of botanical interest was found.

I should like to draw the attention of the members to one of the rules of the Tyneside Naturalists' Field Club, when it was originated April 25th, 1846, viz.: "The wanton persecution of rare birds and the extinction of rare plants were strongly to be discouraged." Never was this rule more necessary than at the present time, when we hear of the destruction of birds, the ruthless and wholesale removal of plants and ferns—so much so that in places where certain plants used to grow luxuriantly, not a single specimen can now be found. I trust our members will do all they can to discourage this practice whenever possible.

In conclusion, I have to thank the ladies and gentlemen who have attended the meetings for their kind consideration and assistance to me, especially our excellent and indefatigable Hon. Secretary, Mr. C. E. Robson, who has always made such admirable arrangements to ensure our comfort, and the successful carrying out of our programme.

Terrestrial Acari of the Tyne Province.

By the REV. J. E. HULL, M.A.

I.—ORIBATIDÆ.

ADDENDA ET CORRIGENDA.

(See vol. IV., part II).

At p. 382 the primary division of the Family into two groups was accidentally omitted, viz. :—

§i. Brachypylina.

Anal and genital apertures comparatively small, more or less quadrate, subequal, well separated. Tibiæ of all the legs clavate or subclavate.

(Includes sub-families A, B, C, and D).

§ii. Macropylina.

Anal and genital apertures longer, contiguous, unequal. Tibiæ all cylindrical or broadest at the base.

(Includes sub-families E and F.)

On p. 384, for 4th line of dichotomous table of Tegeocranus, read " Lamellæ without cusp."

On p. 392, after the entry under 55 add

55a. *Melanozetes cambricus*, Hull (sp. nov.)

Body rather rotund, dull black. Dorsal spines pretty long curved, stiff but slender. Lamellæ as of *edwardsi* but running to a point in front. Sensilli clavate, small.

Taken by Dr. Jackson on Moel Siabod in moss at 2,000 feet.

P. 393. **Oribates nervosus**, Berl. Has occurred with *Formica rufa* at Riding Mill and Chopwell (66b, 67b).

P. 400. In line 5 of the dichotomous table delete "acute."

P. 408. **Hoploderma stricula**, K. Has occurred plentifully under stones in West Allendale (67a).

On page 409, fifth line from the end, read "*spiculate* head."

II.—THROMBIDIIDÆ.

In extending the local list so as to include all species on record for the British Isles I have had to rely chiefly on the published papers of Dr. C. F. George (Naturalist *passim*) and the Irish list of Mr. J. N. Halbert (Clare Island Survey). I am indebted to Dr. George and the authorities of the Hull Municipal Museum for the privilege of examining Dr. George's mounted specimens—41 slides in all, including 21 British species. The Irish list enumerates 31. A few other odd records gave me a nucleus of 46 species in all, and I have been able to increase the total to 87. I owe very much to the ample supplies of material which I have received from Dr. Randell Jackson, Mr. R. S. Bagnall, Dr. J. W. H. Harrison, Mr. W. Falconer, Mr. W. P. Winter, Mr. J. C. Varty-Smith, and others. I have also to thank Mr. Wm. Evans for a MS. list of Scotch species.

What I have said concerning classification, nomenclature, and arrangement in my previous paper on the Oribatidæ is equally applicable here and need not be repeated.

By Dr. Berlese and others the Family is divided into two sections according as the larvæ and adults are similar (homomorphous genera) or dissimilar (heteromorphous). The distinction appears to be quite good though based on facts imperfectly known and useless for purposes of identification. The heteromorphous group includes the first two sub-families —*Thrombidiinæ* and *Rhyncholophinæ*—distinguished by the presence of a continuous pubescence on body and legs, and a chitinous crista (median, longitudinal, and usually more or less linear) bearing one or two pairs of sensilli.

A.—Sub-family Thrombidiinæ.

Mandibles external and hooked. Sensilli situated near the middle of the crista. Eyes (British species) always 4.

1.	Tarsus conspicuously pulvillate	*Allothrombium.*
	Pulvillus absent or very inconspicuous	2
2.	Body hairs simple spiniform nude	3
	Body hairs otherwise...	6
3.	Crista with two pairs of sensilli	*Johnstoniana.*
	Crista with only one pair of sensilli...	4
4.	Eyes conspicuously pedunculate	*Podothrombium.*
	Eyes not on common peduncle, sessile	5
5.	Fore margin of body with a super-rostral process (nasus)	*Rhinothrombium.*
	Nasus absent	*Eothrombium.*
6.	Sensilli situated behind middle of crista	7
	Sensilli situated before the middle	*Sericothrombium.*
7.	Body hairs spiniform pectinate or plumose	*Microthrombidium.*
	Body hairs crassate, variously formed, villous ...	*Enemothrombium.*
	Body hairs (at least behind), ramose above, villous below	*Georgia.*

ALLOTHROMBIUM, Berl., 1910.

Tarsi with a conspicuous pulvillus under and between the claws. Palpal claw large, without accessory claws or spines. Dorsal setæ plumose, pretty dense. Eyes on long peduncles.

Type: *fuliginosum*, Herm.

1. Allothrombium fuliginosum, Herm. 67.

British examples appear to belong to *var. norvegicum*, Berl.

Yorkshire, Scotland.

SERICOTHROMBIUM, Berl., 1910.

Palp without secondary claws or spines. Dorsum wide, depressed, usually wrinkled and impressed, indented in the middle of the posterior margin. Eyes on long peduncles. Crista bad to see.

Type: *holosericeum*, L.

1.	Tarsus i much thicker than tibia i... ...	*brevimanum.*
	Tarsus i not thicker than the tibia ...	2
2.	Dorsal trichomes all alike	*scharlatinum.*
	Anterior and posterior trichomes dissimilar	*holosericeum.*

2. Sericothrombium holosericeum, L. 66, 67, 68.

Tarsi i slightly clavate. Dorsal trichomes truncate-clavate, but attenuate or even acute in the thoracic region.

The common "scarlet mite," abundant everywhere. It sometimes reaches a length of 4mm.

3. Sericothrombium scharlatinum, Berl. 67.

Dorsal trichomes uniform—very slightly clavate with rounded tips; about 130 μ in length. Very plentiful in West Allendale in May; elsewhere the records are hopelessly confounded with the preceding.

Yorkshire.

4. Sericothrombium brevimanum, Berl. 66, 67.

Trombidium mushami, Geo.

T. buccinator, Geo.

Dorsal trichomes much shorter than in the two preceding species, varying a little in form, but all truncate-clavate with expanded tips.

Yorkshire.

ENEMOTHROMBIUM, Berl., 1910.

Dorsal trichomes more or less inflated (usually also transversely septate) rising from a socket which is generally rayed or lobed at its summit: the trichomes of the limbs (at least of the upperside) spatulate and feathered, plano-convex. Article iv. of the palp with secondary claw or claws and seriate spines. Eyes not pedunculate but seated on a tuber.

Type: *bifoliosum*, Can.

1.	Dorsal trichomes arcuate clavate	*clavatum.*
	Dorsal trichomes erect	2
2.	Dorsal trichomes fusiform clavate	*pexatum.*
	Dorsal trichomes much inflated, not acuminate	3
3.	Dorsal trichomes without stalk above the socket	*bullatum.*
	Dorsal trichomes shortly stalked	*subrasum.*

5. Enemothrombium clavatum, Geo. 66, 67.

E. densipapillum, Berl.

Fond of sphagnum, though by no means confined to it. Easily distinguished by the curved trichomes.

Yorkshire, Scotland.

6. Enemothrombium pexatum, K. 67.

Ottonia conifera, Geo.

Enemothrombium calycigerum, Berl.

Dorsal trichomes septate, the distal segment smaller, smooth and bluntly pointed or slightly wedge shaped.

Yorkshire, Ireland, Scotland.

7. Enemothrombium bullatum, Geo. 67.

E. rasum, Berl.

This species, like the next, has much inflated trichomes which mostly collapse in drying or when mounted in balsam. They are everywhere contiguous on the living animal, so that the dorsum under the lens appears to be areolate and glabrous.

Usually found in water or near it. Yorkshire. Cumberland (Varty-Smith). Scotland.

8. Enemothrombium subrasum, Berl. 67.

Ottonia ignota, Geo.

Generally in water or wet sphagnum. After death only a few of the larger trichomes preserve their form. The basal segment appears to be longitudinally ribbed (so also in the other three species), but this may be due to the seriate hairs. The distal segment is a mere flattened cap with a fringe of minute spiny hairs.

GEORGIA, gen. nov.

General appearance of a slender *Enemothrombium*, but (as in some *Sericothrombia*) the dorsal trichomes vary, being more or less setaceous and feathered on the anterior parts of the dorsum, but from the shoulders backward they are lobate or ramose at the apex and plumose below; always obtuse and opaque. Hairs of the limbs simple, plumose.

Type: *ramosa*, Geo.

9. Georgia ramosa, Geo. 66, 67.

Ottonia ramosa, Geo.

Ottonia sheppardii, Geo.

Microtrombidium ramosum, Halbert.

Quite a common species in Britain, but not yet recognised abroad.

Yorkshire, Cheshire, Lancashire, Scotland, Ireland.

MICROTHROMBIDIUM, Berl., 1910.

Agreeing generally with the two foregoing, but differing in the following characters: Abdomen not narrowed behind; no inflated or spatulate or branched trichomes on either body or limbs; eyes usually sessile or nearly so; accessory armature of article iv. of the palp considerably reduced, and article v. more or less bluntly pointed, never distally expanded.

Type: *pusillum*, Herm.

I give these characters with some reserve as few species are known to me; but those which I do know indicate two very distinct groups.

§i. *Microthrombidium*, s. str. Type : *pusillum*, Herm.

Dorsal pubescence of thickened opaque trichomes. Eyes obliquely raised on a much abbreviated peduncle. Tarsus i broadly ovate. Lateral spine of palp usually solitary and very strong.

§ii. Type : *sucidum*, L. K.

Dorsal pubescence of true translucent spines uniformly tapering to a fine point, feathered with long fine hairs. Eyes less oblique, more nearly sessile, and further apart than in §i. Tarsus i oblong or only slightly clavate.

§i.

1. Dorsal trichomes mingled with some feathered spines ... *plancum*.
   Dorsal trichomes all similar 2
2. Dorsal trichomes slender, rather long, almost cylindrical *pusillum*.
   Dorsal trichomes shortly fusiform, densely hairy ... *simulans*.

10. Microthrombidium pusillum, Herm. 67.

Ottonia valga, Geo.

Trombidium parvum, Geo.

The examples recorded under this name are all northern (Germany northwards). The species may therefore be different from Hermann's *pusillum*, in which case its name will be *puniceum*, Koch. I do not find any specific difference between the British specimens I have seen and the *pusillum* of Thor and Oudemans. In West Allendale I find it in sphagnum and have never seen it below 1,000 feet.

Yorkshire, Ireland, Scotland.

11. Microthrombidium plancum, K. 67.

M. geographicum, Berl.

West Allendale, in moss, 1913. I have never seen it since.

12. *Microthrombidium simulans*, Berl.

This I have never seen.

Ireland.

§ii.

1.	Dorsal trichomes all spinous, feathered	*sucidum.*
	Some of the trichomes longer nude	*spinosum.*

13. Microthrombidium sucidum, L. K. 67.

Rare, in sphagnum, West Allendale.

14. *Microthrombidium spinosum*, Can.

Not known to me.

Ireland.

PODOTHROMBIUM, Berl.

Abdomen ellipsoid, dorsum convex, its clothing spinous simple, its cuticle often dusky. Legs long and slender; tarsus i not (or scarcely) thicker than the tibia. Article v. of the palp long, slender, clavate. Sensillar area of crista central between the eyes which are pretty strongly pedunculate.

Type: *bicolor* Hermann.

Tarsus i shorter than the tibia	*filipes.*
Tarsus i not shorter than the tibia	*bicolor.*

15. Podothrombium bicolor, Herm.

Conspicuous on account of the contrast between the dark body and red legs. In West Allendale it is the most abundant of the *Thrombidiinæ*, particularly among the rushes and sphagnum of the fells, ascending to 2,000 feet.

Generally distributed.

16. Podothrombium filipes, K. 67.

Johnstoniana levipes, Geo.

The slender legs give it the appearance of a *Rhyncholophus*. The usual habitat is under stones, and I have not seen it above 600 feet.

Yorkshire.

17. Podothrombium magnum, Berl. 66.

First pair of legs as in *bicolor* but the species is larger (always over 2 mm.) and wholly red.

Durham (Easington—R.S.B.)

JOHNSTONIANA, Geo. (*Diplothrombium*, Berl.)

Accessory claw of palp lateral with a basal tooth. Above the rostrum a conical process ('nasus'). Eyes very prominent, lateral. Dorsal trichomes elbowed at the base and seated on tubercles.

Type: *eximia*, Berl.

18. Johnstoniana eximia, Berl. 67.

Diplothrombium eximium, Berl.

Johnstoniana errans, Geo.

This interesting little species I usually find on dead wood. Dr. George identifies it with Dr. Johnston's "Wandering mite," but I cannot follow him.

Yorkshire, Cheshire, Scotland (Evans).

18a. Johnstoniana errans, Johnston. 3 mm. 68.

Rhyncholophus errans, Johnston (Proc. Berw. Nat. Club, 1852). Dorsal setæ on tall cylindrical tubercles. The crista terminates behind in a curious heart-shaped bald spot.

Somerset, Yorkshire, Cambridge.

19. *Johnstoniana longipalpis*, Berl.

Tarsus i tuberculate at the base above.

Cheshire (Delamere—Dr. Jackson).

EOTHROMBIUM, Berl.

Crista linear, the sensilli independent and unenclosed on either side of the middle. Eyes quite sessile, red, conspicuously unequal. Dorsal trichomes spinous, simple, short and not very dense. Abdomen oblong; cephalothorax well defined.

Type: *echinatum*, Berl.

20. Eothrombium echinatum, Berl. 66, 67.

Ottonia echinata, Geo.

Ottonia evansii, Geo.

A small species of a pale flesh colour, with conspicuous red eyes, not uncommon among moss.

Yorkshire, Cheshire, Cumberland, Scotland (Evans).

21. *Eothrombium siculum*, Berl.

Smaller than *echinatum* with more slender legs. I have not seen it.

Ireland.

RHINOTHROMBIUM, Berl.

Exactly like the preceding genus except that a nasus is present, and the sensillar area is enclosed

Type: *nemoricola*, Berl.

22. Rhinothrombium nemoricola, Berl. 1950μ. 66, 67.

Very similar in appearance to No. 18, but much less common, and usually found under stones.

Ratio of tarsus i : tibia i = 100 : 60.

Cumberland.

23. Rhinothrombium inopinum, sp. n. 1560μ. 67.

Considerably less than *nemoricola*. Dorsal pubescence composed of stout short spines, acute and dagger-shaped, each springing from a well-defined ring. Cuticle scabrid. Anterior eye much smaller than the posterior and not placed obliquely. Tarsus i, 280; tibia, 240. (Fig. 47).

West Allendale, in moss.

B.—Sub-family Rhyncholophinæ.

Mandibles internal, not hooked. Sensilli terminal, anterior or posterior or both. Post-thoracic furrow present or not. No accessory claws to the palps. Eyes 2 or 4, sessile.

1.	Crista consisting of sensillar area only	*Smaris.*
	Crista normal, i.e., linear with terminal expansions	2
2.	Eyes 4	*Rhyncholophus.*
	Eyes 2	3
3.	Dorsum sculptured, its clothing crassate or scaly...	*Smaridia.*
	Dorsum plain, setæ not crassate, nude or plumose	4
4.	Post-thoracic furrow absent...	*Achorolophus.*
	Post-thoracic furrow present...	5
5.	Dorsal trichomes opaque, dark coloured	*Ritteria.*
	Dorsal trichomes trunslucent	*Belaustium.*

SMARIDIA, Dugès, 1834.

Dorsum strongly shouldered, its surface variously sculptured; trichomes more or less clavate or squamose Rostrum prominent, very long when fully extended.

Type : *papillosa*, Herm.

24. *Smaridia ampulligera*, Berl.

Dorsal trichomes not pectinate or plumose.

Yorkshire, Scotland.

SMARIS, Latr., 1807.

Like *Smaridia* but much larger, and the sensillar area only of the crista is present (often taken for a pair of median eyes !). Rostrum inferior, normally hardly visible from above. Dorsal trichomes spine-like.

Type : *expalpis*, Herm.

25. Smaris expalpis, Herm. 66, 67, 68.

Quite common, and partial to watery places and sphagnum. Ascends over 2,000 feet on Cheviot. The dorsal trichomes are narrowly lanceolate, elbowed at the base, each springing from the centre of a hexagonal space.

RHYNCHOLOPHUS, Dugès, 1834.

Eyes four. Body not rounded behind, but truncate or slightly angular. Dorsal trichomes rodlike, opaque, dark. Pedes i. and iv. usually long and slender.

Type: *phalangioides*, De Geer.

1.	Dorsal trichomes bluntly serrate	2
	Dorsal trichomes minutely pectinate, or nude... ...	3
2.	Dorsal trichomes long, slender, acute	*regalis.*
	Dorsal trichomes shorter, thicker, obtuse	*phalangioides.*
3.	Dorsal trichomes very minutely and sparsely pectinate	*penninus.*
	Dorsal trichomes quite smooth	*pachypus.*

26. Rhyncholophus phalangioides, De Geer. 67.

The dorsal trichomes, thickly serrate to the very tip, never end in a single point.

Yorkshire, Cumberland, Scotland.

27. Rhyncholophus regalis, Koch. 66, 67, 68.

R. communis, Geo.

The dorsal trichomes end in a single point. (Fig. 53, 57).

The most abundant species, ascending to 1,800 feet in West Allendale. It runs swiftly in hot sunshine, on dry banks and over rocks. Generally distributed.

28. Rhyncholophus penninus, sp. nov. 67.

Total length, 1,300μ. Differs from the two foregoing species in having no spines on the third joint of the palp, and those on the fourth are mere tubercles, hardly visible. Also the legs are less unequal, due to the comparative shortness of the fifth and sixth articles of legs i and iv (counting the tarsus as the seventh). From trochanter to tarsus of leg iv the lengths of the joints of an average specimen are 110, 120, 240, 250, 290, 130. The exceedingly minute pectinations of the setæ are only visible under a high power. (Fig. 55, 58).

A few specimens only, West Allendale.

29. Rhyncholophus pachypus, sp. nov. 67.

Distinguished from the preceding by the nude setæ, which are of varying length and comparatively few. Also the legs are much thicker, and the proportions of the articles are different (compare the following measures of the fourth leg with those given above—130, 130, 280, 320, 400, 170). The dorsum is unicolorous. (Fig. 59).

West Allendale, at 900 feet. I have also received it from Yorkshire (Cleveland).

RITTERIA Krämer.

Eyes 2. Body large and almost quadrate, not rounded behind, widest at the shoulders. Dorsal trichomes opaque, serrulate. Crista not projecting beyond the fore margin.

Type: *nemorum*, Koch.

1. Three white spots on the dorsum ... ... *trimaculata.*
Dorsum without spots ... ... *nemorum.*

30. Ritteria nemorum, Koch. 2,200μ. 66, 67, 68.

The most abundant species in this family, met with chiefly in the larval (on various Opiliones) and adult forms. Note that under the microscope some of the trichomes (which are all black) may appear white by reflected light. The cuticle is clear red.

var. vertex, Krämer, has the long trichomes of the anterior sensillar area serrulate, not smooth as in the type. General and common.

31. *Ritteria trimaculata*, Herm.

I have met with this species only in a sedgy bog in Delamere Forest, where it was plentiful. It is narrower than *nemorum.* The dorsal trichomes are brown except two large humeral spots (reniform) of white trichomes, and another behind generally smaller and more or less circular. Cuticle pallid.

Scotland.

BELAUSTIUM, Heyden, 1828.

Eyes 2. Body elliptical, elongate, not shouldered, clothed with slender translucent setæ, simple or plumose. Dorsum not very convex. Post-thoracic furrow present. Anterior sensillar area projecting above the rostrum in a sort of nasus.

Type: *murorum*, Herm. (= *quisquiliarum*, Herm).

1.	Dorsal trichomes plumose or serrulate ..	...	2
	Dorsal trichomes nude	...	4
2.	Dorsal trichomes fusiform densely serrulate	...	*scopularium.*
	Dorsal trichomes normally filiform ...	...	3
3.	Apex of crista triangular...	...	*tardum.*
	Apex of crista more ot less rounded ...	...	*quisquiliarum.*
4.	Dorsal trichomes rigid, spiny, acute ...	...	*rubripes.*
	Dorsal trichomes normally filiform ...	...	5
5.	Apical pre-sensillar setæ, several ...	...	*miniatum.*
	,, ,, two	...	*harrisonii.*
	,, ,, one only ...	...	*sabulosum.*

32. **Belaustium miniatum**, Herm. 66, 67, 68.

Rhyncholophus hirsutus, Geo.

Apical part of crista hardly projecting beyond the prodorsal margin, and bearing about 10 slender setæ. A form with pubescence a little denser than the type, especially behind (*Rhyncholophus hirsutus*, Geo.) has been referred to *rubripes*, Trou. which is, I think, a mistake.

Generally distributed in moss and detritus of all kinds. I have even taken it from a squirrel's drey.

Lancashire, Yorkshire, Cumberland, Ireland.

33. **Belaustium rubripes**, Trouessart. 66.

The spiny setæ mark this species off from all the rest. In front of the anterior sensilli there are nine, exactly like those of the dorsum, 4 in a transverse line, 5 marginal.

Maritime or sub-maritime. Taken by Dr. Harrison in Greatham marshes. Other British records under this name should probably be referred to 32.

34. Belaustium quisquiliarum, Herm. 66, 67, 68.

Abundant in moss and at the roots of grass in summer.

Not recorded for Ireland, but probably distributed quite generally.

35. *Belaustium tardum*, Halbert.

West coast of Ireland, under stones. (Fig. 63).

36. *Belaustium scopularium*, sp. nov.

Body very long and narrow ($1{,}850\mu \times 700\mu$) like the next species, but distinguished from that and from all the rest by the form of the dorsal trichomes—fusiform, acute, thickly clothed with appressed spinules. The post-thoracic furrow is inconspicuous, and the prodorsum (or cephalothorax) is very small compared with the rest of the body. Crista normal, apical presensillar setæ two. Setæ of the legs simple. (Fig. 64, 65).

Colour light red. A single example was taken on the sandhills at St. Anne's-on-the-Sea, Lancashire.

37. Belaustium harrisonii, sp. nov. 66.

Body long and narrow ($1{,}500\mu \times 600\mu$) like that of the preceding, the pubescence simple but dense—more so than in any other species. Prodorsum small, transverse furrow inconspicuous. Presensillar setæ 2. (Fig. 61, 62).

Colour red, but the dense pubescence gives the animal a greyish brown appearance. Probably maritime or sub-maritime; taken by Dr. Harrison in Greatham marshes.

38. Belaustium sabulosum, Halbert. 66.

Greatham marshes (Dr. Harrison).

Ireland (coast sandhills).

38a. **Belaustium vittatum**, sp. nov. 1,900 μ (width 740 μ.) 66.

Elongate; red with a median yellow stripe commencing behind the shoulders and expanding a little at the posterior margin. There is a slight constriction of the body about the middle. Crista linear not prominent in front. Dorsal spines short but spiny, not very dense. (Fig. 60).

Durham (Easington, R. S. B.)

ACHOROLOPHUS, Berl.

Eyes 2. Body more or less ellipsoid, without postthoracic furrow. Dorsal setæ usually spinous, short, simple. Anterior sensillar area prominent, very strongly spinose with straight long spines.

Type: *globiger*, Berl.

1.	Front sensillar area globose	*globiger.*
	,, not globose	2
2.	Crista in a chitinous plate as wide as sensillar area ...	*norvegicus.*
	Chitinous plate of crista much narrower	*porcinus.*

39. **Achorolophus globiger**, Berl. 2.2 mm. 67.

The globose knob on the prodorsal margin is very conspicuous. Pubescence spiny.

Yorkshire, Cumberland. Not common.

40. **Achorolophus norvegicus**, S. Thor. 2 mm. 67.

Rhyncholophus mantonensis, Geo.

The broad chitinous channel in which the crista lies distinguishes this species at once.

Cheshire, Yorkshire, North Wales (Flintshire).

41. **Achorolophus porcinus**, sp. nov. 3.3 mm. 68.

Elongate (breadth 1.5 mm.) Pale red. Pubescence short and fine, hardly spiny. Length of fore leg 2.8 mm., its tarsus rectangular 380 μ long, penultimate joint 520 μ. (Fig. 48).

A single example in Newham bog, Northumberland.

42. *Achorolophus falconerii*, sp. nov.

Of the size, form, and colour of *A. norvegicus*, but distinguished from that and from the rest of the genus by the form of the dorsal trichomes which are short, thick, serrulate, and thinly scattered over the dorsum. (Fig. 49, 52.)

Yorkshire (W. Falconer), a single specimen.

C.—Sub-family Erythræinæ.

Mandibles external, hooked. Epimera contiguous. No post-thoracic furrow ; no crista. Dorsal few, scattered.

1.	All the tarsi many-jointed	... ...	*Tarsolarcus.*
	Tarsi undivided (except, rarely, tarsus ii)	...	2
2.	Apical joint of palp terminal on the penult	...	*Anystis.*
	,, ,, lateral on the preceding	...	*Erythræus.*

ANYSTIS, Heyden.

Palp of 4 articles, the last on the apex of the preceding. Tarsi undivided.

Type : *baccarum*, L.

43. Anystis baccarum, L. 66, 67, 68.

Ubiquitous. The " money-spinner."

ERYTHRÆUS, Latr.

Palp of 5 articles, the last appendiculate—*i.e.*, seated laterally on the base of the preceding. Tarsus ii occasionally of several segments.

Type : *parietinus*, Herm. (Type fixed by Heyden, 1828).

44. Erythræus parietinus, Herm. 66.

On school walls, Chester-le-Street.

TARSOLARCUS, S. Thor, 1912.

Palp appendiculate. All the tarsi of several segments ; ambulacrum with two strongly pectinate claws and a pulvillum.

Type : *articulosus*, S. Th.

45. *Tarsolarcus articulosus*, S. Th.

North Wales (Aberglaslyn, Capel Curig—Dr. Jackson).

D.—Sub-family Rhaphignathinæ.

Mandibles external, styligerous. Epimera disjunct.

1.	Dorsum concave, fore margin, 4-lobed ...	*Bryobia.*
	Dorsum more or less convex	2
2.	Palp 4-jointed	*Tetranychus.*
	Palp 5-jointed	3
3.	Rostrum retractile	*Cryptognathus.*
	Rostrum not retractile	4
4.	Dorsum areolate	*Rhaphignathus.*
	Dorsum not areolate	*Stigmæus.*

CRYPTOGNATHUS, Krämer, 1879.

Rostrum exposed or not, with a basal transparent collar.

Type: *lagena*, Krämer.

46. *Cryptognathus lagena*, Kr.

Dorsum punctate and reticulate. Bright red.

Ireland.

RHAPHIGNATHUS, Dugès, 1824.

Legs short. Tarsi 2-clawed. Cuticle areolate.

Type: *piger*, Schrank.

1.	Areolations round or oval	*patrius.*
	Areolations angular (mostly pentagonal) ...	*sphagneti.*

47. *Rhaphignathus patrius*, Berl. ♂ 350 μ, ♀ 520 μ.

Lancashire (Southport, in moss—Dr. Chaster).

48. Rhaphignathus sphagneti, sp. nov. 67

Bright red. Length of ♂ 430μ; ♀ a little larger. Body strongly shouldered; areolations polygonal; dorsal setæ long, rodlike, very slightly thickened apically, minutely spiculate.

West Allendale, in sphagnum.

STIGMÆUS, Koch. 1842.

Legs short, tarsal claws 3. Cuticle not areolate.

Type: *kermesinus*, Koch.

49. Stigmæus elongatus, Berl. 67.

Under stones, West Allendale, rare.

BRYOBIA, Koch, 1842.

Dorsum flat or concave with raised margin, produced in front into a 4-lobed hood. Peritreme present.

Type: *pretiosa*, Koch.

50. Bryobia pretiosa, Koch. 66, 67, 68.

Bryobia pratensis, Geo.

General and abundant, in all sorts of situations, but more particularly in moss and under stones.

TETRANYCHUS, Dufour, 1832.

Legs rather long and slender. Palp of 4 articles. Ambulacrum 4-clawed.

Type: *telarius*, L.

51. Tetranychus telarius, L. 67.

The "red spider"; a garden pest, living gregariously in a web on the leaves of plants, but probably blamed for damage done by other creatures.

52. *Tetranychus pilosus*, Can.

Dorsum with very long setæ.

Scotland (W. Evans).

E.—Sub-family Cheyletinæ.

Mandibles internal styliform. Legs of five articles only. Palpi working horizontally. Eyes none or very inconspicuous.

1. Legs i abnormal (with coiled claw) short ... *Myobia.*
2. ,, normal ... ... *Cheyletus*

MYOBIA, Heyden, 1828.

Legs of the first pair short, thick with spiral claw. Cuticle hyaline. Parasitic on mammals.

Type: *musculi*, Schrank

53. **Myobia musculi**, Schrank. 67.

Common on *Apodemus silvaticus* and *Sorex vulgaris*. Has all the appearance of a Sarcoptid.

54. *Myobia chiropteralis*, Mich.

On *Vesperugo pipistrellus* and *Rhinolophus hipposideros*.

54a. *Myobia ensifera*, Poppe.

On rats, wild and tame. Middlesex (Hirst).

CHEYLETUS, Latreille.

Legs normal. Palp thick, with a strong claw and one or two pectinate setæ. Not parasitic.

Type: *eruditus*, Schrank.

1.	Trichomes of legs and dorsum flabelliform	...	*ornatus*.
	,, ,, setaceous	...	2
2.	Pedes i twice as long as the body ...	...	*venustissimus*.
	,, shorter	...	*eruditus*.

55. **Cheyletus eruditus**, Schrank. 66, 67, 68.

Abundant everywhere, in the litter of barns, &c.; in meal and fodder; in nests of *Formica rufa*, &c.

56. **Cheyletus venustissimus**, Berl. 66, 67.

In the open among grass; in barns, &c., among litter. Also on *Apodemus silvaticus*, and on the hay moth, *Caradrina cubicularis*: not a parasite, of course.

Easily recognised by the pink colour and long slender legs.

57. **Cheyletus ornatus**, Can. 67.

In barns and byres, among hay refuse. Ninebanks; not common.

F.—Sub-family Eupodinæ.

Mandibles hooked or chelate. Palpi not appendiculate. Legs of 5–6 articles. Eyes conspicuous, generally pearly white.

1.	Body black, wholly or partly; legs more or less red	2
	Body fuscous or whitish, legs pink	3
2.	Excretory aperture dorsal	*Penthaleus.*
	,, terminal behind	*Halotydaeus.*
	,, ventral	*Chromotydæus.*
3.	Pedes i more than twice length of dorsum... ...	*Linopodes.*
	,, scarcely longer than dorsum	4
4.	Femur iv much swollen	*Eupodes.*
	,, not crassate	*Tydæus.*

PENTHALEUS, Koch, 1842.

Body black, legs red. Excretory aperture dorsal.

Type: *hæmatopus*, Koch.

1.	Dorsum with long hairs	*longipilis.*
	Hairs of dorsum short	*hæmatopus.*

58. **Penthaleus hæmatopus**, Koch. 66, 67, 68.

Plentiful everywhere in ground moss.

59. **Penthaleus longipilis**, Can. 66, 67, 68.

Exceedingly like *hæmatopus*, but seems lighter coloured on account of the long hairs. Nearly as frequent in West Allendale, but I have not met with it so freely elsewhere.

HALOTYDÆUS. Berl., 1891.

Black marked with red, legs red. Excretory aperture marginal behind.

Type: *hydrodromus*, B. & Tr.

60. **Halotydæus hydrodromus**, B. & Tr. 67, 68.

General; on stones and sea-weed.

LINOPODES, Koch, 1842.

Legs long and slender, especially the first pair which much exceed the length of the body, and are not gressorial but tactile. Femur iv very slightly enlarged.

Type: *motatorius*, L.

61. **Linopodes motatorius**, L. 550 μ. 66, 67, 68.

Colour usually yellowish brown with a pale T-mark as wide as the dorsum. First pair of legs pale and long, four times the length of the body.

Abundant everywhere under stones, dead wood, &c. Gregarious, nearly always in restless motion, zigzag or almost gyratory, the fore-legs held forward with continual tremulous movement.

EUPODES, Koch, 1842.

Legs of normal length; femur iv swollen.

Type: *variegatus*, K.

62. **Eupodes variegatus**, K. 330 μ. 66, 67, 68.

Variable in colour but commonly yellowish or greenish with dark reddish irregular spots, or patches. Shoulders prominent, eyes conspicuous.

Under stones, flower-pots, wood, &c., and in moss—everywhere.

63. **Eupodes clavifrons**, Can. 170 μ. 67.

West Allendale, in sphagnum. (Fig. 73, 75).

RHAGIDIA, Thorell.

Femur iv not swollen. Setæ rod-like (Brit. spp.) Mandibles broad-based and conspicuously chelate.

Type: *gelida*, Thorell.

64. **Rhagidia gigas**, Can. 1200 μ. 67.

Yellowish white. Sometimes called *terricola*, K., but among the many *Scyphius* "species" of Koch it is not easy to say definitely which name belongs to this species. There is, however, no doubt whatever that our species is *gigas* Canestrini. It may be recognised at once by the subscapular setæ, of which three are visible from above. We have probably one or two other species of lesser size hitherto overlooked as immature examples of *gigas*.

One at least I have found to possess fully developed external genitalia, but it is so exceedingly fragile that I have never been able to make a satisfactory mount.

. West Allendale: adults rare.

64a. **Rhagidia muscicola**, sp. nov. 314 μ. 67.

Pure white. Carapace as broad as long (110μ.) Posterior setæ 6, straight, two long (65μ), two a little shorter (40μ), and two lateral, very short. Subscapular bristle solitary. Legs of first pair with the middle joints thickened.

In moss from a pinewood at 800 feet, West Allendale.

65. **Rhagidia halophila**, Lab. 68.

Budle Bay, pretty frequent. Light orange yellow.

Ireland, Lancashire.

TYDÆUS, Koch, 1892.

Body oval, legs short. Fixed finger of mandibles straight: usually on plants.

Type: *foliorum*, Schrank.

1.	Dorsum finely granulate	*granosus.*
	Dorsum quite smooth	2
2.	Colour red; posterior setæ 6 short	*roseus.*
	Yellowish; posterior setæ 4, the middle pair long	*foliorum*

66. **Tydæus foliorum**, Schr. 67.

On trees, shrubs, and herbage generally; also very commonly in hay refuse. Usually pale yellow.

Distribution quite general though records are wanting.

67. **Tydæus roseus**, sp. n. 190 μ. 67.

Oval, but almost truncate behind; widest ($120\ \mu$) just behind the transverse furrow. The anterior part of the dorsum is not indented laterally. The transverse furrow is curved backwards in the middle, and has the usual scapular bristle near each extremity. A little in front of it is another similar but shorter lateral bristle. On the hind margin of the dorsum there are six setæ, very short, with a stronger seta very little farther forward on each side. All these setæ are straight, rigid, acute, and quite nude.

The colour is a clear salmon-pink. A few specimens were taken on the leaves of *Sanicula europæa* in September (West Allendale).

67a. **Tydæus olivaceus**, K. 67.

Broad oval, quite smooth; setæ few simple. Greenish with dark markings.

West Allendale, moss in woods.

68. *Tydæus granosus*, Can.

Lancashire (Southport—Dr. Chaster).

G.—Sub-family Alichinæ.

Body somewhat quadrate, the dorsum very distinctly divided into two or three parts, of which the anterior is much the narrower and usually bears two pairs of sensilli, the second pair seated in an Oribatoid astheterium.

Of the few genera I have seen only one—*Alichus*.*

ALICHUS, Koch.

Mandibles stout with strong chela. Eyes 2.

Type: *roseus*, Koch.

69. **Alichus roseus**, Koch. 67.

Clear crimson red behind where the dorsum is studded with short plumose setæ: in front darker, tinged with purple.

West Allendale, rare.

* Since this was written Mr. S. Hirst has recorded (Journ. Zool. Research, Nov., 1917) *Nanorchestes amphibius*, T. & T., from the Isle of Wight, and a new species *N. poduroides*, Hirst (sub *Speleorchestes*, Träg., which seems to me an unnecessary genus) from the Malvern Hills. *Nanorchestes* differs from *Alichus* in being saltatory and having only one tarsal claw. *Alichus* is 3-clawed.

H.—Sub-family Bdellinæ.

Mandibles elongate minutely chelate. Palpi simple antenniform, second and fifth joints longer than the rest, the latter usually setate, rarely with terminal claw instead of tactile setæ.

1.	Apical joint of palp forming a claw	*Scirus.*
	,, ,, setate, blunt	2
2.	Eyes 4	*Bdella.*
	Eyes 5	*Cyta.*

SCIRUS, Herm., 1802.

Mandibles long and slender. Palp not elbowed, terminal article acuminate.

Type: *setirostris*, Herm.

70. **Scirus setirostris**, Herm. 67.

Small, pink. Usually among hay litter in barns and stables, but also at the roots of grass. I have also taken it from a squirrel's drey.

Lancashire.

CYTA, Heyden, 1828.

A fifth (median) eye near the base of the rostrum. The third joint of palp hardly distinct from the second. Palp elbowed. Mandibles short and broad.

Type: *latirostris*, Herm.

71. **Cyta latirostris**, Herm. 66, 67, 68.

In detritus of all sorts, inland or maritime.

Yorkshire, Cheshire, Flintshire.

72. **Cyta cæruleipes**, Dugès. 67.

Ninebanks, in moss. Distinguished readily by the purplish hue of the legs.

BDELLA, Latr.

Eyes 4. Palp elbowed; article iii quite distinct.

Type: *rubra*, Latr. (= *longirostris*, Herm. or *vulgaris*, Herm.)

1.	Dorsal setæ of mandible 2 or more	3
	Dorsal setæ fewer (1 or 0)...	2
2.	Apex of palp broadly truncate, its setæ unequal...	*longirostris.*
	Apical setæ of palp subequal	*calva.*
3.	Dorsal setæ of mandible 2	4
	,, ,, many	6
4.	Apical article of palp clavate short	*vulgaris.* *lignicola.* *decipiens.*
	Terminal article of palp cylindrical	5
5.	Dorsal setæ of mandible both basal	*norvegica.*
	,, ,, basal and median ...	*silvatica.*
6.	Setæ of art. 5 of palp all equal	*littoralis.*
	Apical setæ of art. 5 of palp longer than the rest	7
7.	Articles iii and iv of palp equal in length ...	*pallipes.*
	,, ,, unequal	8
8.	Dorsal setæ of mandible more than 12 (about 20)	*lacustris.*
	,, ,, 11 or 12	*capillata.*

73. Bdella longirostris, Herm. 66, 67, 68.

Bdella hexophthalma, Geo.

General and common. The bases of the sensilli (a pair near the base of the mandibles, another just in front of the line joining the eyes) are frequently conspicuously red like the eyes, and being of the same size, have been mistaken for eyes.

74. Bdella vulgaris, Herm. 66, 67, 68.

I take the species of the Italian authors as the standard, as their naming is not questioned and definite details are available. I append a comparison of measurements of the palp—1, of *vulgaris*, according to Canestrini; 2, *vulgaris mihi*, from the Northumbrian coast; 3, *dicipiens*, Thor. (from the original description). The numbers represent in order the length of the articles, beginning from the second, the length of the longer apical seta being added. In each case article ii is taken as the unit.

1.	*vulgaris* (Canestrini) ...	100	:	24	:	16	:	50—144.
2.	*vulgaris* (*mihi*) ...	100	:	24	:	16	:	60—150.
3.	*decipiens*, Thorell ...	100	:	9	:	8	:	32—Circa 144.
	[*lignicola*, Can. ...	100	:	14	:	14	:	18—120.]

The first two agree in having the length of the rostrum double its width at the base; but there is discrepancy in the body-lengths which are: (1) ·66 mm.; (2) ·88 mm.; [(3) 1·50 mm]. Again, according to Thorell, *decipiens* has the sixth article of the fourth leg nearly twice as long as the fifth: in the other two these joints are about equal. The rostrum of *decipiens* is four times as long as wide at the base, which is approximately the proportion in *lignicola*, Can.

From these facts I conclude that *decipiens*, Thor. is a valid species allied to *lignicola*, Can., and certainly not a variety of *vulgaris* as Trägardh supposes. Moreover my littoral *vulgaris* presents no character sufficient to separate it from *vulgaris*, Can., but in view of the discrepancies already noted together with the spiny nature of the dorsal setæ it may be very well be named *var. maritima.*

75. **Bdella decipiens**, Thor.

Ireland (Halbert). Whether this is genuine *decipiens* or my *vulgaris var. maritima*, I do not know.

76. **Bdella lignicola**, Can. 600 μ. 66, 67, 68.

Crimson pink; often more or less purple. The smallest species of the genus.

77. **Bdella calva**, Hull. 67.

Very pale pink. The mandibles long and very slender.

West Allendale, under a rotten log.

78. **Bdella silvatica**, Krämer (*fide* Thor.) 67.

West Allendale, under stones and in moss; not common.

79. Bdella norvegica, S. Thor. 67.

West Allendale. The few examples I have taken occurred under stones.

80. Bdella littoralis, L. 66, 67, 68.

A large species distinguished by the long setæ (*e.g.* on the dorsal face of the mandibles and abdomen) in general, but comparatively short apical setæ of the palp, which are about the same length as the setæ on article ii.

Not reported for Ireland; otherwise it seems pretty general on British coasts.

81. Bdella capillata, Kr. 67, 68.

Local specimens and those taken by me on the Dee estuary hardly appear to be anything more than a variety of *littoralis*. The distinctive characters of Krämer's species seem to be three apical setæ on the palp, and not more than 11 or 12 setæ* on the dorsal face of the mandibles. So far as I can make out only Halbert's Irish specimens conform to these conditions, other authors seem to have had more than one form before them.

Flintshire, Ireland.

82. Bdella lacustris, Hull. 66, 67, 68.

An abundant species in the north of England, equally at home on stony shores of lakes and among grass, rushes, &c., on the moors, as well as in the plains. This and the next have the dorsal setæ of the abdomen transformed into short stout acute spines. The setæ on the mandible number 20 or more.

* Eleven in Krämer's figure. According to Dr. Thor, the corresponding setæ in *littoralis* range from 8 to 15 (it is 10 to 13 in my specimens). No other known species save *capillata* conforms to these limits.

83. Bdella pallipes, L. Koch. 66, 67, 68.

Originally described from the Arctic. It seems to be as general as the preceding, but never so gregariously plentiful. Easily recognised by the equal length of the third and fourth joints of the palp.

Westmoreland, Yorkshire, Lancashire (Southport, Dr. Chaster). Lincolnshire (Dr. George—three specimens, now in the Hull Museum).

III.—GAMASIDÆ.

The chief existing British records are due to Michael (various papers), Halbert (Clare Island Survey—71 species), Hirst (parasites), and Donisthorpe (myrmecophiles). These in the aggregate make a good solid total which I have been able to increase by some 50 per cent. or thereabouts, very largely by means of material sent by the same correspondents who so liberally supplied me with other Acari. I have had the further advantage that my own collecting has been chiefly confined to an upland area (ranging from 700 feet to 2,200 feet above sea-level) while my correspondents have ransacked the plains and coast regions. But my geographical position has the very serious disadvantage that the indispensable books of reference and microscopical appliances do not abound in this recess of the Pennines. I am therefore deeply indebted to those who have lent me books, &c., and others who have verified references for me, and have made extracts and tracings from works not accessible to me.

In 1916 Dr. Berlese of Florence described over 100 new Gamasids. While new material is coming in at this rate it is fairly obvious that the limits of genera cannot be in a very fixed state.

For convenience of arrangement, I divide the family into two main sections—the *Barypoda*, short-legged and slowfooted; and the *Oxypoda*, long-legged and swift-footed. They may be formally characterised thus :—

§i. Barypoda.

Genital foramen of the male in the middle of the sternal scutum, usually circular.

Legs comparatively short, especially the first pair Mouth parts nearly always inferior and invisible from above. Lateral margin of the dorsum forming a projecting ledge or ridge, very rarely white rounded and unprotected.

§ii. Oxypoda.

Genital foramen of the male on or before the margin of the sternal scutum, usually transverse.

Legs usually long, especially i and iv. Rostrum always conspicuous. Sides of the body rounded and unprotected, except when the dorsal and ventral scuta are continuous.

SUB-FAMILIES.

i. Barypoda.

1.	Genital valve of ♀ central in sternal scutum : leg-grooves usually present	*Uropodinæ.*
	Genital valve of ♀ behind the sternal scutum : no leg-grooves	2
2.	Dorsum broad behind with membranous centre	*Antennophorinæ.*
	,, much longer than broad	*Zerconinæ.*

ii. Oxypoda.

1.	Parasites of vertebrates. Epidermis glabrous, striate	2
	Living at large (except a few hirsute parasites)	3
2.	Stigmata dorso-lateral	*Pteroptinæ.*
	Stigmata normal	*Dermanyssinæ.*
3.	Ped. ii of ♂ swollen, one or more joints spurred	*Gamasinæ.*
	,, not conspicuously crassate or spurred	*Laelaptinæ.*

A.—Sub-family Uropodinæ.

Mouth-parts all reduced and enclosed in a ventral cavity (camerastoma) as in Oribatidæ. No unchitinised expansible skin in the adult stage.

1.	Venter grooved laterally for the legs	2
	Leg-grooves absent	12
2.	Ped. i without claws, very short	3
	,, with normal ambulacrum	5
3.	Dorsum without border, the setæ very long ...	*Trichocylliba.*
	Dorsal setæ very short, dorsum bordered ...	4
4.	Annular scutum of border continuous or 0 ...	*Cillibano.*
	,, ,, interrupted behind ...	*Discopoma.*
5.	Perigenital scutum present	6
	No perigenital scutum	7
6.	Pre-anal suture present	*Uroplitella.*
	No pre-anal suture	*Urodiscella.*
7.	Pre-anal suture present	*Urobovella.*
	No pre-anal suture	8
8.	Marginal scutum interrupted behind	*Haluropoda.*
	,, of several isolated plates ...	*Uropolyaspis.*
	,, otherwise	9
9.	Epigynal plate fringed	*Urotrachytes.*
	,, not fringed...	10
10.	Infra-marginal lamina projecting in front... ...	*Trachyuropoda.*
	,, not projecting	11
11.	Marginal scutum as in *Cillibano*	*Urodinychus.*
	,, ,, *Dinychus*	*Uropoda.*
12.	Ped. i clawless	*Uroseius.*
	,, normal	*Dinychus.*

CILLIBANO, von Heyden, 1828.

Type: *cassidea*, Herm.

1.	Elliptic oblong	*catula.*
	Circular or sub-circular	2
2.	4 bacillar setæ on dorsum, in a transverse row ...	*virgata.*
	Dorsal setæ all minute, hardly visible	*cassidea.*

Halbert records *Cill. vegetans*, Dugès (from *Geotrupes stercorarius*)—the nymph of some fimicole species unknown. The name, I suppose, is taken from Oudemans, who is inclined to be arbitrary in such matters. As a matter of fact, there is no such species; Dugès writes "*vegetans* Latreille," and gives no figure nor any specific character.

1. **Cillibano cassidea**, Herm. 800–1,000μ. 66, 67, 68.

Perfectly circular (the outline often slightly flattened in front), with the disk of the dorsum conspicuously pitted, as also is the ventral scutum. I have recorded a form with pitted genital valve as *C. minor*, Berl., but I now think that the presence or absence of this local pitting is of no significance. In well developed specimens the dorsal scutum will be found to be beautifully reticulate, the meshes polygonal with a pit in the centre of each.

Quite general everywhere, in moss, under stones, &c.

2. **Cillibano virgata**, sp. n. 750μ. 67.

Sub-circular, smooth, claret brown. Dorsal shield divided by a very shallow median furrow forked behind the middle and curved backward on each side to the margin, leaving a transverse part behind which bears a pair of clavato-pectinate setæ. Two similar setæ stand in a line with these on the lateral margin. Epigyne oval, rounded at both ends, apiculate in front. Ventral shield reticulate.

West Allendale, Leicestershire. Usually on wood.

3. **Cillibano catula**, sp. n. 370μ. 67.

Broad oblong-ovate, yellowish brown. Dorsal shield finely and densely punctate, margin narrow. Marginal setæ hardly projecting over the rim. Epigyne narrow oval, round in front, straight behind, deeply punctate. Ventral shield not punctate.

In moss and manure, West Allendale.

Cheshire, Westmoreland.

4. **Cillibano dinychoides**, sp. n. 655μ. 67.

Sub-circular, smooth, shining reddish brown, uniformly convex. Leg-grooves exceedingly faint. Male genital aperture between coxæ iv rather large (width 85μ). Femur ii with a stout conical acute spine underneath. A clavate seta on each side of the anus, projecting beyond the posterior margin.

Ninebanks, in manure, male only.

5. *Cillibano littoralis*, Trou.

Margin setate, without scutum.

Ireland (under stones between tide-marks).

UROSEIUS, Berl., 1888.

Type; *acuminatus*, Koch.

6. **Uroseius acuminatus**, K. 67.

Cilliba vegetans, Halbert?

West Allendale on *Pterostichus niger* and other beetles not specialised in habitat. I have never met with the adult acarus (my specimens are of course "pedunculate nymphs") but evidently it does not frequent manure or carrion.

Ireland?

7. **Uroseius novus**, Oud. 67.

A pedunculate nymph exactly like the preceding, but with a pair of bacillar setæ on the hind margin.

West Allendale, on *Necrophorus mortuorum*. Evidently the adult acarus is a carrion feeder, but my carrion "traps" have failed to attract it.

DISCOPOMA, G. & R. Can., 1882.

Type: *splendida*, Krämer.

8. *Discopoma integra*, Berl. 440μ.

Ireland, in sphagnum and under bark.

9. *Discopoma pulcherrima*, Berl.

Ireland, with *Formica fusca*.

10. *Discopoma splendida*, Krämer.

Delamere Forest, among dead leaves (nymph). I have not seen the adult which is included by Berlese among myrmecophiles.

TRICHOCYLLIBA, Berl.

As *Cillibano*, but with large curved spiny dorsal setæ.

Type: *comata*, Berl.

11. *Trichocylliba comata*, Berl.

Myrmecophile, at least in part. (Donisthorpe).

GLYPHOPSIS, Mich. (*Urotrachytes*, Berl.)

Type: *formicariæ*, Lubb.

12. Glyphopsis formicariæ, Lubb. 66, 67.

Usually with *Lasius flavus*.

Lancashire (R.S.B.). Cornwall (Michael). Isle of Wight, Surrey, &c. (Donisthorpe). Scotland, Ireland.

TRACHYUROPODA, Berl., 1888.

Type: *festiva*, Berl. (South American).

All the species are myrmecophiles, red; dorsum rough and sculptured.

1.	Dorsal ridges interrupted by a transverse furrow ...	2
	Median ridge continuous	3
2.	Rim of the transverse furrow densely setose ...	*bostockii.*
	Transverse furrow broad, shallow, nude	*troguloides.*
3.	Marginal scutum interrupted in front	*wasmanniana.*
	,, continuous all round	4
4.	Lateral indentations of dorsal ridge closed within ...	*coccinea.*
	,, ,, open on both sides within ...	*excavata.*

13. Trachyuropoda coccinea, Mich. 66, 67

This is the red Uropod usually occurring in the nests of *Formica rufa* and *F. fusca*—at any rate in the north of England; also east of Ireland, but not in the west.

Lancashire, Yorkshire.

13a. *Trachyuropoda excavata*, Wasm.

With *Lasius* spp. Notts and South of England (Donisthorpe).

14. *Trachyuropoda troguloides*, C. & F.

T. lamellosa, Halbert.

Ireland, with *Lasius flavus* and *L. niger*.

15. *Trachyuropoda wasmanniana*, Berl.

See Donisthorpe's British Ants for this and other myrmecophiles.

16. *Trachyuropoda bostockii*, Mich.

The largest of the red Uropods. Usually with *Lasius umbratus*.

Lancashire (Ainsdale–R. S. Bagnall).

URODINYCHUS, Berl., 1903.

Type : *carinatus*, Berl.

1.	Dorsum obovate ; smooth and unpunctured ...	*campomolendinus.*
	Dorsum wide, elliptical or oval	2
2.	Dorsum not pitted	3
	Dorsum pitted	4
3.	Bay-coloured, shining, uniformly convex	*kramerii.*
	Gray and dull, with longitudinal ridges	*minusculus.*
4.	Dorsum studded with scaly hairs	*janetii.*
	Dorsum without scaly hairs	5
5.	Dorsum rosy pink	*roseus.*
	Dorsum usually brown	6
6.	Four stout setæ in a transverse row on dorsum behind	*thorianus.*
	No such setæ preseut	7
7.	Dorsal pitting spare and coarse	*ovalis.*
	,, fine and dense	*punctatissimus.*

17. Urodinychus kramerii, Can. 66, 67.

In barn and stable refuse chiefly, often in countless myriads, like small reddish brown seeds.

Lancashire. I have no other record, but no doubt it is similarly abundant elsewhere.

18. Urodinychus janetii, Berl. 66, 67.

With *Formica rufa* and *F. fusca*. Rather dingy looking.

Lancashire, Yorkshire (J.W.H.H.)

19. *Urodinychus campomolendinus*, Berl.

Ireland ("commonly under bark"—Halbert).

20. *Urodinychus punctatissimus*, Halb.

Ireland (Achill Island, one ♀ in moss, Halbert).

21. Urodinychus roseus, sp. nov. 67.

Length 500μ. Form of body and dorsal scuta as in *janetii*, but cuticle quite smooth and rather glossy, and the punctures are finer and farther apart. Median scutum with three series of fine longish hairs on each side. Genital valve of ♀ a broad ellipse truncate behind, very broadly rounded in front: this and the whole ventral scutum punctured like the dorsum.

Ninebanks, 2 females: note of habitat lost, but almost certainly from manure.

22. Urodinychus ovalis, Koch. 67.

Claret brown.

West Allendale, usually in manure, but once or twice on damp boards laid out as traps.

23. Urodinychus thorianus, Berl. 66, 67.

Like the preceding in form, size, and colour, and described by Berlese as a variety of it. The habitat is quite different so far as my observations go.

Under bark of standing trees, Ninebanks, Birtley; also in moss occasionally.

Ireland, under bark.

24. *Urodinychus minusculus*, Hull.

Grange-over-Sands, in a mole's nest (R. S. B). Not very happy in this company, but cannot be included in *Trachyuropoda* (which it resembles very closely).

25. **Urodinychus tectus**, Krämeur. 67.

If this really is Krämer's species, he deserves to lose the honour of discovery on account of his misleading figure of the epigyne. In our species it is narrow oval, broadest in the posterior half; he draws it oblong with broadly rounded fore margin. Dorsum ridged as in the preceding, but polished and glossy.

On account (apparently!—no diagnosis being given) of the presence of a small posterior dorsal scutum, Berlese has recently (1916) made Krämer's species type of *Urodiaspis.*

Moss and dead leaves, Ninebanks.

Cumberland (Penrith, Varty-Smith). Ireland, (Wicklow, in fungi).

26. **Urodinychus** [**reticulatus**, sp. nov.] 650μ (Nymph). 67.

Dorsal shield reticulate, mesh 8–10μ, with three longitudinal series of short bristly setæ. Similar on the lateral scutum, not passing the margin. Peritreme sinuous running forward and outward, then directly forward, terminating on the margin.

West Allendale.

27. *Urodinychus lucidus*, sp. nov. 550μ.

Dorsal shield divided as in *Cillibano virgata*, but by a glabrous band, not a furrow; sparsely punctate; two series of short spiny setæ on each side. Margin narrow with fairly long projecting spiny setæ. There are four longer rodlike setæ behind, extending well beyond the margin. Epigyne long, narrow, straight behind, and tapering to an acute point in front; smooth, the rest of the venter pitted.

Ainsdale (R.S.B.); female only.

28. Urodinychus [pontianus, sp. nov.]
480μ (Nymph). 67.

Oblong oval, well shouldered. Margin very narrow with strong spiny setæ projecting beyond the rim, 9 or 10 on either side; two similar frontal setæ.

Ninebanks, in moss.

PHAULODINYCHUS, Berl.

Type: *interruptus*, Halb.

1.	Marginal scutum not reaching the end of the dorsal.	*interruptus.*
	,, just reaching the posterior end of dorsal	*minor.*

Maritime species.

29. Phaulodinychus interruptus, Halb. 900μ. 68.

Plentiful under stones, Budle Bay, North Sunderland, Warkworth.

30. *Phaulodinychus minor*, Halb.

Ireland; habitat same as that of the preceding. Not yet found elsewhere.

URODISCELLA, Berl.

Type: *ricasoliana*, Berl.

1.	Dorsal median scutum with shallow punctures ...	*signata.*
	Without punctures above	2
2.	Ventral plates quite smooth and shining	*philoctena.*
	,, more or less pitted	*ricasoliana.*

All the species are myrmecophilous.

31. *Urodiscella philoctena*, Tr.

Ireland (with *Lasius flavus*).

32. *Urodiscella ricasoliana*, Berl.

See Donisthorpe's British Ants.

33. *Urodiscella signata*, sp. nov.

Length 485μ. Scuta both above and below finely and pretty densely pitted. Hairs of dorsum as in *ricasoliana*. Marginal border narrow as in that species, but set with tiny spines as in *philoctena*; not interrupted in front. Colour pinkish.

Lancashire (Ainsdale, R.S.B.) with *Lasius flavus*.

UROPLITELLA, Berl.

Type : *paradoxa*, C. & B.

1. Body oval ; peritreme very slender ... ... *ovatula.*
   Sub-circular ; peritreme normal ... ... *minutissima.*

All the species are myrmecophilous—pink, rather hirsute.

34. *Uroplitella ovatula*, Berl.

Lancashire (R.S.B.) with *Lasius flavus.*

35. Uroplitella minutissima, Berl. 66, 67.

Whitfield, Birtley, Fatfield : with *Lasius flavus* and *L. niger.*

UROBOVELLA, Berl.

Type : *obovata*, C. & B.

1. Length about 500μ ... ... *obvata.*
   ,, 750μ ... ... *notabilis.*

Myrmecophiles ; pink and glossy.

36. Urobovella obovata, C. & B. 67.

Ninebanks, with *Formica fusca*, at 1,200 feet.

37. *Urobovella notabilis*, Berl.

Ireland, with *Formica fusca.*

UROPOLYASPIS, Berl.

Type : *hamuliferus*, Mich.

38. Uropolyaspis hamuliferus, Mich. 66, 67.

The specific name is a misnomer. Michael apparently studied the species as a balsam mount, and Berlese has never seen it alive. I was quite sure my specimens were of a different species till I had mounted one and found that the peculiar trichomes had collapsed into the hooked form delineated by Berlese. In life, they appear to be pellucid globules when viewed vertically ; in profile they are seen to taper into a curved stalk, which is indented on one side. Berlese is mistaken in saying that the trichomes are absent on the ventral plates (of the adult). They appear even on the genital valve of the female. Nymphs—not known to Michael or Berlese—do not present any notable feature. The characteristic trichomes are present but less numerous than in the adult.

West Allendale, Penshaw; with *Lasius niger* and *L. flavus*.

Lancashire (Ainsdale—R. S. B.)

UROPODA, Latr.

Type : *obscura*, Koch (according to Berlese !)

1.	Median scutum divided transversely behind... ..	*obscura*.
	,, undivided	*sartor*.

Whatever Latreille's *Uropoda vegetans* may be it is certainly not *obscura*, Koch, and the use of the generic name here is *technically* indefensible.

39. *Uropoda obscura*, Koch.

Ireland (Nymph, in moss, Dublin county).

40. **Uropoda sartor**, sp. nov.* 66, 67.

Length 900–1,200μ. Outline a long oval; dorsum strongly arched; colour dark reddish brown; surface slightly scabrid. The median scutum merges into the marginal in front, where there is a very slight pseudo-cephalic prolongation of the dorsum. The whole dorsal surface is pretty densely and rather coarsely punctured; but as usual there is a median strip with modified cuticle—smoother and more finely punctured. This strip is broad behind, tapering gradually forward, bounded on either side by the two innermost rows of setæ, and runs to the extreme edge of the scutum behind, thus including the area which in *obscura* is cut off by a transverse furrow. There are three rows of setæ on each side of the median scutum, and one

* Should have been included under *Urodinychus*.

on the marginal. All the setæ are of the same length (about equal to the breadth of the marginal scutum), stout, straight, rodlike.

The under side is irregularly punctured, less densely than the dorsum (except the genital valve of the female, where the punctures are more numerous). The outline of the epigyne is rather narrow oval, truncate behind, rounded in front where the rim is produced forward into a long subulate point which just reaches the sternal margin. The epigyne is small for the size of the species, lying almost wholly between the coxæ of the third pair of legs.

Abundant in manure. I have specimens from West Australia. Nymphs were found swarming on asters at Chopwell. The protonymph travels on beetles but is not pedunculate.

DINYCHUS, Krämer, 1886.

Type: *perforatus*, Kr. (= *inermis*, Koch).

1.	Median dorsal scutum without thick posterior setæ...	*inermis.*
	2 or 4 stout setæ near posterior margin of median scutum	2
2.	Posterior setæ 2	3
	,, 4	4
3.	Marginal scutum continuous	*vartismithii.*
	,, interrupted in front...	*bisetis.*
4.	Posterior setæ less than their own length apart ...	*tetraphyllus.*
	,, much farther apart	*fossor.*

41. **Dinychus inermis, K.** 66, 67.

Fairly plentiful in manure; also under loose boards, &c.

42. *Dinychus vartismithii*, sp. nov.

A very well-marked species.

Narrow oval, with elongate pseudo-capitulum, which runs to a rounded point. It is formed by an extension of the marginal scutum, acutely triangular, and bordered by an infra-marginal ridge as in *Trachyuropoda*. Dorsum smooth, concave along the middle line, with a ridge on either side, smoothly rounded. Median strip outlined by setæ. Posterior setæ close together, acute. They overlooked a small detached scutellum, narrow transverse. Lateral margins beset with short curved spines; 3 or 4 nearest to the posterior margin short, straight and farther apart than the rest. Just within the posterior margin are the four characteristic short foliate setæ.

Genital aperture of male circular, its fore margin opposite the interval between coxæ ii and coxæ iii.

Two males sent from Newton Moss, Penrith, by J. C. Varty-Smith.

43. **Dinychus bisetis**, sp. nov. 67.

Very like *inermis* and similarly pitted, closely and deeply: but— the pseudo-capitulum is much larger with two frontal setæ and the marginal scutum is not continued upon it; the two posterior setæ correspond to the lateral two of *tetraphyllus*; they overlook a broad indentation in the marginal scutum, but it does not include a definite scutellum as in the preceding species.

In manure heaps, not uncommon. West Allendale.

44 **Dinychus tetraphyllus**, Berl. 66, 67.

Fairly plentiful; usually on dead wood, or under bark.

Ireland, in moss.

45. **Dinychus fossor**, sp. nov. 67.

Much like *tetraphyllus* in general appearance, but the four large setæ are placed as in *Cillibano virgata*.

Moles' nests, West Allendale.

B.—Sub-family Zerconinæ.

Here I include *Celaenopsidæ*, Berlese, *Rhodacarinæ*, Oudemans, and *Thinozerconidæ*, Halbert; also the genus *Dendrolaelaps*, Halb. Some or all of these sub-families may be justified by-and-by, but at present it seems to me that the available material is hardly sufficient to fix the comparative value of the characters on which the divisions have been based.

The dorsal plate may be entire or divided, but if divided the parts are contiguous so that always the whole dorsum is covered, and the covering plate may be, at least in part, continuous with ventral plate. The ambulacrum of the first pair of legs is always reduced, but never, I believe, wholly lacking. The genital aperture of the male is always in the sternal scutum but sometimes lies close to the fore margin, thus approximating to the Gamasine position. The epigyne is always post-sternal. In the adult stage there is never any unchitinized expansible skin (except in some species of *Seiodes*).

1.	Body elongate, dorsum quite smooth	2
	Body broader, dorsum more or less rough	3
	Body oval convex, dorsum smooth	*Celaenopsis.*
2.	Rostrum large and conspicuous	*Rhodacarus.*
	,, of normal size	*Dendrolaelaps.*
3.	Peritreme dorso-lateral	*Thinozercon.*
	Peritreme absent	*Epicrius.*
	Peritreme normal	4
4.	Dorsal scutum not transversely divided	5
	,, divided transversely in the middle ...	6
5.	Body trigonous, broad behind	*Trachytes.*
	,, oblong or oval	*Seiodes.*
6.	Dorsum with a diverse margin and posterior spines	*Seius.*
	,, with only a serrate and setate margin ...	*Zercon.*

SEIODES, Berlese, 1877.

Type; *ursinus*, Berl.

1.	Dorsal setæ obtuse, dorsum rounded in front ...	*histricinus.*
	,, slender acute, dorsum truncate in front..	*punctatus.*

46. **Seiodes histricinus**, Berl. 67.

The undivided dorsal scutum is oblong, leaving a pretty wide nude margin (an exception in this group).

Ninebanks, in manure.

47. **Seiodes punctatus**, sp. nov. 67.

Body oblong oval, yellow brown. Dorsal scutum concave in the middle, but with a median ridge (narrow in front, expanded behind). The margin is flat, of uniform width, and bears on each side a series of fine setæ. The outer edge bears a series of similar setæ. The hollow part is conspicuously punctate, but the ridge and margin are smooth and shining with a very few faint punctures. Ventral plates strongly punctate.

West Allendale, in moss on the fells.

TRACHYTES, Mich., 1894.

Type: *piriformis*, Koch.

48. **Trachytes piriformis**, K. 66, 67.

Gibside, Chopwell; Allendale. In moss.

General, but records are lacking.

RHODACARUS, Oudemans, 1902.

Made the type of a new sub-family by Oudemans, mainly because it was supposed to have a "true cephalothorax and abdomen." On the strength of this he says the genitalia are placed exactly as in spiders—which might be said of the female but certainly not of the male. As a matter of fact, the division seems to be merely the usual division of the shield, which is just like that of *Dendrolaelaps*, placed by Halbert among the *Gamasinæ*.

Type: *roseus*, Oud.

49. **Rhodacarus roseus**, Oud. ♂ 385 μ. 66, 67.

Silksworth, Gibside, Chopwell; West Allendale. In moss usually. Rosy pink.

Lancashire (Grange – R. S. B.) Westmoreland (Varty-Smith). Ireland.

50. Rhodacarus pallidus, sp. nov. ♂ 440 μ. 67.

Translucent white with the appendages tinted with brown. Considerably larger than *roseus*. Epistome with a simple acute tapering process without terminal plume or basal teeth; otherwise resembling *roseus*.

West Allendale, under deeply embedded stones with *Pergamasus hamatus*. I have seen two males only.

DENDROLAELAPS, Halbert, 1915.

Very like the preceding genus but with less conspicuous rostrum, and the male has a dorsal spur on tarsus ii, as well as a ventral spur on femur ii.

Type: *oudemansii*, Halbert.

51, *Dendrolælaps oudemansii*, Halbert.

Ireland, under bark.

52. Dendrolaelaps bicornis, sp. nov. ♂♀ 500 μ. 67.

The female of this species differs only in size from that assigned to *oudemansii* by Halbert, so far as I can see. The male also is of the same general form, but the dorsum is excavated behind, and on the forward rim of the hollow there is a pair of very stout lateral spines, conical and obtuse. This excavation is present in male nymphs also, but the spines are acute and no longer than broad, and there is another similar pair between them.

Adults hyaline with brownish legs. Nymphs and larvæ milky white.

West Allendale, abundant under bark of fallen trees with *Zerconopsis remigera*.

THINOZERCON, Halbert, 1915.

Type: *michaelii*, Halb.

Halbert makes this species the type of the new subfamily; but I think a solitary genus should not be so isolated without very strong reasons. With much more hesitation I also include *Celaenopsis* here.

53. *Thinozercon michaelii*, Halbert.

A *Zerconoid* species living between tide-marks; as yet recorded from Ireland (east and west coasts) only.

CELAENOPSIS, Berlese, 1886.

Type: *cuspidata*, Krämer.

The most striking feature of this genus is the three marginal scuta of the ventral surface.

54. Celænopsis cuspidata, Krämer. 66.

Gibside (R. S. B.)

Ireland.

ZERCON, Koch, 1842.

Type: *triangularis*, Koch.

1.	All the dorsal setæ similar acute	3
	Some of the setæ thickened rodlike	2
2.	All the dorsal setæ thick	*trigonus.*
	Twelve plumose setæ in the posterior half	*triangularis.*
3.	Posterior dorsal scutum regularly pitted	*perforatulus.*
	,, ,, finely reticulate	*caudatus.*

55. Zercon triangularis, K. 66, 67, 68.

General, and fairly frequent.

Cheshire, Ireland.

56. Zercon caudatus, Berl. 67.

(?= *pellatus*, Koch).

Westmoreland (Varty-Smith). Lancashire.

57. Zercon perforatulus, Berl. 67.

Ninebanks; particularly plentiful in nests and runs of *Sorex vulgaris*.

58. Zercon trigonus, Berl. 67.

West Allendale; few, mostly in sphagnum.

Westmoreland (Patterdale, R. S. B.) Ireland.

SEIUS, Koch, 1842.

Type : *togatus*, Koch.

59. Seius togatus, Koch. 66, 67.

Holywell Dene; Chopwell (R. S. B.)

EPICRIUS, C. & F., 1877.

Type: *geometricus*, C. & F.

60. Epicrius geometricus, C. & F. 67.

Holywell Dene (R. S. B.) West Allendale, under stones.

Cheshire, Flintshire. Lincolnshire (Dr. George). Ireland.

Scotland (Evans. Also *E. mollis*, which Berlese says is only a sub-adult form of *geometricus*. I have seen only one example of *E. mollis*—taken in West Allendale—and cannot give an opinion).

C.—Sub-family Antennophorinæ.

ANTENNOPHORUS, Haller, 1877.

Type : *uhlmanni*, Haller.

1.	(♀) Sternal scutum undivided	*foreli*.
	(♀) ,, divided into 2 parts	2
2.	Coxæ denticulate above	*uhlmanni*.
	,, not denticulate above	3
3.	Central dorsal scutum present	*grandis*.
	No central dorsal scutum	*pubescens*.

Myrmecophiles, characteristically broader than long The fore-legs are antenniform, without ambulacrum, wholly or distally darkened.

61. *Antennophorus uhlmanni*, Hall.

[Donisthorpe].

62. *Antennophorus grandis*, Berl.

[Donisthorpe].

63. *Antennophorus foreli*, Wasm.

[Donisthorpe].

64. *Antennophorus pubescens*, Wasm.

[Donisthorpe].

D.—Sub-family Pteroptinæ.

PTEROPTUS, Dufour, 1832.

Type: *vespertilionis*, L.

65. *Pteroptus vespertilionis*, L.

PTILONYSSUS, Berl. & Trou., 1889.

Type: *nudus*, B. & T.

66. *Ptilonyssus nudus*, B. & T.

Middlesex: on a sparrow (Hirst).

E.—Sub-family Dermanyssinæ.

DERMANYSSUS, Dugès, 1834.

Type: *gallinae*, Redi.

67. Dermanyssus gallinae, Redi. 66, 67.

Birtley, on a canary. West Allendale—on fowls, and swarming in sparrows' nests.

Lancashire (Manchester, on pigeons—A. D. Imms). Oxford (on *Pipistrelle*!—R. S. Bagnall).

F.—Sub-family Lælaptinæ.

1.	All the tarsi with pulvillus but no claws	*Myrmonyssus.*
	,, normal	2
2.	Ventral scutum of male undivided	3
	Anal scutum of male separate	8
3.	Parasites of vertebrates: mandibles almost styliform	4
	Living at large: mandibles normal	5
4.	Tarsi with normal ambulacrum	*Lælaps.*
	Tarsi all clawless	*Myonyssus.*
5.	Body rotund: ventral and anal scuta of ♀ amalgamated	*Ololaelaps.*
	Oval or oblong: anal scutum of ♀ free	6
6.	Dorsum scabrid, with variously formed trichomes ...	*Cosmolaelaps.*
	Dorsal trichomes normally setaceous	7
7.	Epistome very long, produced into a spine	*Oolaelaps.*
	Epistome rounded and toothed	*Hypoaspis.*
8.	Anal (or ventro-anal) scutum narrowed behind ...	*Eviphis.* / *Amblyseius.*
	,, ,, very broad behind ...	9

9. Zerconiform ; dorsum pitted or sculptured ... ... *Zerconopsis.*
Oval ; smooth or very slightly scabrid 10
10. Dorsal setæ crassate ; no ventro-lateral scutellum ... *Ameroseius.*
Trichomes normal ; ventro-lateral scutellum present 11
11. Pulvillus trifid, the lobes narrow acute ... ... *Episeius.*
Pulvillus normal ... ... *Lasioseius.*

MYONYSSUS, Tiraboschi, 1904.

Type : *decumani*, Tir.

There are two postero-lateral tubercles on the dorsal shield. Anal scutum large, wider than long.

1. Five ridges, longitudinal, on the dorsum ... ... *gigas.*
Dorsal ridges not marked ... ... *decumani.*

68. Myonyssus decumani, Tir. 67.

Ninebanks, on the common rat.

Shetland Islands, on house mouse (Waterton).

69. Myonyssus gigas, Oud. 67.

Ninebanks : abundant on *Mus silvaticus* ; occasionally in moles' nests ; frequent in nests of *Sorex vulgaris.*

Scotland (Ayrshire—J. Gloag).

LAELAPS, Koch, 1842.

Type : *agilis*, Koch.

§i. Dorsal scutum scabrid, reticulate, covering the whole dorsum, pubescence pretty dense, practically uniform. Ventral shield large, similarly pubescent ; anal plate contiguous, much wider than long. *Hemilaelaps* (type : *stabularis*).

1. Sternal scutum as wide as long ... ... *echidninus.*
,, wider than long ... ... *stabularis.*

§ii. Dorsal scutum not covering the whole dorsum, pubescence sparse, irregular, very spiny, usually a few long spines behind. Ventral shield small, with 3 (or 4) pairs of spines. *Laelaps* proper.

1. Lateral anal spines very small ... ... *festivus.*
Anal spines sub-equal 2

2.	Sternal spines equal...	*hilaris.*
	Sternal spines unequal...	3
3.	Anterior sternal spines shortest	*agilis.*
	„ „ longest	*pachypus.*

70. *Laelaps pachypus*, K.

On *Arvicola amphibius*, *Microtus orcadensis.*

Middlesex; Orkneys (Hirst).

71. Laelaps agilis, K. 67.

Usual host *Arvicola amphibius.* Ninebanks, on *Mus silvaticus.*

Middlesex and Berwickshire (Hirst). Lincolnshire (Dr. George). Ireland (on a field mouse, Halbert). Scotland (Evans).

72. Laelaps festivus, K. 67.

Laelaps semitectus, L. Koch, 1879.

Ninebanks, on *Mus silvaticus* and *Evotomys glareolus*; also in a nest of *Sorex.*

Scotland (Ayrshire, Bute, Aberdeen, Lewis, Shetlands—Hirst).

73. *Laelaps hilaris*, K.

On field voles, &c.

Scotland (Orkneys, Cumbrae, Islay, Kincardine—Hirst).

74. Laelaps echidninus, Berl. 67.

Ninebanks, on *Mus silvaticus.*

Lancashire (Silverdale, from a mole's nest—R. S. B.)

"Only on *Epimys norvegicus*"—Hirst.

75. Laelaps stabularis, K. 66, 67.

A regular inhabitant of barns, stables, &c., as well as a regular inmate of the nests of rodents. I have found the nymph "travelling" on the common hay moth, *Caradrina cubicularis.*

LAELASPIS, Berl.

Type: *astronomicus*, Berl.

76. *Laelaspis equitans*, Mich.

Myrmecophilous. Very broad, acuminate behind, with long spiny dorsal hairs.

MYRMONYSSUS, Berl.

Type: *diplogenius*, Berl.

All myrmecophilous. Tarsi bearing a caruncle without claws. Ventral scutum of ♀ acuminate behind remote from the anal.

77. Myrmonyssus acuminatus, Berl. 66.

Birtley, with *Formica fusca*.

PSEUDOPARASITUS, Oud.

Type: *meridionalis*, Cann.

78. *Pseudoparasitus meridionalis*, Cann.

Ireland, debris from nests of sea-birds, Clare Island. Also with *Formica fusca*, county Dublin.

AMBLYSEIUS, Berl.

Type: *obtusus*, K.

Small ovate species conspicuous by reason of three pairs of long simple flexuous setæ, one pair scapular, one posterior, the other postero-lateral.

1. Dorsum truncate behind ... ... *obtusus*.
" rounded behind ... ... *fœnalis*.

79. Amblyseius obtusus, K. 67.

West Allendale: barns, stables, &c., in hay litter.

80. *Amblyseius foenalis*, Berl.

Leicestershire, under pieces of wood about a farm-stead.

EPISEIUS, nom. nov.

Type: *serratus*, Halb.

This is the *Paraseius*, Trägardh of Halbert, of which unfortunately the type is an *Epicrius* (*E. mollis*).

Berlese includes Halbert's species under *Lasioseius*, from which they differ in chaetotaxy and form of ambulacrum. Hairs of dorsum all fine and short. Caruncle of three spreading acute lobes (indicating a partly aquatic habit).

1. Anal scutum (♀) sub-circular	... ...	*serratus.*
,, much wider than long	... ...	2
2. Lateral scutum inflexed behind coxa iv.	... ...	*tenuipes.*
,, not inflexed (obliquely truncate)	...	*italicus.*

81. *Episeius serratus*, Halb.
Ireland, in sphagnum.

82. *Episeius tenuipes*, Halb.
Ireland, from moss on a stone in a mountain stream.

83. Episeius italicus, Berl. 67.
Ovingham (R. S. B.). West Allendale.
Yorkshire (W. P. Winter). Ireland, in moss, one ♀.

AMEROSEIUS, Berl.
Type: *hirsutus*, Koch.
Body broad oblong. Dorsal setæ spiny long in a single lateral series, marginal behind, 2 or 3 in front (immediately behind the shoulder) submarginal. Cuticle smooth.

⁂ In Berlese's sub-division of this I cannot follow his distribution of species, and I drop *Zercoseius*, which is simply *Lasioseius* with crassate setæ. And there seems to be no alternative but to institute *Zerconopsis* for *remiger* and *minutus*.

84. Ameroseius hirsutus, K. 66, 67.
Marsden, Chopwell (R. S. B.)) West Allendale.
Cheshire, Ireland.

85. Ameroseius ingens, sp. nov. 67.
Body somewhat quadrate; dorsum finely and conspicuously reticulate, but quite smooth. Very considerably larger than *hirsutus*, and the dorsal spines are similarly placed, differing only in size.
West Allendale, a single specimen (♀) in moss.

LASIOSEIUS, Berl.

Type: *muricatus*, K.

Body oval. Dorsal setæ in longitudinal parallel series, simple setaceous, or slightly squamose-clavate or plumose. Cuticle smooth or very slightly scabrid.

1.	Dorsal pubescence setaceous	2
	,, of thickened setæ...	3
2.	Ventro-anal scutum straight in front...	*muricatus.*
	,, emarginate in front	*levis.*
3.	Ventro-anal shield nearly as broad as venter ...	*spathuliger.*
	,, not so broad	*plumosus.*

86. Lasioseius muricatus, K. 67.

Whitfield—on a decaying log, abundant.

Ireland (Wicklow, one specimen).

87. *Lasioseius levis*, O. & V.

Ireland, moss and sphagnum.

88. Lasioseius plumosus, Oud. 66, 67.

In the litter of barns, stables, &c., abundant.

89. Lasioseius spathuliger, Leon. 67.

Very like the preceding but larger and always in living herbage. I have never met with it indoors.

Ireland, in moss.

ZERCONOPSIS, gen. nov.

Type: *remigera*, Krämer.

Body oblong, truncate behind, the prescapular part triangular. Sides more or less serrulate: dorsum flat, rough and punctured.

1.	Two clavate setæ on the hind margin	*remigera.*
	All the setæ minute similar	*minutus.*

90. Zerconopsis remigera, Kr. 67.

Ninebanks Vicarage, under a dead blackbird laid out as a trap. Also abundantly under bark of a fallen tree.

Ireland, in fungus and fungus-infected bark.

91. **Zerconopsis minuta**, Halb. 67.

West Allendale, in moss.

Ireland, in sphagnum.

EUIPHIS, Berl.

Type: *ostrinus*, Koch.

92. **Euiphis ostrinus**, K. 66, 67, 68.

Quite general, chiefly on dead wood.

Ireland.

OLOLAELAPS, Berl.

Type: *venetus*, Berl.

1.	Marginal hairs very short	*confinis.*
	,, wanting	*venetus.*

93. *Ololaelaps venetus*, Berl. 600 μ.

Ireland, common.

94. **Ololaelaps confinis**, Berl. 700 μ. 66, 67, 68.

Very broadly ovate. Claret brown. Abundant.

Ireland, in moss.

95. **Ololaelaps placentula**, Can. 66, 67, 68.

Nearly hemispherical; yellow brown.

Cheviot and Wooler (R. S. B.). West Allendale, Waldridge Fell.

Cumberland.

HYPOASPIS, Can.

Type: *Kramerii*, Can.

Very like *Hemilaelaps*, but mandibles normal, and ventral scutum of female narrow with a few paired setæ. Cuticle smooth, or nearly so.

1.	Hirsute with short hairs: dorsal scutum narrowed behind	*longipes.*
	Sparsely setate	2
2.	Dorsal scutum covering the whole dorsum	3
	,, leaving part of dorsum exposed ...	4

3.	Broad oval, rounded behind	*nitidissimus.*
	Narrow elongate, truncate behind	*hypudæi*
4.	Anal shield trigonous equilateral	*oblongus.*
	,, ,, base (front margin) longer than sides	*ovatulus.*

96. *Hypoaspis longipes*, Halb.
Ireland, a single ♂, habitat unknown.

97. *Hypoaspis hypudaei*, Oud.
I have not seen this species, which is certainly not at home in its present company.*
Neighbourhood of London, on rats (Hirst).

98. *Hypoaspis ovatulus*, Halb.
Ireland, in flowers of *Campanula.*

99. **Hypoaspis oblongus**, Halb. 691 μ. 67.
West Allendale, in various habitats.
Ireland, under bark of decayed trees. Scotland (Evans).

100. **Hypoaspis nitidissimus**, sp. n. 870 μ. 67.
Oval, but well-shouldered, pale yellow brown, broadest behind the middle. Dorsal scutum faintly reticulate in wide mesh, pretty densely clothed with longish hairs, a little longer and stronger on the hind margin. Genital shield of female rather long (400 μ) narrowed in the middle and widest behind the constriction, rounded before and behind, lightly reticulate, with two traverse rows of 4 setæ in the posterior part. In a line with these setæ there is a semi-elliptic scutellum on either side. Anal scutum small, rounded, a little wider than long.
West Allendale, Leicestershire. Usually in barns.

101. **Hypoaspis bombicolens**, Can. 67.
In nests of *Bombi* (*smithianus*, *pratorum*) and occasionally travelling on the bees.
Essex, in a wasp's nest (Nicholson).

* Taken in barns and byres in West Allendale since this was written.

GYMNOLAELAPS, Berl.

Type: *myrmecophilus*, Berl.

Sternal scutum and genital (♀) overlapping.

1.	Length 1,300μ: dorsal hairs few and minute ...	*laevis.*
	Much smaller: hairs longer and more numerous ...	2
2.	Anal and ventral scuta well separated	*acutus.*
	,, ,, contiguous	3
3.	General form obvate	*myrmophilus.*
	Body not narrowed behind	*myrmecophilus.*

102. *Gymnolaelaps laevis*, Mich.

[Donisthorpe].

103. *Gymnolaelaps myrmecophilus*, Mich.

[Donisthorpe].

104. Gymnolaelaps myrmophilus, Berl. 66.

Birtley, with *Formica fusca.*

105. *Gymnolaelaps acutus*, Mich.

Ireland, with *Myrmica scabrinodis.*

COSMOLAELAPS, Berl.

Type: *claviger*, Berl.

1.	Dorsal setæ clavate	*claviger.*
	Setæ expanded distally, but not clubbed	2
	Setæ sub-simple or blade-like, acute	3
2.	Setæ all ciliate	*ornatus.*
	Setæ not ciliate	*cuneifer.*
3.	Male with ventral dagger-like process	*styliferus.*
	Male with venter normal	*vacuus.*

Generally myrmecophilous.

106. *Cosmolaelaps claviger*, Berl.

Ireland (Dublin and King's County).

107. *Cosmolaelaps ornatus*, Berl.

Lancashire (Silverdale, in moles' nests, R. S. B).

108. Cosmolaelaps cuneifer, Mich. 66, 67.

Abundant with *Formica rufa* and *F. fusca.*

109. *Cosmolaelaps styliferus*, Halb. 473 μ.

Ireland, with *Lasius flavus*.

110. Cosmolaelaps vacuus, Mich. 67.

Ninebanks, with *Lasius niger*.
Ireland, with *Lasius niger* and *Myrmica scabrinodis*.

OOLAELAPS, Berl.

Type: *oophilus*, Wasm.

1	Posterior dorsal setæ longer and stronger	*oophilus*.
	,, hardly longer than the rest ...	*montanus*.

Myrmecophilous. Digits of mandibles small, nearly edentate (♀).

111. Oolaelaps oophilus, Wasm. 66, 67.

Quite abundant with *Formica fusca*: less so with *F. rufa*.

112. Oolaelaps montanus, Berl. 66, 67.

With *Formica fusca*, *Myrmica* spp., &c. The only species commonly found with *Myrmica* in West Allendale.

Ireland, with *Formica fusca*.

G.—Sub-family Gamasinæ.

Sexual dimorphism of the second pair of legs is the great characteristic of this group. In rare instances the fourth pair also is affected, and in the titular genus the dorsal scuta. The latter is usually associated with a difference in general body-form, as well as the general difference in size.

1.	Parasites of mammals	*Haemogamasus*.
	Living at large*	2
2.	Tarsi i without ambulacrum	*Macrocheles*.
	All tarsi with the usual ambulacrum	3
3.	Lobes of pulvillus lanceolate acute (littoral species)	4
	Ambulacrum normal in form	6
4.	Dorsal scutum undivided	*Hydrogamasus*.
	Dorsal scuta 2	5

* Migrant nymphs of species frequenting manure, carrion, and bees' nests are often found, sometimes in great number, on insects.

5.	Epistome trifid	*Cyrthydrolaelaps.*
	Epistome denticulate, not divided	*Halolaelaps.*
6.	Tarsi (ii at least) with apical spurs	*Pachylaelaps*
	Tarsi not apically spurred	7
7.	Anal aperture in ventral scutum	9
	Anal scutum separate	12
8.	Two dorsal scuta	10
	Dorsal scutum undivided	11
9.	Epigyne triangular	*Gamasus*
	Epigyne quadrate	*Euryparasitus.*
10.	Dorsal and ventral scuta continuous	*Ologamasus.*
	,, ,, not continuous	*Pergamasus.*
11.	Anal scutum small, rotund	*Gamasolaelaps.*
	,, broad, trigonous	12
12.	Body oblong, dorsal scutum divided (at least partly)	*Cyrtolaelaps.*
	Body rotund, dorsum scutum undivided	*Sphaerolaelaps.*

MACROCHELES, Ltr.

Type: *marginatus*, Herm.

The specific characters given below, in the table and otherwise, will perhaps be found to be more valuable than the names, as in one or two cases I have been unable to reconcile the nomenclature of the Italian authors with that of others.

The genus is well marked by the absence of ambulacra on the tarsi of the first pair, and by the possession of a single dorsal scutum very strongly chitinized and (*minimus* excepted) rough with reticulations. This dorsal scutum is really composed of two so intimately welded together as to be indistinguishable in nearly every species; but indications of the dividing line are sometimes visible in well-marked individuals, and always plain to see in *superbus* and *minimus*.

1.	Dorsal scutum finely punctured, not reticulate ...	*minimus.*
	,, reticulate (at least in part)	2
2.	Epistome with elongate undivided process	3
	,, with forked process (usually on a forked base)	4

3.	Base of the process rhomboid, apex shortly plumose	*longispinosus.*
	No rhomboid base, apex not plumose	*longulus.*
4.	Femur iv (♂) spurred	5
	Spurs only on the second leg (♂)	6
5.	Patella iv (♂) spurred	*superbus.*
	Patella iv (♂) not spurred	*gladiator.*
6.	All the dorsal setæ simple curved acute	7
	Humeral setæ, at least, clavate	8
7.	Basal branches of epistome apically bifurcate ...	*pisentii.*
	,, ,, simple	*glaber.*
8.	All the dorsal setæ clavate	*tridentinus.*
	Setæ of the middle of dorsum simple or 0	9
9.	Tarsus iv with about 8 clavate plumose setæ ...	*plumipes.*
	,, without clavate setæ	*marginatus.*

113. Macrocheles gladiator, sp. nov. 67.

Length 1,080 μ. Pale yellow-brown. Epistome similar to that of *plumipes*, as is also the dorsal chaetotaxy (nearly all the setæ clavate and minutely plumose); otherwise very different from that species as the ventro-anal scutum of the ♀ is very large and semicircular, while the male has on femur iv a large curved acute spur with a blunt branch at its base.

Ninebanks, in manure.

114. *Macrocheles superbus*, sp. nov. 1800 μ.

Body parallel-sided behind the shoulders then much narrowed. In this posterior region the dorsal scutum leaves a wide margin. Setæ few, all clavate. Ventral shield reticulate, sternal not reticulate. Femur iv and patella iv each with an acute spur. No plumose setæ on tarsus iv.

Lancashire (Grange—Bagnall). Yorkshire (East Riding, W. Falconer).

115. Macrocheles marginatus, Herm. 66, 67, 68.

A large and common species, conspicuous by the contrast of the dark dorsal shield with the very white body-margin which surrounds it.

Ubiquitous. Halbert records a variety *littoralis* for Ireland, probably a distinct species.

116. **Macrocheles plumipes**, sp. nov. 67.

Very like *marginatus* in general appearance, but the legs are shorter, especially the fourth pair. The dorsal shield is completely margined with clavate setæ. Most readily distinguished by the tarsus of the fourth pair which is comparatively short (4 times the length of the ambulacrum : in *marginatus* 6 times), with only three simple acute spines, the rest, about 8 in number, being clavate and finely but conspicuously plumose.

Ninebanks, in manure.

117. **Macrocheles tridentinus**, Can. 66, 67.

The only species with *all* the dorsal setæ clavate.

It is, I think, the *M. terreus* of Oudemans, but not of Halbert: certainly not *tridentinus*, Oudemans !

Cheshire, Ireland.

118. **Macrocheles pisentii**, Berl. 66, 67.

Chopwell, from a nest of *Formica rufa*. Ninebanks, moss.

Cheshire, dead leaves.

119. **Macrocheles glaber**, Müll. 66, 67, 68.

Very abundant everywhere in manure, and almost always one of the passengers on *Geotrupes*, spp. and other dung-beetles, along with various nymphs. Berlese appears to identify it with *badius*, Koch, which I think is a mistake. Oudemans, on the other hand, seems to consider it identical with Berlese's *vagabundus* ! Though I have had thousands of females under my eye, I have never succeeded in capturing a male. This species and *Hypoaspis bombicolens* are the only (non-parasitic) *Gamasids* I have met with 'travelling,' when sexually mature, on insects, along with various nymphs.

Linked with the two preceding by the uniform shape and distribution of the dorsal setæ; except the frontal pair which are slenderly clavate, all are acute and spinous, curved and appressed, three series on each side of the dorsal scutum and one marginal on the nude body—all of the same size except one on each shoulder which is larger. Process of epistome with lamellar base as in *marginatus*. Genital and ventral scuta contiguous.

120. Macrocheles longispinosus, Kr. 66, 67.

Similar to the next following species in the subcircular form of the body and finer texture of the dorsal scutum. Marginal setæ very slightly clavate, longer and more patent than in *longulus*.

Yorkshire North Wales (Flintshire and Moel Siabod—Jackson). Ireland. It is probably quite general in moss of woods.

121. Macrocheles longulus, Berl. 67.

Ninebanks, at one of my carrion traps.

Ireland (moss and rotten wood).

122. Macrocheles minimus, sp. nov. 740 μ. 66.

Body oval, dorsal scutum oblong, with two lateral rows of clavate setæ on either side and four fine bristles in a trapesium on the disk; one curved clavate scapular setæ on each side and three subscapular; vertical setæ contiguous. Dorsal scutum yellow brown, very finely pitted. Genital shield without hyaline border, large co-terminous with the ventro-anal shield on a transverse line; the rest of the outline of the posterior scutum circular, widest near the middle.

Gibside (R. S. B.) Female only. Leicestershire.

PACHYLAELAPS, Berl.

Type: *pectinifer*, Cann.

Process of epistome distinctive, more or less Y-shaped with a multidentate comblike terminal margin. Body oblong with parallel sides; dorsal shield smooth, undivided. Tarsi (at least of legs ii) with one or more conical thick spines near the apex. Anal scutum of ♀ separate.

1.	Teeth of epistomal comb contiguous acuminate ...	*longisetis.*
	,, ,, basally free, more or less bifurcate	2
2.	Peritreme undulate	*fossorius.*
	,, straight	3
3.	Teeth of epistome eight uniformly bifurcate ...	*littoralis.*
	,, fewer	*pectinifer.*

123. Pachylaelaps pectinifer, Cann. ♂ 700 μ, ♀ 800 μ. 67.

Anal scutum (♀) discoidal but wider than long.

Leicestershire, Flintshire. Ireland (a single female—*var. magnus*, Halbert).

124. *Pachylaelaps littoralis*, Halb. ♂ 819 μ.

Ireland, maritime.

125. *Pachylaelaps longisetis*, Halb. ♀ 793 μ.

Peritreme undulate. Anal scutum (♀) longer than wide.

Ireland, under bark.

126. Pachylaelaps fossorius, sp. nov. ♀ 680 μ.

Broad oblong, slightly wider behind.

Epistome terminating in a V-shaped pecten; the three central teeth broad bifid from the middle. Margin of epistome diverging immediately from the base of the pecten (*i.e.*, there is no long 'neck') and finely denticulate.

Ventral shields reticulate with large mesh; sternal with eight lateral setæ, the front pair longer than the rest; genital more or less hexagonal with a long strong spiny setæ at each of the lateral angles, and a pair of smaller setæ projecting over the anterior margin; anal shield much wider than long with a setæ at each lateral angle. There are four spines flanking the anal scutum on either side, one only to the genital shield. No lateral scutellum.

Ninebanks, under deeply embedded stones; once only in moss.

CYRTOLAELAPS.

Type: *nemorensis*, Koch.

Epistome with two lateral dentate lobes and a median bifurcate or penicillate seta. Two dorsal plates, or one deeply incised.

1.	Dorsal scuta 2	2
	One dorsal shield with lateral incisions	5
2.	Dorsal shields overlapping on the median line ...	*herculaneus.*
	,, quite separate	3
3.	Posterior dorsal shield emarginate behind	*kochii.*
	,, ,, rounded behind	4
4,	Space between the shields angular in the middle ...	*humilis.*
	,, ,, rounded in the middle ...	*nemorensis.*
5.	Lateral incisions wholly oblique	*cervus.*
	,, transverse, only oblique at the apex	*transisalae.*

127. **Cyrtolaelaps herculaneus**, Berl. 66, 67.

The largest species, which with *kochii* and *transisalae* ascends to the sphagnum of the fells in West Allendale. Probably of wide distribution, but there are no records.

128. **Cyrtolaelaps nemorensis**, K. 66, 67, 68.

A small species common among grass and in moss of woods.

Cheshire, Yorkshire, Lancashire, Cumberland, Flintshire, Ireland.

129. **Cyrtolaelaps humilis**, sp. nov. 67.

Similar in form and size to *nemorensis* of which it may possibly prove to be a variety though I have no reason for believing that it is.

Length (♀) 700 μ; greatest breadth 480 μ. Differs from all the other species in having the innermost tooth of the lateral lobes of the epistome smaller than the rest (two in number and about equal in size). The median seta is simply bifurcate. Dorsal scuta broad, leaving very little nude surface; the dividing space narrow and broadly V-shaped in the middle. Humeral setæ fairly strong; the rest of the dorsal setæ nearly uniform, nevertheless a little longer in front (especially on the frontal slope) and shortest on the hind margin; all slender, acute.

West Allendale, under stones.

130. Cyrtolaelaps kochii, Trag. 66, 67.

Harperley, Hylton, Fatfield (Bagnall). West Allendale, frequent among sphagnum and rushes up to 2,000 feet. Flintshire, Ireland (Clare Island, a single female).

131. Cyrtolaelaps transisalae, Oud. 67.

West Allendale, not unfrequent among sphagnum, which appears to be its usual habitat.

Westmoreland (Varty-Smith). Yorkshire, (*Polytrichum*, W. P. Winter), Ireland.

132. Cyrtolaelaps cervus, Kr. 66, 67.

Gamasus ignotus, Geo.

I believe this to be quite general, though records are few.

Yorkshire, Ireland.

HYDROGAMASUS, Berl.

Type: *giardi*, B. & T.

133. *Hydrogamasus giardi*, B. & T.

Ireland (Dublin, rocks exposed by the tide).

CYRTHYDROLAELAPS, Berl.

Type: *hirtus*, Berl.

134. **Cyrthydrolaelaps hirtus**, Berl. 68.

Budle Bay, not frequent.

Ireland.

GAMASOLAELAPS, Berl.

Type: *excisus*, L. Koch.

135. **Gamasolaelaps excisus**, L. K. 68.

Budle Bay, with the preceding.

Ireland (Mayo, Dublin).

HALOLAELAPS, Berl.

Type: *glabriusculus*, Berl.

136. **Halolaelaps glabriusculus**, Berl. 66, 67, 68.

Seahouses, Druridge Bay, Warkworth, Marsden.

Ireland (Westport). Scotland (Firth of Clyde—King).

137. **Halolaelaps celticus**, Halb. 68.

Bamburgh (Bagnall).

Ireland (Westport, Howth).

HAEMOGAMASUS, Berl.

Type: *hirsutus*, Berl.

1.	Sternal shield diffusely hairy	*hirsutus.*
	,, with 3 pairs of setæ	2
2.	,, deeply excavated behind	*oudemansii.*
	,, only slightly concave behind	3
3.	Genito-ventral shield very convex laterally	*nidi.*
	,, ,, much narrower	*horridus.*

138. **Haemogamasus hirsutus**, Berl. 66, 67.

Swarms, as a rule, in moles' nests.

Lancashire (Silverdale, Bagnall).

139. **Haemogamasus nidi**, Mich. 67.

Nests of moles, rats, &c. Commonly on *Mus silvaticus*.

140. Haemogamasus horridus, Mich. 67.

In West Allendale, I have seen this on *Mus silvaticus* only.

Scotland (Hebrides, Shetland—Hirst).

141. *Haemogamasus oudemansii*, Hirst.

On the common rat (Hirst).

EURYPARASITUS, Oud.

Type: *terribilis*, Mich.

142. Euryparasitus terribilis, Mich. 66, 67.

A regular inmate of moles' nests, and found occasionally on various rodents.

[GAMASOIDES, Berl.

Gamasoides bispinosus, Halbert.

Ireland, in moss.

If correctly diagnosed, this should be the 'coleoptrate' nymph of some species of *Gamasus*, known or unknown].

GAMASELLUS, Berl.

Type: *falciger*, Can.

143. Gamasellus alienus, sp. n. 67.

♀ 950μ (breadth 600μ). Clavate setæ 8–2 humeral, 2 posterior, 2 on each scutum, each about 100μ in length. The nymph appears to be *Asca affinis* of Oudemans.

West Allendale; moles' nests, and in moss.

143a. Gamasellus rubicundus, sp. n. 67.

Differs from *alienus* in size (♀ 800μ); in colour, which is vinous red; and the epistome ends in two little incurved horns.

Ninebanks; females only, under a dead fowl.

OLOGAMASUS, Berl.

Type: *calcaratus*, Koch.

1.	Sternal shield divided by a transverse line	*inornatus*.
	,, not so divided	2
2.	Fermur ii (♂) with long acute spur	*pollicipatus*.
	,, short obtuse spur	*calcaratus*.

144. **Ologamasus calcaratus**, K. 66, 67, 68.

Red-brown. The female (of all three species) is similar to *Ololaelaps*, the male narrower.

Quite general, in moss.

145. **Ologamasus pollicipatus**, Berl. 66, 67, 68.

Yellow-brown. Apparently very variable, and Berlese tabulates several varieties which at present I cannot undertake to identify with any certainty.

Abundant everywhere, in moss.

146. **Ologamasus inornatus**, Berl. 67.

Not difficult to separate from the preceding; but whether it is really specifically distinct, I do not know. Like Berlese I have failed to turn up a male.

West Allendale, moss in woods, rare.

Cumberland, Ireland.

PERGAMASUS, Berl.

Type: *crassipes*, L.

A miscellaneous assortment, but only one sub-genus (*Amblygamasus*, Berl—type: *septentrionalis*, Oud.) has been put forward, while *alpestris*, *hamatus*, and *robustus* are each typical of a group of at least equal value. There should therefore be 4 sub-genera—or none.

§i. **Amblygamasus**, Berl.

Body of both sexes piriform, rostrum very prominent, cuticle polished and smooth. Femur ii of ♂ crassate but spurless. Colour ruddy brown.

The only British species is *septentrionalis*.

§ii. Pergamasus, proper.

Body of both sexes piriform, cuticle conspicuously reticulate and rather rough. Femur ii crassate with a strong falcate spur: patella ii with a prominent apical spur or branch projecting inwards and forwards. Colour ruddy brown, rather dull.

1.	Epistome 5-dentate	*crassipes.*
	,, 3-dentate	2
2.	Patella ii (♂) with thick L-shaped process below...	*alpestris.*
	,, without this process	*coniger.*

Also, probably, *processiferus, diversus, lapponicus.*

§iii. Paragamasus.

Body oblong, more or less parallel-sided in both sexes. Ped. ii as in section ii, but without the patellar spur. Colour pale yellowish brown.

1.	Main spur of femur ii (♂) very large truncate ...	*robustus.*
	,, ,, not truncate	2
2	Accessory spur of femur ii (♂) as long as the main spur	*minor.*
	,, ,, shorter	5
3.	Accessory spur of femur ii (♂) truncate	*runciger.*
	,, ,, acute slender ...	*runcatellus.*

§iv. Plesiogamasus—type: *hamatus.*

Body of male narrow oblong, of female rather piriform. Ped. ii of male only slightly crassate, all the spurs more or less cylindrical. Colour very pale.

1.	Body of male constricted in the middle	*parvulus.*
	,, without constriction	*hamatus.*

147. Pergamasus crassipes, L. 66, 67, 68.

Ubiquitous; of *Gamasids* found at large, by far the most frequent.

Var. longicornis, Berl., with elongate patellar spur is very common in the north of England. Also two or three other forms with variations of the patellar spur, especially a small spring form (♂ 1 mm.) in which this spur is hardly visible from above.

148. Pergamasus alpestris, Berl. 66, 67.

The local form is *var. alpinus*, Berl. Common.

Ireland, a single ♂ in moss.

149. Pergamasus coniger, Hull. 66, 67.

Exceedingly near *alpestris*: perhaps only a variety.

Yorkshire, Lancashire, Flintshire.

150. *Pergamasus processiferus*, Halb. 742 μ.

Ireland, in moss.

151. *Pergamasus lapponicus*, Träg.

Ireland, frequent in moss.

152. *Pergamasus diversus*, Halb.

Ireland, under stones.

153. Pergamasus robustus. Oud. 66, 67, 68.

A very common species.

Ireland, common.

154. Pergamasus runciger, Berl. 66, 67, 68.

Common, gregarious.

Ireland (also *var. armatus*, Halb.)

155. Pergamasus runcatellus, Berl. 66, 67, 68.

Birtley, Hylton, Waldridge Fell, West Allendale, Newham Bog. Yorkshire, Cumberland. Ireland (apparently not common).

156. *Pergamasus minor*, Berl.

Lancashire.

157. Pergamasus parvulus, Berl. 66.

Gibside; West Hartlepool.

Ireland (also *var. dilatatellus*, Berl.)

158. Pergamasus hamatus, Koch. 67.

Under deeply embedded stones, West Allendale; males and females in March. The long narrow body of the male makes it very conspicuous. It is extremely probable that the ♀ described by Berlese is not the ♀ which I find with *hamatus* ♂. The habitat is peculiar, the only other *Gamasid* found there normally is *Rhodacarus pallidus*.

159. Pergamasus septentrionalis, Oud. 66, 67, 68.

Usually in moss of woods.

Cheshire. Ireland (*var. norvegicus*, Berl.)

GAMASUS, Latr.

Type: *coleoptratorum*, L.

§i. *Gamasus*, proper. Labial cornicles on a tubercular base. Tarsi not spined.

Species: *coleoptratorum*, *kempersi*, *lunaris*, *consanguineus*, *fimetorum*, *hortivagus*, *anglicus*, *bombianus*, *stygius*.

§ii. *Eugamasus*. Labial cornicles sessile. Tarsi with at least one spine.

Species: *immanis*, *kraepelini*, *magnus*, *cornutus*, *trouessarti*, *oudemansi*, *nidicolens*, *fucarius*.

1.	Epistome with many teeth (laterally at least) ...	2
	,, undivided, or 3 lobed, or with 2 or 3 or 5 teeth	5
2.	Epistome with a long central spine	3
	Central spine similar or sub-similar to the rest ...	4
3.	Femur i (♂) with bifurcate axillar tubercle ...	*anglicus.*
	,, with undivided axillar tubercle ...	*lunaris.*
4.	Length exceeding 2 mm.	*immanis.*
	,, under 2 mm.	*trouessarti.*
5.	Body piriform, dorsal setæ thickened	6
	Body elliptic or more or less parallel-sided	7
6.	Dorsal setæ uniformly rod-like	*cornutus.*
	,, short, deflexed, distally lanceolate ...	*nidicolens.*
7.	Setæ of posterior scutum equal and similar	8
	,, ,, dissimilar (obviously) ...	11

8.	Epistome 5-dentate	*hortivagus,*
	,, 2-dentate	*wasmannii.*
	,, 3-dentate	9
9.	Epistome constricted behind the lobes	*kraepelinii.*
	,, not constricted	10
10.	Humeral spines obtuse	*coleoptratorum.*
	,, acute	*magnus.*
11.	Some clavate setæ on hind margin	*kempersii.*
	No clavate setæ anywhere	12
12.	Epistome 3-lobed	*bombianus.*
	Epistome deeply 3-dentate	13
13.	Setæ of vertex 2, fairly long	*fimetorum.*
	Setæ of vertex 4 short	*consanguineus.*

160. Gamasus kempersii, Oud. 68.

Seahouses, on the rocks.

Ireland.

161. Gamasus lunaris, Berl. 66, 67.

Usually in manure.

Cheshire. Ireland (coast).

162. Gamasus fimetorum, Berl. 66, 67, 68.

Common everywhere; not confined to manure heaps. Lancashire, Yorkshire, Cheshire, Ireland.

163. Gamasus consanguineus, Can. 67.

West Allendale; a few from a stack-bottom.

164. Gamasus coleoptratorum, L. 66, 67, 68.

Common everywhere; adults usually on manure, nymphs at large or passengers on beetles (especially *Geotrupes* spp.)

165. Gamasus hortivagus, Berl. 67.

West Allendale, adult in barn refuse. Nymphs on beetles.

Ireland (*Gamasoides spinipes*, Halbert).

166. Gamasus anglicus, sp. nov. 1,200 μ. 66, 67.

♂. Second leg very thick; femoral spur long, tapering blunt, axillar tubercle bifid; a small patellar process, and a large conspicuous one on the tibia, wedge-shaped.

Yorkshire (W. Falconer). Lancashire (Rev. S. G. Birks).

167. Gamasus nidicolens, Hull. 1,700 μ. 67.

♀. Body piriform; anterior scutum triangular with long setæ; posterior rounded, leaving a very narrow border all round: no space between the scuta. Spines of posterior scutum and margin short flattened lanceolate.

Nests of *Bombi*, West Allendale.

168. Gamasus bombianus, Hull. 1,500 μ. 67.

Found in nests of *Bombus smithianus* and *B. pratorum* in West Allendale.

♂. Hirsute with spiny setæ. Second leg very thick, with stout femoral spur and short broad patellar process; tarsus with two strong spines within, one basal, the other near the middle.

♀. Body oval; anterior scutum pentagonal, concave before and behind the shoulders, with ten long spiny setæ; posterior scutum oblong, short haired, leaving a wide margin.

169. Gamasus wasmannii, Oud. 67.

West Allendale, two females on separate occasions under stones.

170. *Gamasus loricatus*, Wankel.

Middlesex; nymph on the brown rat (Hirst). Scotland.

A species unknown to me.

171. Gamasus magnus, Kr. 66, 67.

Appears to be local. Fatfield, Birtley; West Allendale.

Ireland, in moss.

172. Gamasus immanis, Berl. 68.

Littoral. Bamburgh (Bagnall).

Lancashire (Furness, Bagnall). Ireland, Scotland (King).

173. Gamasus trouessartii, Berl. 68.

Littoral. North Sunderland, Budle Bay.

Lancashire (Bagnall).

174. Gamasus kraepelinii, Berl. 67, 68.

Ninebanks, on a dead fowl. Bamburgh, on a dead rabbit.

Ireland, on decayed fungi. Scotland (Isle of May, Evans.)

175. Gamasus cornutus, Can. 66, 67, 68.

General and common in grass, &c. Pale yellow-brown, piriform, with many rod-like setæ.

Ireland (one ♂ only, under bark). Scotland (Evans).

176. Gamasus oudemansii, Berl. 67.

West Allendale, in moles' nests.

177. Gamasus stygius, sp. n. 67.

Length of both sexes about 1,100 μ; nymph very little smaller. Colour of body and scuta dull whitish.

♀ broad elliptic oval, not shouldered; posterior scutum leaving a narrow margin all round, anterior strongly convex in the middle behind, both evenly covered with rather spiny setæ of uniform length, as also is the exposed body margin, the two humeral setæ only about twice as long.

♂ narrower; dorsal setæ longer and denser; epistome with one ligulate lobe rounded at the apex minutely denticulate at the base and with one or two lateral denticles; setæ of the legs (both sexes) spinous and long, especially on the proximal joints.

Nymph similar in form to the ♀; but with posterior scutum shorter and straight in front, not contiguous to the anterior; dorsal setæ longer, especially the humeral pair; scuta red brown. Epistome (like that of the ♀) of three acute lobes, the median much the largest. This nymph is in all probability the *Poecilochirus carabi* of Canestrini. It travels in a fasting state on *Necrophorus*, spp., but feeds rapidly on reaching carrion, becoming considerably distended. Adults appear within twenty-four hours of the arrival of beetles carrying the nymphs.

Ninebanks, on dead birds and mammals exposed as traps.

178. Gamasus fucarius, sp. n. 67.

Of the same size and general appearance as *G. nidicolens*, but the dorsal setæ are simply spinous and not flattened. The two occur together with various species of *Bombus*, and in spring the female bees almost invariably carry a considerable number of nymphs. All bee-borne nymphs are doubtless included under the *fucorum* of De Geer and most subsequent authors, but the form named *bomborum* by Oudemans probably belongs to *nidicolens*, and his *subterraneus* (*ex* Muller) to *bombianus*, while the remaining form (with triangular posterior scutum) may be assigned to the present species; but I have no definite proof of these collations.

Fucarius ♂ is much smaller than the female. The femoral stridulatory spur is very stout, and constricted at the base without accessory tubercle, unless that is represented by a branch on the distal side. Tarsus ii has two strong inferior spines, one basal, the other about midway (see fig. 37).

DESCRIPTION OF PLATES.

Plate I.

1. *Cillibano dinychoides*, dorsum.
2. ,, ,, posterior margin of venter.
3. ,, *virgata*, dorsum.
4. ,, ,, ventral plates and epigyne.
5. *Urodinychus reticulatus*, dorsum.
6. ,, ,, peritreme.
7. ,, *lucidus*, dorsum.
8. ,, ,, peritreme.
9. ,, ,, epigyne.
10. ,, *roseus*, dorsum.
11. ,, ,, epigyne.
12. *Cillibano catula*, dorsum.
13. ,, ,, outline of epigyne.
14. *Urodinychus minusculus*, dorsum.
15. ,, ,, outline of epigyne.
16. ,, *sartor*, dorsum.
17. *Urodinychus tectus*, epigyne of British example.
18. ,, ,, epigyne, according to Krämer.
19. *Dinychus bisetis*, dorsum.
20. ,, *vartismithii*, dorsum.
21. *Dendrolaelaps bicornis* ♂, posterior margin of dorsum.
22. ,, ,, ♂ nymph, posterior margin of dorsum.

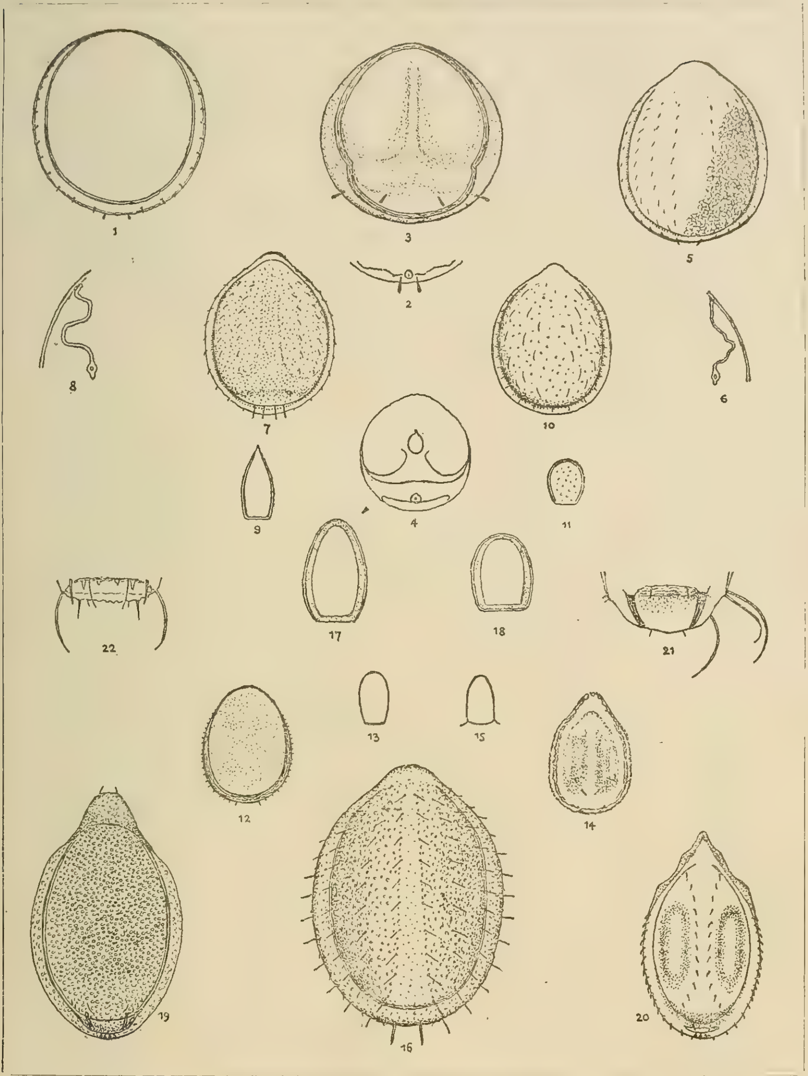
Plate II.

23. *Macrocheles superbus*, dorsum.
24. ,, ,, part of fourth leg of male.
25. ,, *gladiator*, part of fourth leg.
26. ,, ,, humeral trichome.
27. ,, ,, epistome.
28. ,, *plumipes*, epistome.
29. ,, *glaber*, dorsum.
30. ,, *minimus*, dorsum.
31. *Gamasus anglicus* ♂, dorsum.
32. ,, ,, ♀, dorsum.
33. ,, ,, ♂, tarsis i.
34. ,, ,, ♂, stridulatory spurs of second leg.
35. ,, *fucarius* ♂, dorsum.
36. ,, ,, ♀, dorsum.
37. ,, ,, ♂, stridulatory spurs.
38. *Pergamasus coniger* ♂, mandibles.
39. ,, ,, ♀, mandible.
40. ,, ,, ♂, stridulatory spur.

41. *Pachylaelaps fossorius*, epistome.
42. ,, ,, ♀, ventral and anal plates.
43. *Hypoaspis nitidissimus*, ♀, genital and anal plates and lateral scutella.
44. *Cyrtolaelaps humilis*, dorsum.
45. *Ameroseius ingens*, dorsum.
46. *Seiodes punctatus*, dorsum.

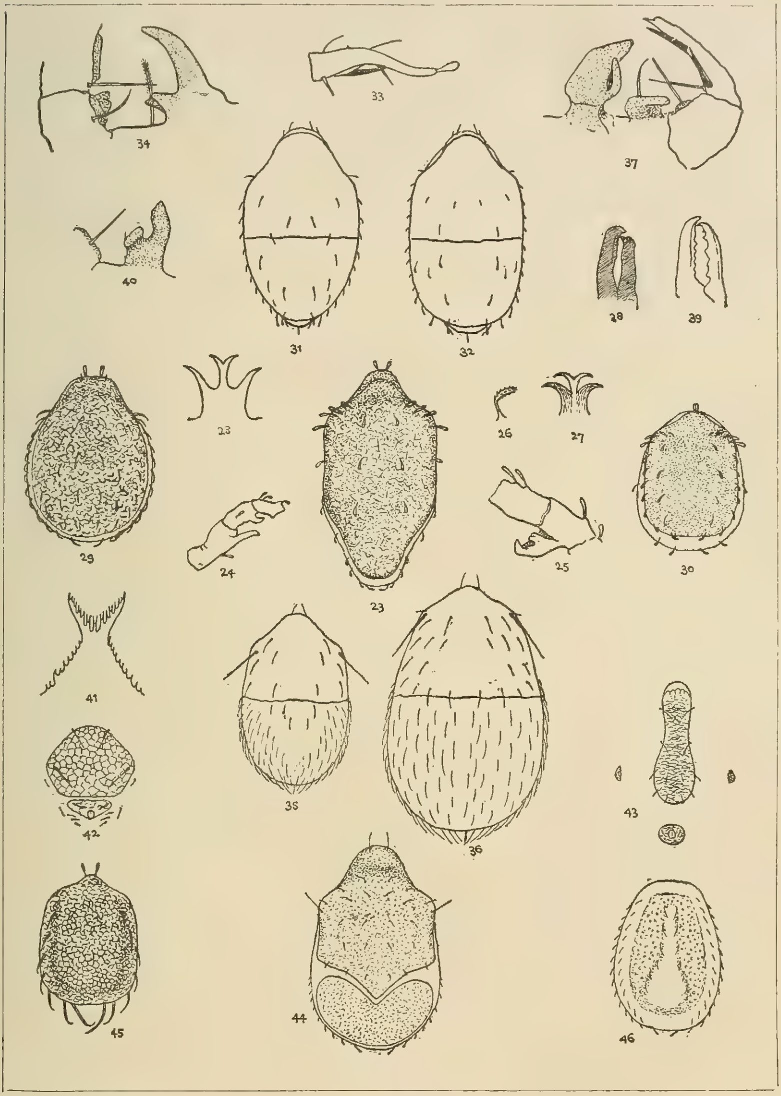
PLATE III.

47. *Rhinothrombium inopinum*, dorsum.
48. *Achorolophus porcinus*, dorsum.
49. ,, *falconerii*, dorsum.
50. ,, ,, dorsal trichome.
51. ,, ,, trichome of leg.
52. ,, ,, extremity of palp.
53. *Rhyncholophus regalis*, extremity of palp.
54. ,, *phalangioides*, extremity of palp.
55. ,, *penninus*, extremity of palp.
56. ,, *regalis*, dorsal trichome.
57. ,, *phalangioides*, dorsal trichome.
58. ,, *penninus*, dorsal trichome.
59. ,, *pachypus*, dorsal trichome.
60. *Belaustium vittatum*, dorsum.
61. ,, *harrisonii*, dorsum.
62. ,, ,, dorsal trichome.
63. ,, *tardum*, dorsal trichome.
64. ,, *scopularium*, dorsal trichome.
65. ,, ,, fore-leg.
66. ,, *miniatum*, fore part of crista.
67. ,, ,, posterior margin of dorsum.
68. ,, *rubripes*, fore part of crista.
69. ,, ,, posterior margin of dorsum.
70. *Rhaphignathus sphagneti*, dorsum.
71. ,, ,, dorsal trichome.
72. ,, ,, aredations of dorsum.
73. *Eupodes clavifrons*, Can., dorsum.
74. ,, ,, humeral trichome.
75. ,, ,, frontal trichome.
76. *Bdella lignicola*, Can., dorsum and palp.
77. ,, ,, palp.
78. ,, *vulgaris*, *var. maritima*, palp.
79. ,, *capillata*, mandible, according to Krämer.
80. ,, *lacustris*, mandible.
81. *Rhagidia muscicola*, dorsum and legs.



J. E. Hull del.

NEW GAMASIDÆ.



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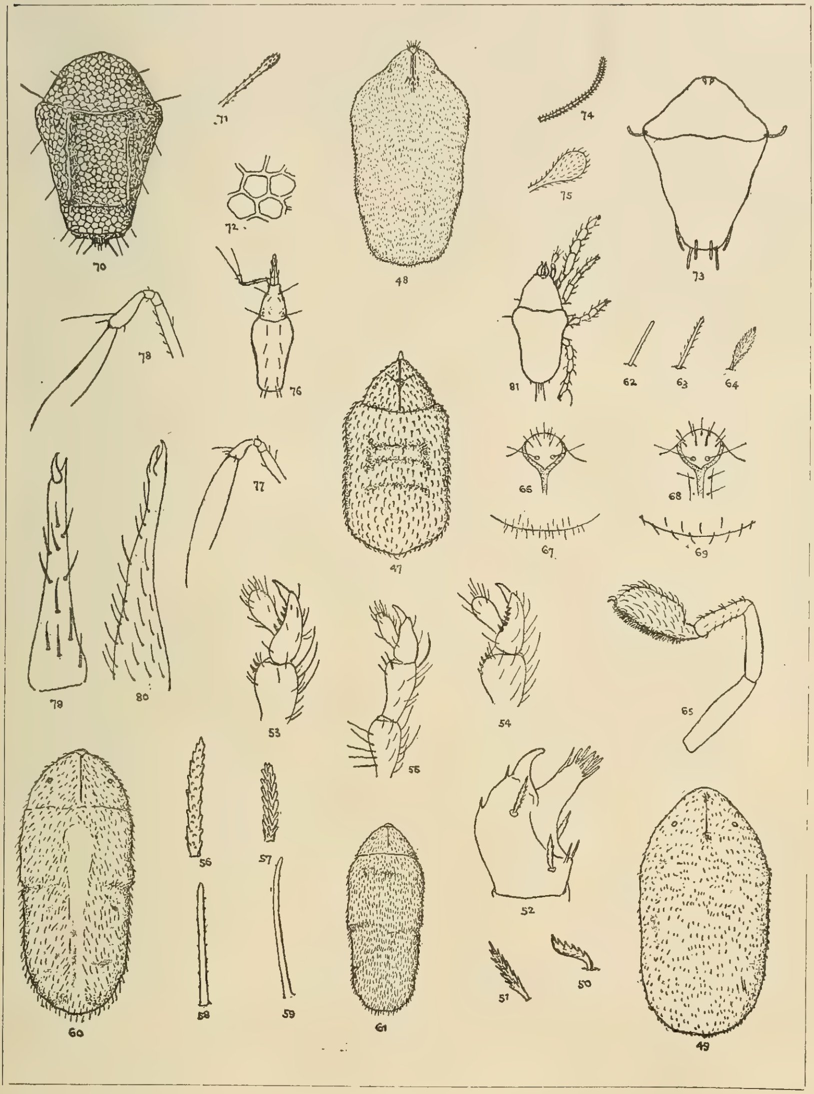


J. E. Hull del.

NEW THROMBIDIIDÆ.

A Survey of the Lower Tees Marshes and of the Reclaimed Areas adjoining them.

By J. W. HESLOP HARRISON, D.Sc.

I.—INTRODUCTORY.

The work outlined in the present paper was undertaken for a variety of reasons, but none was more pressing than the obvious need of determining the salient features of the existing Flora and Fauna of this section of South East Durham before the projected industrialisation of much of the area had exterminated everything. Of great importance, too, was the necessity of comparing the present vegetation with what had been recorded a century ago in such works as Brewster's History of Stockton (1829) and Sharp's History of Hartlepool (1818).

When first planned, the work was intended to follow ecological lines, both experimentally and otherwise. This plan had to be abandoned immediately owing to the necessary restrictions placed upon photography and map-making when war broke out. Now, I have left the district permanently, and all hopes of continuing my labours in brighter days have vanished. From this it will be seen that, whilst offering many facts of value to the ecologist, my work will prove more interesting to the student who approaches the subject purely from the floristic standpoint.

II.—GENERAL CONSIDERATION OF THE AREA.

Topography, etc.

As a whole, the drainage basin of the river Tees has an extent of some 760 square miles, but of this only the comparatively small area lying immediately to the north of the river near its mouth, and extending inland to Billingham has been surveyed; this area covers 14½ square miles.

Geologically, this nook of South East Durham is of Post Glacial origin, and briefly its development took the following course. Soon after the close of the Glacial Period, the Tees and many minor streams emptied themselves into a broad and rather complex common estuary, extending far inland, and including the valleys now traversed by Billingham Beck and others adjacent; it is even possible that some of the low-lying flats of Mid-Durham formed part of the same system. Be that as it may, with the freeing of the North Sea from ice, far reaching changes took place. Owing to the southward trend of the tidal stream in the North Sea, in conjunction with the inability of the somewhat sluggish Tees to carry away the silt borne inward by the sea, enormous deposits of marine warp, which form no inconsiderable part of the sandy and muddy flats surrounding Tees Bay, were laid down as well as small portions further up the river. Aided by the impeding action of these deposits, a gradual backward filling up of the arms of the old estuary occurred, thus originating the tremendous stretch of alluvial soils now present; these are composed of sandy clays, heavily impregnated with magnesium and calcium carbonates washed down by the streams from the Magnesian limestone.

In thickness, these clays, and any boulder clay present, average a hundred feet. Beneath these lie Red (and occasionally Grey) Marls and the New Red Sandstone which share between them somewhat irregularly a further thickness of 1,000–1,500 feet. In the vicinity of Middlesbrough, and extending under the river to Greatham, these are further followed by a layer of 100 feet of rock salt which, however, does not exist far inland as it appears to form a saucer-like deposit, thinning out rapidly in all directions; borings indicate its complete absence under Billingham and Norton parishes.

It must not be supposed that with the cessation of the greater silting-up movements just described that the flats assumed characteristics approximating in any way those of to-day; such a view is far from harmonising with the facts. Various borings near Middlesbrough, revealing the presence of peat beds, tell us very emphatically of far reaching changes, the causes of which we can only guess at, and the magnitude of these changes is confirmed by the presence of enormous sub-fossil oaks of (geologically speaking) recent age. Further, physical changes acting in the reverse direction from these, are hinted at by the great masses of somewhat recent oyster, mussel, and cockle shells lying at no great depth and even on the surface in Greenabella Marsh.

Two hundred years ago, the sandy estuary, with the mud flats known locally as "slems," had an area approaching fourteen or fifteen square miles. If attempts had previously been made to reclaim portions of this tract they were of no significant extent. The first really valuable reclamation attempted was that of Saltholme and Cowpen marshes in 1740, this being brought about by building a solid earth wall skirting Greatham Creek, aided by one striking in a southerly direction from it. Over a hundred years later, the erection of a massive slag wall has completed the good work, resulting in all, in the gain of about 26,000 acres of former salt marsh, now utilised* as a valuable grazing ground for numerous cattle, and in part as the site of valuable iron and salt works.

Although the salt industry in its modern guise only dates from 1862, when Bolckow and Vaughan, in boring for water, struck the rock salt, it is a very ancient one locally, as the name Saltholme indicates. Moreover, in documents dating from the 14th and 15th centuries, frequent references point to the manufacture of considerable quantities of salt here; very probably brine springs and sea water were used as sources.

Relics of the old salt works are visible on all of the marshes in the form of more or less irregular mounds which, until I had grasped their precise import, puzzled me not a little.

If one glances at Hewitt's (1832) Chart of Tees Bay, these reclaimed tracts are represented as being intersected by numbers of small streams; even at that early date this was incorrect, as the earth wall had completely deprived most of these of direct access to the sea. Obviously, for the landward

* This year (1918) extensive portions are being ploughed up in order to grow grain and other food crops.

section of his chart, Hewitt was relying on some earlier one. By this barrier great bodies of water, infinitely greater than one would suspect from the chart, bearing the aspect of long narrow lakes came into being. These are the several "fleets" which form an interlacing system of channels so intricate as to render it difficult for the uninitiated to extricate himself, and render Saltholme and Cowpen Marshes so interesting. They are the home of countless birds and dragon flies. More complete study of these and their ultimate passage into "stells" will be reserved until Saltholme Marsh is considered in detail.

North of Greatham Creek, the erection of the slag wall has had parallel effects in isolating sheets of water in Greenabella Marsh; these, however, are neither so deep as the Saltholme Fleets nor have they lost their original saltiness for, by percolation through the slag wall or otherwise, they still obtain constant supplies of salt water.

Striking across the marshes, now passes the new road to Hartlepool; certain portions of this, however, are of some age. For long stretches on the Saltholme side, this is followed by a drainage ditch or lode into which drain secondary lodes which in turn are fed by "stells," sometimes, but not always, continuous with the main fleets. When first surveyed, the new road, where it struck the earthwall, followed it. Now it swings somewhat abruptly to the east to cross Greatham Creek by a substantial iron bridge, thence traversing Greenabella Marsh and on to Seaton Carew. Enclosed between the abandoned section and the road as it actually exists, is a triangular patch of ground of some botanical importance as will appear later.

Between the Creek and the wall with its westward continuation, is the saltmarsh proper, displaying all the phenomena of primary and secondary marsh with their more or less active or decadent sets of "pans." A similar wall cuts off another salting on the north side of the creek, although this is not so perfect in its development, and further, is hopelessly spoilt by the picturesque "house boats" of the numerous "gunners" who live here during the week-ends.

Greatham Creek itself is a deep cutting (with steep slimy sides which render it very dangerous) driven through the boulder clay by the tidal drive. As we walk up its banks, it gradually assumes the appearance of an ordinary beck; as it does so, the vegetation loses its halophytic nature by degrees, and we see instead the ordinary plants of the streamside.

Leaving now the saltmarshes and the adjacent areas, we must consider the other ground included in the survey. This is that portion of Billingham and Norton parishes enclosed in the small square in Fig. 1, and shown on a larger scale in Fig. 3, representing alluvial flats formed by the filling up of the old valley of Billingham Beck and now known as Billingham Bottoms. Here, as elsewhere, man has stepped in and by his interference changed all. Instead of enormous stretches of fenland differing in little from that of East Anglia, such formations are restricted to a few score of acres which, fortunately enough, retain to some degree their primitive condition. These, however, do not comprise the only ground to be studied for we have the beck itself, fringed by the many water meadows which arose after the cutting of the first drainage lodes; all of these meadows lie at an average height of 10 feet above sea level. On their south side there is a sharp sudden rise to the 25 foot contour line along which stagnates (I almost wrote flows !) the old mill race which used to feed Norton Mill. This, as well as the marshy slopes, are not without interest.

Intersecting the Bottoms runs the Stockton and Hartlepool Railway line, to the east of which flourishes a productive osier bed locally termed the "Willow Garth." This is of great age as it is referred to in Brewster's History of Stockton. Portions of this "holt" (whether by reversion or as an original feature I know not) still display fen characteristics.

Much of the land adjoining the Beck is capable of being flooded, and is so treated deliberately when there are prospects of long continued frosts and the consequent skating.

Climate, etc.

As is usually the case on the north-east coastal area, the coldest months are January and February, the warmest July and August. In the first-named month the average mean maximum temperature for the last ten years has been 45·5° F., and the average mean minimum 33·8° F. Similarly, over the same period, the average mean maximum for July has been 67·7° F., and the average mean minimum 51·9° F. The rainfall for the area is surprisingly slight, the average for the past ten years having been 24·92 inches per annum. The average number of rainy days per annum has been 175, the yearly totals varying between 165 and 214, and most of them very near the former figure.

III.—BILLINGHAM BOTTOMS.

The Trollius Bog.

Description.—The name "Trollius Bog" was, in default of a better, bestowed upon it by myself as indicative of the (for such a low lying area) unusual plant dominating its vegetation over considerable sections; as most of us who have worked in, and learned to love the locality call it nothing else, the name will suffice. Whether the appellation "bog" is justified is quite another matter, for the low annual rainfall, combined with a water supply rich in calcium salts, is not such as conduces to the development of true bogs; the fact remains that we use it.

The soil is a clay very rich in calcium and magnesium carbonates with a slightly higher percentage of iron than the usual. As was to be expected, the water content is always very considerably above the average. Still one must note that we have every stage of transition between soils no wetter than those of a fairly well drained pasture and those constantly under water. With such a choice of moisture conditions one cannot wonder at the excessive richness of the vegetation and the unexpected stragglers derived from diverse sources.

In shape, the "bog" is a long narrow strip lying just north of Billingham Beck toward the western boundary of Billingham parish ; its limits may be regarded as the 25 foot contour line on the north, and on the south, as a lode or runner following more or less exactly that of 12 feet. This lode, which I call the South or Upper Lode, falls into the Lower Lode, and this, in turn, runs into the Beck.

Crossing the marsh almost due north and south, are one or two traverse drains, too narrow to be dignified by the title "lode," and of too little capacity to be of great value in drainage. Linking these up east and west, is a further small ditch, likewise of no value as a drain, but of great significance in dividing the marsh into two sections, a high level marsh and a slightly lower one, the dividing line following the contour line of 18 feet.

North, east and west of the marsh, we pass abruptly into cultivated land, whilst on the south the break of the lode merely separates us from the rich water meadows, which, although intersected by the Lower Lode, stretch right down to to Billingham Beck.

Winter and summer, viewed from a distance, the *Trollius* Bog bears a dull uninteresting aspect owing to the obtrusiveness of the predominating Monocotyledonous components of the plant communities. However, when the reeds flower, the gently swaying heads of the purple-flowered *Phragmitis* are not without a certain sombre beauty which becomes even striking when the reeds, massing themselves in an isolated "island" tower high above the various *Junci* and their associates. Nor do the seasonal colour changes appear great from a distant viewpoint; in winter the tall dead reeds with their yellow brown tints blot out everything just as successfully as the yellow green of the leaves, mingled with the brown of the dying tips, do in summer.

But a closer approach alters everything; even the swaying reeds, with their streamer-like leaves waving to and fro under the influence of the prevalent easterly winds, present a novel and pleasing sight to us dwellers in the North Eastern counties where reeds are very far from being familiar factors in the landscape. And their novelty becomes only the more vivid as their setting gradually passes from the gold of the spring-time Marsh Marigold and Celandine to the lemon of the Globe flower, yielding in its turn to a tangle of blues, pinks and purples derived from Orchids, Scabious, Valerians, Willowherbs, Ragged Robin and the like. These are succeeded for one only too brief week by the delicately moulded Grass of Parnassus with its greeny white, replaced in the end by the yellow of the Fleabane. Hours could be spent in describing all these changes, which I have followed week by week as the year swung round, without exhausting them, so I must hasten to a more particular description of the plant communities.

The Plant Communities.

An accurate mapping out of the various associations quickly forces itself upon one as being of an intricate, nay even impossible, nature, a state of affairs brought about by two sets of circumstances. In the first place, owing to varied choice of moisture conditions offered, coupled with the effects of periodic human interference in the way of firing and cutting the reeds, in many places other than the reed beds, dominant species occur in every possible proportion mingled with associates of diverse types and in equally baffling percentages. The second disturbing factor arises from the fact that the deep water of the lode is so sharply cut off from the marsh by the embankment that one is at a loss in deciding whether we are to regard the whole as one, *i.e.*, the MARSH FORMATION, or to look upon it as two, the reeds forming a definite element of the AQUATIC FORMATION. Although in all probability the Reed Swamp is truly transitional, it seems advisable in view of its standing constantly in a fair depth of water, added to the obvious connection with the vegetation of the lodes, to treat it as an essential feature of the AQUATIC FORMATION.

We have therefore to deal with two formations (1) The AQUATIC FORMATION, (2) The MARSH FORMATION.

(1) THE AQUATIC FORMATION.

The Upper Lode provides us with a closed shallow water association of no great complexity for, probably owing to repeated efforts to clear it, rendered nugatory by the small fall and consequent stagnant nature of the water, we find generally an association of the following* composition dominated by *Lemna minor* and *L. trisulca*:—

Lemna minor	*cd*	Apium nodiflorum	*o*
L. trisulca	*cd*	Nasturtium officinale	*f*
Scirpus lacustris	*f*	N. sylvestre	*r*
Callitriche spp.	*f*	Alisma plantago-aquatica	*o*
Phragmitis vulgaris	*ld*	Potamogeton pusillum	*o*

The Reed Swamp.

Following this, and isolated from it by an embankment (the vegetation of which will be considered below), we encounter a reed swamp association of a well developed type occupying a band of varying width throughout the length of the "bog." Viewed from the slope to the north, this *Phragmitis* transition association seems to bear the aspect of a sharply defined homogeneous community—a view not inconsistent with the facts to a large extent. Closer examination, however, demonstrates that fairly successful attempts have resulted in the infiltration of forms, more at home in the typical marsh associations, even to the very midst of the association in its purest form.

Whilst *Phragmitis vulgaris* remains dominant throughout, the debatable border between the attacking marsh and the (probably) decadent reed swamp seems more properly to appertain to the marsh, and will be treated as an integral portion of such.

As one examines this swamp, one cannot but wonder at the marvellous way in which *Caltha palustris* and *Ranunculus Ficaria* complete their life history before the reeds

* The symbols for frequency are :—*d*, dominant ; *sd*, sub-dominant ; *cd*, co-dominant ; *f*, frequent ; *o*, occasional ; *a*, abundant ; *r*, rare ; *vr*, very rare ; *la*, *ld*, *lsd*, etc., locally abundant, locally dominant, locally sub-dominant, etc. ; *rr*, rather rare.

interfere. They flower before the latter commence to grow, and *Caltha* ripens its seed before the spreading leaves cut off the light supply. *Ranunculus Ficaria* rarely, if ever, seeds, but increases vegetatively in a very vigorous fashion.

A further source of wonder to one is the marvellous manner in which *Oenanthe fistulosa* maintains itself. Its first leaves are necessarily produced in water, and consequently are very finely segmented. Before typical aerial leaves can appear, the plant is completely shaded by the *Phragmitis* leaves; yet it flowers and ripens seed almost destitute of foliage!

Of the association the following is the average composition:

Phragmitis vulgaris	*d*	Rumex Hydrolapathum	*r*
Caltha palustris	*a*	Iris pseudacorus	*o*
Ranunculus Ficaria	*a*	Carex riparia	*f*
Spiraea Ulmaria	*f*	C. vesicaria	*o*
Oenanthe fistulosa	*f*	C. gracilis	*o*
Mentha aquatica	*o*	C. paludosa	*f*
Epilobium hirsutum	*o*	Equisetun limosum	*o*
Myosotis palustris	*f*	Hypnum cuspidatum	*f*
Polygonum amphibium	*f*	Hypnum aduncum	
Galium palustre	*f*	var. pseudofluitans	*f*
Hippuris vulgaris	*la*	Aulacomnium palustre	*f*

At one station in the reed swamp, a slight elevation surrounded by an intensified depression occurs; here a sub-association dominated by *Phalaris arundinacea* holds possession. So like the association just described is it, that it tempts one to classify it as a consocies rather than an association. However, slight though important differences are manifested and justify the latter classification.

The following is the list of associated plants:—

Phalaris arundinacea	*d*	Myosotis caespitosa	*o*
Spiraea Ulmaria	*ld*	Iris pseudacorus	*r*
Caltha palustris	*f*	Carex gracilis	*r*
Cardamine pratense	*f*	Equisetum palustre	*f*
Mentha aquatica	*f*	Hypnum cuspidatum	*f*
Myosotis palustris	*o*	Mnium affine, var. elatum	*la*

(2) THE MARSH FORMATION.

To disentangle the crowded mass of species encountered in the marsh and classify them in associations is, for the most part, beyond one's powers owing to what presents itself to much more than the casual glance as a heterogeneous layer of closed perennial vegetation. In the main, one could describe the whole as a Juncetum, but by listing the various species one would give a fictitious idea of uniformity very far indeed from squaring with the actual facts, it being possible definitely to refer the extreme east of the main marsh to the fen association, and equally satisfactory to assign the western extremity to a Juncetum glauci. These two associations glide imperceptibly into one another in the body of the marsh, and thus give rise to the confusion alluded to above, the causes of which will be apparent when we amplify the meagre details concerning the area given previously.

To begin with, it must not be forgotten that to the east we have a small detached marsh cut off by a hedge and a deep lode or ditch, bounded on three sides by rich meadows and ending abruptly on the sonth at a fence separating it from the first of the water meadows. This, in many features, differs markedly from the area comprising the main part of the marsh.

Jumping over the eastern lode (a matter of considerable difficulty) we discover that the *Trollius* marsh proper is divided into two by the feeble North Lode at the 18 foot level, so that, for about one half of its total length, we have a narrow high level marsh differing widely in many ways from the more extensive lower marsh. These two divisions offer widely diverse conditions of moisture, since the upper one is much wetter to the east and becomes drier as it thins out; besides, it undergoes greater vicissitudes in its fortunes as a marsh, inasmuch as it has to blend with the zone of cultivation which, however, it does more or less abruptly. The lower marsh, on the contrary, becomes wetter southward, and to a less significant extent westward, until the next transverse drainage cutting is reached, where we have a definite bank-side. Throughout its southern front, the lower marsh battles with the reed swamp vegetation.

West of this embankment, the tendency to separate into marshes of two distinct levels progressively diminishes until, to all extents and purposes, no distinction exists. Conditions become much drier until the site of an ancient *Salix* association comes into view. Again to the west, a region very manifestly drier than any hitherto considered is evident, which, by virtue of this dryness, merges almost insensibly into the neighbouring meadows.

Finally, the whole narrows into a finger-like angle, maintaining a coterie of lush-growing plants of even opposed affinities.

With such emphatically different environments, it would be an ill-judged procedure to treat the formation as a whole, and we shall therefore endeavour to divide it into recognisable units and to point out the peculiarities of the Floras.

The Detached Eastern Angle.

Concerning the vegetation of this nook, there is no possibility of doubt; it forms emphatically a Junco-caricetum, although not of uniform character throughout, owing to the configuration of the land. In the centre, this is gently elevated, and from this slight eminence it falls slowly enough away to the east and south, but even less definitely to the north. In consequence, a sort of zonation of the vegetation displays itself, and as we pass inward we proceed from an almost pure Caricetum paludosae to a Junco-caricetum in which the co-dominants are the same *Carex* and *Juncus effusus*. At all times the latter approaches in its general aspect the fen associations owing to its high percentage of dicotyledonous plants, of which one, *Valeriana sambucifolia*, practically attains dominancy in July in the centre. Round this is a zone in which *Angelica sylvestris* and *Lotus uliginosus* become very plentiful, but as we proceed outward the ground becomes very wet, and the Junco-caricetum gives place to a society of which *Phalaris arundinacea* is the predominant feature. To the north, until cultivated land is reached, *Junci* remain dominant, but, to the eye, the vegetation is more a matted collection of miscellaneous perennials than anything else.

Strange to say, despite the apparently suitable situations the nook has to offer, *Trollius europaeus* almost fails, one plant representing the species. For this deficiency one has to blame the absence of the mole-worked ground which seems to favour the germination and future success of the seedlings. A second prominent plant almost an absentee is *Parnassius palustris*, but this causes little surprise when one compares the habitat with stations at Wolsingham, Middleton-in-Teesdale, Ninebanks and Blackhall Rocks where sturdy seedlings abound. There we have a light soil clad with vegetation of an exceedingly open character.

Appended is a list of the plants found here :—

Carex paludosa	*cd (ld)*	Tritolium pratense	*o*
Juncus effusus	*cd*	Myosotis caespitosa	*f*
Phalaris arundinacea	*ld*	Parnassius palustris	*r*
Valeriana sambucifolia	*ld*	Mentha spp.	*f*
Ranunculus Ficaria	*f*	Scabiosa succisa	*f*
Ranunculus repens	*rr*	Rumex acetosa	*f*
Caltha palustris	*a*	R. conglomeratus	*f*
Trollius europaeus	One plant	R. Hydrolapathum	*r*
Cardamine pratense	*o*	Rhinanthus cristagalli	*r*
C. flexuosa	*o*	Salix caprea	*vr*
Lychnis Flos-cuculi	*la*	Carex riparia	*o*
L. dioica	*o*	Carex Goodenowii	*r*
Cerastium viscosum	*o*	C. vulpina	*f*
Spiraea Ulmaria	*a*	Juncus glaucus	*o*
Epilobium hirsutum	*f*	J. conglomeratus	*o*
E. palustre	*o*	J. acutiflorus	*f*
Angelica sylvestris	*a*	Orchis maculata	*f*
Galium palustre	*a*	Listera ovata	*r*
Cnicus palustris	*o*	Deschampsia caespitosa	*f*
Senecio aquatica	*o*	Holcus lanatus	*f*
Achillea ptarmica	*f*	Agrostis alba	*f*
Vicia cracca	*f*	With stragglers from cultivation.	
Lotus uliginosus	*a*		

The Upper Marsh.

Here, as we stated above, we are dealing with what is primarily a genuine fen association, the constituents of which vary with kaleidoscopic rapidity, so that one almost overlooks the fact that the unobtrusive *Junci* are to be regarded as dominant; indeed, locally, this is not the case, for rarely various dicotyledons play that rôle as also does *Molinea caerulea* at slightly drier points.

To the landward side, a fringing band of *Phragmitis* appears as a pathetic reminder that here the seeds of that plant, driven before the south easterly winds, find their last chance of germination in suitable soil for many miles. Ignoring this (here) purely adventitious element, we find that owing to the damp clayey tendencies of the soil, a much opener class of vegetation flourishes, and we have a copious ground Flora of mosses of the genus *Hypnum* of which *H. cuspidatum* is the chief. Occasionally masses of other mosses, such as *Fissidens adiantoides* and *F. bryoides* coat the bare soil, growing amongst which we find, amongst other plants, *Hypericum tetrapterum* which is here unaccountably rare. Throughout this section, *Iris pseudacorus* and *Spiraea Ulmaria* are very common.

Succeeding this area, the vegetation becomes more varied, and *Trollius europaeus* abounds locally, as well as *Orchis maculata* of all shades and forms. There, too, *Parnassius palustris* luxuriates in company with *Angelica*, *Spiraea*, *Crepis paludosa* and *Poterium officinale*, yielding at one point to *Thalictrum flavum*. Then the fringing *Phragmitis* vanishes, and instead, *Eupatorium cannabinum* holds sway.

Gradually the *Trollius* beds diminish as drier conditions supervene; *Gymnadenia conopsea* begins to be common, and societies of *Pulicaria* prevail, interspersed with occasional *Listera ovata* and *Orchis incarnata*.

Just before the lode is reached, a dampish depression supporting a *Caricetum* dominated by *C. Goodenowii* appears in which a common plant is *Helleborine palustris*. The composition of this Caricetum will be given separately below.

Immediately to the north of this, is the habitat of *Gymnadenia densiflora*; on its southern margin, likewise, a rare spider, *Pirata latitans*, was first captured and added to the Durham list.

West of the lode, vegetation of much the same facies occurs, but as a herald of a significant change in moisture content, *Briza media* puts in a somewhat unexpected appearance.

Florula of the depression :—

Carex Goodenowii	*d*	Orchis maculata (agg.)	*f*
Juncus glaucus	*sd*	Helleborine palustris	*a*
Lychnis Flos-cuculi	*f*	Juncus effusus	*o*
Valeriana dioica	*f*	Agrotis alba	*o*
Hydrocotyle vulgaris	*la*	Poa trivialis	*o*
Pulicaria dysenterica	*a*	Equisetum hyemale	*r*
Gymnadenia conopsea	*o*	Hypnum spp.	*a*

In the main area the following were observed :—

Ranunculus Ficaria	*a*	Spiraea Ulmaria	*la*
R. repens	*r*	Poterium officinale	*la*
Caltha palustris	*a*	Crataegus oxyacantha	*vo*
Trollius europaeus	*a*	Parnassius palustris	*a*
Thalictrum flavum	*la*	Epilobium hirsutum	*a*
Cardamine pratense	*o*	E. palustre	*f*
Stellaria uliginosa	*f*	Primula veris	*rr*
Lychnis Flos-cuculi	*a*	Rumex acetosa	*a*
L. dioica	*f*	R. conglomeratus	*o*
Geranium pratense	*a*	Plantago lanceolata	*o*
Hypericum tetrapterum	*o*	Orchis maculata (forms)	*a*
Angelica sylvestris	*a*	O. incarnata	*rr*
Oenanthe fistulosa	*r*	O. hybrid Heinzliana	*r*
Heracleum sphondyllium	*o*	O. hyb. mixta	*r*
Hydrocotyle vulgaris	*r*	O. hyb. ambigua	*r*
Galium palustre	*f*	Gymnadenia conopsea	*f*
Valeriana sambucifolia	*a*	G. densiflora	*l*
V. dioica	*f*	Listera ovata	*f*
Scabiosa succisa	*a*	Iris pseudacorus	*la*
S. arvensis	*f*	Juncus spp.	*a*
Senecio aquaticus	*o*	Triglochin palustre	*o*
S. erucifolius	*vr*	Carex spp.	*o*
Taraxacum palustre	*f*	Schoenus nigricans	*o*

Crepis paludosa	*f*	Phragmitis vulgaris	*la*
Bidens tripartita	*r*	Phalaris arundinacea	*f*
Achillea ptarmica	*f*	Briza media	*o*
Cnicus palustris	*o*	Holcus lanatus	*a*
Centaurea nigra	*f*	Deschampsia caespitosa	*f*
Pulicaria dysenterica	*la*	Agrostis alba	*a*
Eupatorium cannabinum	*la*	Molinia caerulea	*la*
Myosotis caespitosa	*f*	Equisetum spp.	*o*
Prunella vulgaris	*f*	Aulacomnium palustre	*o*
Mentha aquatica	*a*	Hypnum cuspidatum	*a*
Vicia cracca	*a*	Hypnum praelongum	*f*
Lotus uliginosus	*f*	Fissidens adiantoides	*f*
Lathyrus pratensis	*f*	F. bryoides	*l*
Trifolium spp.	*f*		

The Eastern Half of the Lower Marsh.

Necessarily, much damper conditions control the situation here, and more open vegetation prevails. Furthermore, monocotyledons reassert their real dominancy, and although in actual species, either monocotyledonous or dicotyledonous, no great differences are seen, the former occur in much superior percentages to those of the upper marsh. Even in the case of the dicotyledons their relative proportions are greatly changed.

Locally, wetter depressions occur which, offering even damper habitats than the marsh generally, secure a different class of tenant. One, in particular, contains much *Hypnum*, and there *Trollius* fails at once, so that a definite Hypnocaricetum dominated by *Hypnum cuspidatum* and *Carex gracilis* is formed.

To the east of this, *Spiraea* is very common, but to the west *Trollius* enjoys the dominant position. It must be noted as a valuable fact that, wherever these collide and battle for supremacy, then *Spiraea* ousts the *Trollius*. Just north-west of the *Phalaris* island described above, the ground rises slightly and harbours a colony of moles, which considerably lighten the soil. Here *Trollius* revels, and crowds of seedlings grow vigorously in the happy environment.

Over the whole of this marsh *Orchis incarnata* replaces *Gymnadenia* and *Orchis maculata*, being much more tolerant of standing water. Moreover, *Pulicaria*, *Thalictrum* and *Helleborine* fail to appear ; so, too, there is an evident weakening of many of the elements of the upper marsh such as *Parnassius* and *Poterium*, the greater abundance of *Carex gracilis*, *C. Goodenowii*, *C. riparia*, *Iris pseudacorus*, *Oenanthe fistulosa* serving to remind us of the proximity of the Reed-swamp. Whence we see that, at any period other than when the *Iris* and *Trollius* are in full bloom, the hues of the flowers are of a very subdued tone and contrast violently with the *Epilobium* and *Geranium* lining the lodes, and with the greater abundance of brightly coloured flowers in the marsh above.

The differences between the vegetation here and that just studied having been indicated, no list will be given now.

The Western Half.

As described previously, the water content of the soil is limited in this area, and the associations represented may be deemed to be two, despite the fact that no hard and fast boundary line can be drawn between them. These are the rejuvenating Salicetum and the Juncetum communis in which the vegetation becomes sparser and dwarfer—circumstances induced by two controlling factors, (1) the lack of moisture, (2) the advent of a considerable quantity of the parasitic *Rhinanthus crista-galli* which, exactly as in a meadow, robs the plants of their nourishment and brings about their dwarfing.

The slow diminution in moisture is likewise signalled by the intrusion of plants usually members of drier associations, viz., *Primula veris*, *Ranunculus acris*, *Tussilago farfara* and *Briza media*, all of which are fairly plentiful, but more particularly the first-named ; this struggles in competition with the *Junci* with a considerable measure of success, and all advance right into the heart of the *Juncus glaucus* colony up to the limits of the wetter soil which effectually represses them.

The prevalent conditions, too, are demonstrated by the gradual elimination of the *Trollius* and, what seems to be its satellite, *Crepis paludosa.* Of the orchids, *O. incarnata* vanishes, and *O. maculata* becomes less usual, although *Helleborine palustris*, *Listera ovata*, *Gymnadenia conopsea* (in descending order of frequency) still flourish, and so too does *Parnassius palustris.*

In all parts of the marsh previously studied, a remarkable absence of the common *Ranunculus flammula* strikes one as peculiar, yet here it makes a belated appearance in small—very small—quantity, just enough to force more clearly upon one its failure elsewhere. *Triglochin palustre*, likewise sparingly found in the eastern upper marsh, not uncommonly thrusts itself upon one, whilst *Pulicaria* is very plentiful.

The following displays the contents of the marsh :—

Juncus glaucus	*d*	Geranium pratense	*f*
Caltha palustris	*f*	Parnassius palustris	*f*
Ranunculus acris	*f*	Orchis maculata	*o*
R. flammula	*r*	O. mascula	*r*
Heracleum sphondyllium	*o*	Helleborine palustris	*la*
Angelica sylvestris	*f*	Listera ovata	*o*
Hydrocotyle vulgaris	*rr*	Gymnadenia conopsea	*o*
Valeriana sambucifolia	*o*	Juncus effusus	*f*
Trifolium spp.	*f*	J. acutiflorus	*f*
Lotus uliginosus	*f*	Luzula sylvatica	*o*
Vicia cracca	*f*	Carex Goodenowii	*o*
Lathyrus pratensis	*f*	Agrostis alba	*a*
Spiraea Ulmaria	*la*	Phragmitis vulgaris	*o*
Epilobium tetragonum	*o*	Holcus lanatus	*a*
Galium palustre	*f*	Briza media	*f*
Prunella vulgaris	*o*	Phalaris arundinacea	*o*
Taraxacum palustre	*o*	Triglochin palustre	*f*
Pulicaria dysenterica	*ld*	Hypnum spp.	*f*
Primula veris	*la*		

Of the Salicetum, owing to its obviously (so to speak) faulty condition, there is not much more to say than that *Salix caprea* is certainly not now dominant. Nevertheless, in some not far distant future, it will recover from the devastating effects of fire, for already rejuvenescence is occuring both from the old roots, and by means of a goodly stock of seedlings.

Still, the association is clearly separable from the Juncetum for *Phalaris* is plentiful, and *Scrophularia aquatica* attracts one by its presence, the latter being elsewhere non-existent, and the former conspicuously rare in the west generally. Furthermore, *Spiraea Ulmaria* (never really absent anywhere) grows freely, and here other shrubs like *Crataegus oxyacantha*, *Rosa canina* and also *Fraxinus excelsior* appear. With these exceptions the associated plants agree in the main with those just listed.

Finally, the marsh as a whole degenerates into a heterogeneous growth of marsh and hedgerow plants, intermingled with weeds from cultivated land and stragglers of diverse predilections. A selected portion of the western "finger" supported the following plants:—

Ranunculus acris	Rumex spp.
R. bulbosus	Scabiosa arvensis
Lychnis dioica	Centaurea nigra
Epilobium hirsutum	Scrophularia nodosa
Heracleum sphondyllium	Urtica dioica
Galium cruciata	Phalaris arundinacea
G. aparine	Phragmitis vulgaris
Vicia cracca	Holcus lanatus
Potentilla anserina	Dactylis glomerata
Spiraea Ulmaria	Lolium perenne
Geranium pratense	Agrostis canina

All more or less abundant.

The Vegetation of the Stagnant Lodes and their Banks.

This is far from being uniform, for *Phalaris*, *Epilobium*, and *Phragmitis*, in and out of the water, alternate in supremacy, but yield occasionally in the water to *Lemna minor* and to algae of the genera *Spirogyra* und *Vaucheria*.* Very occasionally *Veronica beccabunga* can be seen. Only one other point deserves note, and that is that on the central transverse lode, *Thalictrum flavum*, both down to the water and on the sides, has produced the germs of a future powerful colony to replace those being swamped by *Phalaris* and *Heracleum* just above. Otherwise the plants encountered are those typical of the fen associations.

* Very probably *V. sessilis*.

The Water Meadows and the Railway Sides.

Leaving the *Trollius* "Bog" we pass into the first reclaimed portion, now utilised as a pasture; consequently, many marsh plants are suppressed by the grazing cattle, which would have survived in spite of the drainage. One clayey patch still remains excessively wet, and this allows the development of that form of Juncetum typical of badly drained pastures. Very little worthy of note occurs except *Veronica scutellata* not hitherto met with, but, nevertheless, *Senecio aquatica*, contrary to what obtains in the Trollius Marsh is abundant; further, *Glyceria fluitans* and *Alopecurus geniculatus* are common. In the hedge near by an extremely interesting rose, very close to type *Rosa Sherardi*, finds a home.

Crossing the beck, we reach the main chain of fertile water meadows which, by virtue of their rich alluvial soil, yield great crops of hay. They contain all the usual grasses and other plants of a rich damp meadow which there is no necessity to enumerate. Still, one must not omit to mention the extraordinary sight presented by these when various plants are in flower. At one time, they appear a rich blaze of gold from the crowds of Marsh Marigolds in the furrows, changing to the heliotrope of Cuckoo-flowers, in its turn to be overpowered by the yellow and purple of Cowslips and the early Purple Orchis, the latter, however, varying from white, through salmon and pink to purple.

Cutting the water meadows into two divisions, is the railway embankment yielding crowds of interesting casuals of which the following are singled out to mention :—

Papaver hybridum	Campanula Medium
Reseda lutea	Medicago sativa
Reseda luteola	Rubus caesius
Centaurea scabiosa	Daucus carota
Senecio viscosus	Bromus arvensis

The Osier Bed.

Immediately to the east of the railway the "Willow Garth" lies in a roughly rectangular depression. Formerly, before the railway existed, it seems to have been more extensive, occupying a saucerlike hollow now partly covered by ballast. Whether the bed is natural or not is doubtful, but if one is to judge by the occurrence of the *Salix* thicket in the *Trollius* Marsh, and the sporadic appearance of *Salix viminalis*, *S. caprea* and *S. triandra* elsewhere the chances are that it is so. Even if artificial, since it occurs in a suitable habitat for its dominant *Salix viminalis*, and further because it has existed at least a hundred years*, it has attracted to itself plants proper to the Salicetum of the marsh. It must, however, not be regarded as uniform throughout, as in the deepest part of the depression, where a constant depth of water stands, a local association in which *Phragmitis* holds the premier position is apparent.

The vegetation does not depart greatly from the average of the *Trollius* Marsh ; nevertheless, a few plants not seen there are present in addition to the chief *Salix*. The most important of these is *Geum rivale*, of sparing occurrence in south-east Durham now, and obviously rare enough a century ago to warrant a record† of its presence in this precise station then. Another novelty is the Aspen (*Populus tremula*) which, despite Baker and Tate's cheerful remark|| that it is frequent in woods and hedges, is exceptionally rare in Durham ; at any rate, frequent botanising excursions throughout the county have only shown its occurrence, and that sparingly, at two other stations. Here also *Populus nigra* intrudes, probably, in view of its liking for railway sides, as a "passenger" from some wooded area. *Tanacetum vulgare* is another item foreign to the *Trollius* Marsh.

Appended are the contents of the Osier bed :—

Salix viminalis	*d*	Spiraea Ulmaria	*a*
Phragmitis vulgaris	*ld*	Geum rivale	*f*
Ranunculus Ficaria	*a*	Crataegus oxyacantha	*o*
R. repens	*a*	Rosa spp.	*o*

* *Vide* Brewster's "History of Stockton," Appendix II., page 46, 1829.

† *l.c.*, page 46.

|| Baker and Tate's "New Flora," page 247, 1868.

Caltha palustris	*a*	Rubus spp.	*o*
Lychnis Floscuculi	*a*	Fraxinus excelsior	*r*
L. dioica	*a*	Salix caprea	*o*
Epilobium hirsutum	*la*	S. triandra	*o*
Geranium pratense	*f*	S. alba	*o*
Angelica sylvestris	*f*	Populus tremula	*o*
Valeriana sambucifolia	*f*	P. nigra	*o*
Cnicus palustris	*o*	Phalaris arundinacea	*f*
Tanacetum vulgare	*la*	Carex vulpina	*la*
Pulicaria dysenterica	*la*	Juncus spp.	*a*
Mentha spp.	*la*	Equisetum palustre	*la*
Vicia cracca	*a*	and various intruding	
Lathyrus pratensis	*f*	Graminaceae	*a*

Billingham Beck, the Mill Race and its Embankment.

Owing to the vital importance of keeping the beck constantly cleared to secure a steady flow in such a low-lying district, it is periodically cleaned out. As a natural result, although many plants occur in isolated clumps, they are never associated except perhaps when *Nymphaea lutea* abounds; with it there flourish quantities of *Alisma plantago-aquatica, Scirpus lacustris, Sparganium ramosum* and the like.

On the banks only *Salix triandra* and *Symphytum officinale* call for comment.

As the bottoms lie so low and are so regular, and since the Mill Race follows the 25 foot contour line, the embankment holding it rises very sharply from the meadows and would, therefore, hold no promise of a further marsh. Such, however, owing to the water containing powers of its irregular clayey slopes exists there.

Both the race and the slope being of ancient origin, and the former long since disused, they are colonised by suitable plants. Nor are these exactly the same as those listed for the adjoining marshy ground; in the Mill Race, *Glyceria aquatica* plays the dominant part although, save for *Mentha arvensis* (with hybrids) and *Veronica anagallis*, its fellow colonists are the same as those studied in the lodes and the beck. In addition, *Hypnum riparium* is locally common.

The marsh on the bankside is dominated by *Juncus glaucus*, but it supports Rosaceous shrubs belonging to the genera *Crataegus*, *Rosa*, *Prunus* and *Rubus*. Of these, the *Rosæ* will yet provide material to add to my list of Durham roses*. In addition, several rare and somewhat unusual plants appear of which *Allium vineale* is the chief, *Petasites vulgaris* and *Geum rivale* being more of local importance.

IV.—SALTHOLME MARSH.

This comprehensive designation is intended to include all the reclaimed saltmarsh lying without the earliest earth wall; it therefore covers all the tracts to which the names Saltholme, Cowpen and Fore Marshes are applied in the Ordnance Maps, as well as the roads crossing them.

At all seasons it gives one the impression of a dull dreary waste, relieved by nothing except the cattle grazing in the distance, a few derelict sycamores, and a few mounds. Lying buried within the last, in some instances, are the long abandoned saltworks of the mediaeval period; some of the hillocks, however, enclosed within the bends of the fleets described below, are just as certainly the work of the wind and tides of centuries past.

Near views dispel the lack of interest, especially in the north-east, for before us spread out mighty "fleets," lakelike in their appearance, particularly when Holme Fleet is the object of one's gaze. In origin, these are deep cuttings, driven through the soft boulder clay and alluvial soils by the tidal scour, isolated by the erection of the earth wall, and subsequently filled to the brim with water.

In order of importance these "fleets" are Holme Fleet, Swallow Fleet, Mucky Fleet and Todler's Fleet. As will be seen from the map, they are linked up and provided with an outlet in the form of a deep channel, running parallel to the sea wall, which empties itself by locks into Greatham Creek. As they degenerate they are likewise connected naturally by a

* Harrison "The Wild Roses of Durham," Naturalist, January, 1916.

series of meandering grassy channels in the recesses of the marsh called "stells." They now contain water more or less fresh, but which becomes very perceptibly brackish as we approach Greatham Beck. Although the water level alters slightly according to the season, the change to a casual glance is not apparent. If, however, one follows the fleets backward, it will be discovered that they branch and lead into the little grassy stells which in turn pass imperceptibly into the general level of the "marsh"—using the term not because it is a marsh now but because it was so formerly. It is in these stells, not the greater ones connecting up the several fleets, that any alteration in water level betrays itself, for in summer the water vanishes, and they becomes grassy depressions differing but little outwardly from their surroundings, except in the darker green of their vegetation.

Holme Fleet.

By virtue of its superior size and greater depth, and favoured by the comparative freedom of its waters from salt, the Flora of Holme Fleet is much richer than than that of the other three.

Moreover, the amount of silting up it has undergone is quite negligible, comparisons made between the six inch Ordnance Map of 1860 and the conditions of the present day showing quite unimportant changes. This stability results from its superior depth in the first place, maintained subsequently by powerful hydrodynamic agencies set in motion by the wind which retain the silt in a perpetually suspended condition; this, naturally, means that the water is nearly always turbid. The great wind forces brought into play are further emphasised by the almost total absence of vegetation on the north side and its concentration to the south and east.

I have no exact measurements of its depth; still I am assured by my friend Milburn, who has traversed it in a boat and made rough soundings with a pole (and had unfortunate wading experiences in it!), that its maximum depth exceeds 20 feet. Further, he tells me that, beyond the limits of the

Reedswamp, there is an abrupt descent to great depths, followed by a gentle shelving until the maximum depth for that particular area is attained. Behind the reedbelt, a shelf varying in width from fifteen to forty feet occurs, covered with water to depths varying from an inch to a foot and a half.

At its most easterly limits, the fleet displays a breadth of over forty yards, but this quickly falls to thirty; this breadth is maintained for a quarter of a mile when, as the fleet bends southward, the maximum of sixty yards is attained. From that it diminishes very gradually, sending off offshoots to link up the fleets, or to lose themselves in winding stells.

My friend assures me that everywhere the bottom is composed of a soft, sticky clay.

As was mentioned above, the vegetation masses itself along the southern shore, and there, to the eye, it breaks into four belts. Apparently the zonation is perfect, but when one attempts to to decide as to what formation to assign the landward zones, nay to determine what are to be regarded as true zones, difficulties at once ensue. About the status of the deep water water plants no hesitation is felt; nor do the serried ranks of *Scirpus* and *Glyceria* on the crest behind cause doubt; both, unquestionably, appertain to the AQUATIC FORMATION. But what are we to do with the marginal group of *Glyceria* on the ledge? Outwardly a distinct zone, when critically examined they are found in their vegetation to coincide with the belt just outside; yet how different! There, the plants are tall and flower and fruit well; here, they are low and never flower. Why is this disparity seen? Principally because the inner band is kept down by grazing cattle, that outside being protected by the depth.

Again, how are we to treat the inmost belt of all? *Glyceria* is gone, and instead we have a very open association of marsh plants exhibiting a wealth of species but a poverty of individuals; manifestly, its differs widely from the preceding *Glyceria*. But are conditions different? No, water depth, soil and similar factors are essentially the same; whence we decide that the landward *Glyceria* and the succeeding plants are to be regarded as a unit and that unit a member of the Marsh as opposed to the Aquatic Formation, in spite of its betraying transitional characters. We are thus reduced to the consideration of three zones.

Of these a submerged leaf association occupies that furthest from the shore just when the Fleet deepens abruptly. This association contains only two plants :—

Myriophyllum spicatum	*d*	Potamogeton lucens	*o*

Just within this, on the limits of the ledge, we have a narrow band of Reedswamp dominated by *Glyceria aquatica* and less frequently by *Scirpus maritimus.* No matter which is dominant, the growth is very pure and almost closed, but, at intervals, outposts of *Scirpus lacustris* project into the deeper water. Very rarely *S. maritimus var. monostachys* displaces the type. The following are the plants found here :—

Glyceria aquatica	*ld*	Alisma plantago-aquatica	*o*
Scirpus maritimus	*ld*	Scirpus lacustris	*o*
Ranunculus sceleratus	*f*	S. var. monostachys	*o*

Succeeding this association, we have an open marsh community of strange aspect, the components of which, whilst purely marsh-loving plants, are proper to widely opposed associations and even formations. No sight was stranger than to see *Triglochin palustre* and *T. maritimum* rubbing shoulders with each other. These anomalies give a clue to the fortuitous manner in which this vegetation has assembled. The plants noted there were :—

Glyceria aquatica	*ld*	Juncus compressus	*r*
Ranunculus sceleratus	*f*	J. maritimus	*vr*
R. Drouetii	*r*	J. lamprocarpus	*r*
Nasturtium officinale	*a*	J. glaucus	*la*
Cochlearia officinalis	*o* (on mud)	Scirpus fluitans	*o*
Epilobium hirsutum	*o*	S. compressus	*o*
E. palustre	*o*	S. setaceus	*f*
Atriplex patula (!)	*f*	S. Tabernaemontani	*la*
Rumex conglomeratus	*f*	Eleocharis palustris	*f*
R. sanguineus	*f*	Carex vulpina	*f*

Myosotis caespitosa	*o*	C. distans	*vr*
Glaux maritima	*la*	Alopecurus geniculatus	*o*
Triglochin palustre	*f*	Glyceria fluitans	*f*
T. maritimum	*vr*	Festuca rubra	*f*
Juncus bufonius	*r*	Fontinalis antipyretica	*o*
J. supinus	*r*		

Independent of the main zone system, a somewhat different association occupies a small arm sent off southward just where the Fleet is contained by the earth wall. This is dominated by a mass of *Scirpus maritimus*, which yields in deeper water to *Glyceria* continuous with that lining the Fleet. The Reed-swamp here is of different composition and comprises one plant especially making it worthy of mention; that plant is *Potamogeton compressus* :—

Glyceria aquatica	*cd*	Lemna minor	*a*
Scirpus maritimus	*cd*	L. trisulca	*f*
Myosotis palustris	*f*	Alisma plantago-aquatica	*f*
Callitriche spp.	*a*	Potomageton compressus	*f*
Myriophyllum spicatum	*a*	Glyceria fluitans	*o*

As the Fleet penetrates more remotely into the "Marsh," it breaks into stells, some broad and deep, others shallow and often dry, and still others with a mud bank in the centre.

Those perpetually supplied with water are far from uniform in the vegetation they support, but an example, specially selected for study, possessed a dense central column of *Eleocharis palustris* of an exceptionally luxuriant form, behind which stretched on both sides a band of *Glyceria aquatica* two yards wide; succeeding this was vegetation approximating that in the transition zone to the rear of the Reedswamp. Toward the Fleet, the *Eleocharis* merged into the pure growths of *Scirpus maritimus* which alternate with the *Glyceria* there. Very rarely, *Scirpus Tabernaemontani* plays the part of *Eleocharis*, and then the association is of a characteristically open type.

Passing away from their confluence with the Fleet, the stells, deep and shallow alike, meander in an aimless path across the broad open expanse until, often enough, all the water left occurs in irregular muddy hollows overgrown with grasses. Such would seem ideal habitats for Junceta yet here, as elsewhere in Saltholme, *Junci* are feebly represented in individuals. An average florula of such a grass-grown stell would be :—

Ranunculus lenormandi	*l*	Carex vulpina	*la*
Glaux maritima	*l*	C. pallescens	*r*
Juncus bufonius	*la*	C. distans	*vr*
J. supinus	*f*	Alopecurus geniculatus	*a*
J. var. fluitans	*o*	Glyceria fluitans	*ld*
J. conglomeratus	*vr*	Scirpus setaceus	*f*

Almost unnoticed, the lesser stells glide into the general level of the former marsh which now forms a coarse pasture wholly devoid, not only of all salt marsh plants, but also of many others we look upon as necessary constituents of the Flora of an ordinary field. In addition, there is a great scarcity of other plants commonly abounding there, a prominent defaulter being the common daisy (*Bellis perennis*). The predominant elements everywhere are provided by different species of the coarsest of grasses. On the mounds, except for *Galium verum*, exactly the same plants appear. An hour's careful search yielded the following list :—

Ranunculus repens	*c*	Bellis perennis	*r*
R. acris	*r*	Taraxacum vulgare	*r*
Cardamine pratense	*c*	Crepis biennis	*r*
Cerastium viscosum	*r*	Leontodon autumnalis	*c*
Lathyrus pratense	*r*	Primula veris	*o*
Trifolium repens	*c*	Holcus mollis	*f*
Lotus corniculatus	*rc*	H. lanatus	*f*
Rumex acetosa	*vc*	Dactylis glomeratus	*f*
R. acetosella	*less c*	Poa pratensis	*f*
R. crispus	*o*	Bromus hordeaceus	*o*
Carduus nutans	*o*	Arrhenatherum elatius	*o*
Cirsium arvense	*lc*	Poa annua	*o*
C. lanceolatum	*o*	Juncoides campestris	*rc*
Achillea millefolium	*r*		

Swallow, Mucky and Todler's Fleets.

After discussing such a magnificent expanse of water as Holme Fleet, Swallow and Mucky Fleets come as a great disappointment. Both, although originally as wide as the first-named, are now almost silted up and thus contain sheets of shallow water standing over soft muddy bottoms. In consequence, they are fitted for no great range of vegetation, and even if they were so, their greater brackishness would prove a hindrance to its development. To tell the truth, whilst Swallow Fleet does manage to support a little *Myriophyllum spicatum* in the clear central channel, both are otherwise overgrown by a thick continuous mass of *Scirpus maritimus var. monostachys* and *var. compacta*.

The total absence of type *Scirpus maritimus* is exceedingly curious in itself, but it is combined with two or three other equally striking features. At no time do the two varieties exceed in height three quarters that of the normal form, and this I have verified even in Swallow Fleet where type and variety grow side by side. When I visited the main Fleets on September 22nd, 1917, the *Scirpus* in Swallow and Mucky Fleets was quite brown and dying back, whilst that in Holme Fleet was in full vigour; further, although the type was fruiting freely, the variety bore little, and in most cases no fruit.

Of Todler's Fleet one can say very little so completely has it silted up; and depending on this fact, it has been drained by means of a deep cutting. Naturally, therefore, all of the aquatic forms have disappeared, leaving us with the usual fresh water plants of the various marsh and stell associations except that *Glaux maritima* and *Spergularia marginata*, breaking into the harmony, form a discordant element and remind us of past conditions gone never to return.

The Main Drainage Lode.

With but unimportant interruptions this lode or ditch skirts the road and earthwall on the landward side for fully three miles.

Throughout its length, its depth varies between six and eighteen inches. Just south of Saltholme Farm, it appears to be nothing but a ditch full of stagnant, but nevertheless, fresh water; as it proceeds towards Greatham Creek, owing to its acting as an outlet for the Fleets, it loses its stagnant character to a great extent although it never manifests any definite current unless the locks are open—an event of little frequency. By virtue of a slight tidal backwash on such occasions, it becomes somewhat brackish near its exit; this quality it loses by degrees as we proceed from the locks toward Holme Fleet.

Its Flora, whilst lacking in wealth of species, amply makes up for the deficiency by the rapidity with which it responds to the changing conditions; it thus deserves our closest attention.

Westward, of the plants of taller growth, *Glyceria aquatica* assumes dominancy, quickly to be replaced by *Scirpus maritimus* as we advance towards the Fleets; this position the latter plant maintains for great distances only yielding, and that seldom, to *Carex vulpina*. Whether *Glyceria* or *Scirpus* is paramount they are alike enveloped in summer by a green mantle of *Lemna minor*, locally displaced by *Callitriche*. The other associated plants are few; *Alisma plantago-aquatica*, *Ranunculus sceleratus* and *Carex vulpina* alone being powerful enough to penetrate through and withstand the smothering carpet of *Lemna*—a layer effectually repressing the growth of any form of *Ranunculus aquatilis* (agg.). That *R. sceleratus* should succeed where its congeners fail is attributable directly to its biennial* character, all its vegetative activities taking place when *Lemna* is more or less dormant. When *Lemna* carpets the lode, the flowering shoots of *R. sceleratus* are far beyond its stifling action. That *Lemna* is solely responsible for the inhibition of *Ranunculus heterophyllus* can be demonstrated easily by its ready appearance and instant success wherever cattle, in making watering places, hurl aside the Duckweed. To the same failure of *Lemna*, owing to its overshadowing by *Carex vulpina*, we have to assign the luxuriance of *Alisma* when that latter plant prevails.

* Despite the statements of Bentham and other authors as to the annual character of this plant it is always a biennial with us, no matter what occurs elsewhere.

As we near Holme Fleet, *Glyceria* reasserts itself, *Lemna* weakens and, in consequence, plants displaying submerged leaves appear, the most interesting being *Potamogeton compressus* and *Myriophyllum spicatum* with other plants listed for the backwaters of the Fleet itself. Beyond this neighbourhood and toward Swallow Fleet, *Scirpus maritimus* comes to the fore once more, but the companion plants remain the same. This type of vegetation persists until we pass Swallow Fleet, and then plants with submerged foliage reign supreme, a huge tangle of *Myriophyllum spicatum* and some *M. verticillatum* almost swamping all competitors. However, *Ranunculus Baudotii*, *Zannichellia palustris*, *Lemna minor*, *L. trisulca*, *Glyceria fluitans* and *Enteromorpha intestinalis* occur here and there, and occasionally abound, diversified at intervals by isolated tufts of *Scirpus Tabernaemontani*, *S. lacustris* and a little oftener by *S. maritimus*.

After we move from Mucky Fleet, the *Enteromorpha* still remains thin and straggling with *Myriophyllum* lying beneath in closely interwoven masses. Next *Zannichellia* and *Potamogeton pectinatus* oust the *Myriophyllum* in part, and huge inflated ropes of *Enteromorpha intestinalis* occupy the middle of the channel, edged by impressive clumps of *Ranunculus sceleratus* which tower through streaming *Glyceria fluitans* and genuflecting *Alopecurus geniculatus*. Hereabouts, *Scirpus Tabernaemontani* and *S. maritimus* alike are scarce, but *Carex vulpina* still remains, striving on the bankside with a little *Juncus Gerardi*. At many points *Apium graveolens* and *Callitriche intermedia* are frequent members of the association.

When at length the locks are reached, the *Zannichellia*, *Potamogeton*, *Myriophyllum* and *Enteromorpha* alone tolerate the increasing saltiness of the water. Beyond this area, in the lode parallel to Greatham Creek, retrogression along the same lines sets in, but *S. Tabernaemontani* in this case, and then only feebly, represents the *Scirpi*.

The New Road.

As yet unopened and the recipient of countless loads of ballast, the new Hartlepool road supports along its first stretch of four miles crowds upon crowds of aliens, casuals, and stragglers; some of these are rare and some common, but all are of interest. At the Port Clarence end these are the usual *Linaria vulgaris*, *Reseda lutea*, *R. luteola*, *Artemisia vulgaris*, *A. absinthium* and *Senecio viscosus*, but further along a better class of plants appears and with them two or three quite unusual performers in the rôle of casual. These gradually yield, as we digress to the abandoned section, to a settled type of vegetation reminiscent of the earlier days suggested by such ancient Greatham specialities as *Erigeron acris*. Omitting plants everywhere plentiful on such land in Durham, but including others common in normal habitats with us, the following plants are present:—

Diplotaxis tenuifolia
Lepidium draba
Linum perenne
Viola sylvestris
Primula veris
Ulex europaeus
Trifolium ochroleucum
Carduus nutans
Hieracium pilosella
(rare elsewhere in the district)
Aster linosyris
Erigeron acris
Artemisia campestris
Verbascum nigrum
Euphorbia exigua, var. retusa
Bromus arvensis

Of cryptogams, a thick carpet of the lichen *Peltigera canina*, with the moss *Funaria hygrophila* (which, whatever may be its reputation, does not abound with us), and several species of *Bryum* provide a seedbed for the *Erigeron*.

V.—THE SALTMARSHES.

Greatham Marsh.

Greatham Marsh, although now but a shadow of its former self, consists of two fairly extensive tracts bordering Greatham Fleet or Creek about three miles from the open sea; beyond these limits all possible extension by tidal action is prevented by the old earthwall. Eastward, it terminates at the smaller transverse wall linking up these walls with the tremendously powerful slag barrier just above the iron bridge. To the west, its southern half extends along the Creek until the stream takes its last sudden bend to the north-west, whilst the northern section reaches a point to the south of Cerebos Salt

Works where the appearance of higher natural banks (now showing signs of erosion) admits of the approach of cultivation to the very water edge.

The entire surface of both is broken up by a maze of intricate winding channels and an abundance of pools or pans. As in Saltholme, the remains of saltworks of bye-gone days persist in the shape of detached mounds—one of which is utilised as a garden !

Of the two divisions, that to the south offers by far the most valuable opportunities for study both by virtue of its superior area and of its freedom from human interference.

Its Tides and Channels.

So deep is the main creek, and so steep are its banks, that only the very highest spring tides cover the whole surface, an average high tide merely scouring the channels, and an ordinary one barely entering them.

Whilst the channels falling directly into the Fleet possess fairly stable beds as nearly parallel to the main stream as possible—a circumstance depending on the general direction of the tidal thrust—the secondary channels meander aimlessly across the marsh, ever changing their courses as landslips and similar trivial incidents determine. When such an event occurs, the energy of the advancing tide, taking the line of least resistance, soon scoops out a new path from the lower levels between the hummocks, the irregular disposition of which settles the sinuous course of the newly developed channel, as it presses onward to attain the surface level of the marsh, or to break into a depression pan.

Casually formed as they are, in the end, nevertheless, they serve to run off surface water, and thus a system of tributaries essentially the same, but on a smaller scale, as the brook and its feeders is set up, only to repeat the process of decay and regeneration outlined above.

Secondary Changes in Surface Configuration.

Like all saltmarshes, Greatham Marsh is subject to erosion, but its peculiar configuration renders it specially susceptible to attack at two danger points. The first of these is seen in its south eastern margin, and the second occurs when the creek swerves sharply to the north ; as it does so it exposes a high clayey bluff to bear the full onslaught of the tide. Nor is this action on the two vulnerable points a normal one, for its vigour is enormously increased by human activities lower down toward Tees Bay; there, as may be gleaned above, not only have we the whole tidal wave concentrated by the main slag wall, but further, when it enters Greatham Creek, its rush is intensified by the funnel-like gorge of huge slag walls which rise so steeply just below high water mark.

At the first point, released from its previous restriction within the slag barriers, the oncoming tide strikes the interposed margin of the salt marsh frontally with accentuated force. By its attack the supporting soil beneath the matted *Glyceria-Statice* sward is disintegrated and carried back when the tide recedes. The turf itself, owing to its closely interwoven texture, offers a sturdy resistance and remains intact long after the soil has settled out to form new mudbanks. For a while, it forms a slope up to the primary level; in the end considerable sections are detached, with the exposure of an escarpment upon which the eroding action just described may be renewed. In this way a well-marked secondary low level marsh appears, provided at times with a complicated arrangement of low escarpments. Such a series, by the number of its individual members, offers valuable data for the estimation of the age of any given stretch of secondary marsh.

Matters at the other weak point follow a different procedure. Assaults cannot be carried out on such a wide front, and the destructive energies of the tide are limited to the undermining of the steep banks. Slowly but surely, huge cave-like holes are fretted in the clay, succeeded sooner or later by a collapse on a wholesale scale, when huge masses of clay and soil are thrown into the creek to be smoothed down and to attract silt. By-and-by, muddy spits rise above the water, in some cases sloping gently upward to the level of the embankment.

But these are not the only places where such secondary changes can be studied; within the marsh itself the secondary drainage channels, with all their huge curves, and their intermittent and reversible current, have unique opportunities, on a small scale but at numerous stations, of repeating the operations of their parent. Within their limits marginal erosion is constantly occurring, and their banks falling in, mudbanks develop to play a minor part in the history of the marsh.

Pan Formation.

The precise course pursued in the evolution of the innumerable pans scattered at random over the marsh offers an investigation of great intricacy. If anything is certain it is that the causes of their development are multitudinous! Still, careful study reveals the origin of most of them.

Had they been observed only in the saltmarsh, one would have looked solely to agencies at work there for their initiation, but such a restriction does not harmonise with known facts. Pans differing in no wise from these have been detected at two places on the railway side in Durham, one just north of Darlington, and the second between Thornaby and Stockton. The latter, in particular, with their rounded contour, steep sides, and level bottoms approximate closely in all essentials to the oldest saltmarsh pans. And their discovery there gives us a key to the development of at least some of the primary pans; in both cases they have arisen on flat stretches of soft, newly-made land admitting, at suitable intervals, of the presence of standing water. From this it seems that we have to look back to the time when the primary marsh, in its initial stages of colonisation on soft clayey silt, allowed a similar localisation of surface water. In my opinion this explains the formation of the majority of the primary pans.

In a parallel sort of way, but with minor differences, such pans originate in the secondary marsh. Very rarely in this case, do they arise on broader stretches of level ground exposed as the marsh collapses; they take their origin for the most part in rifts in the newly fallen *Glyceria-Statice* turf, more or less parallel to the direction of the main tidal drive. In such fissures, local breaks strike off laterally, and then water lodges at the point of intersection, the deposition of algal debris completing the action and enlarging the tiny pool into a fully developed pan.

Warming* has suggested that even on highly organised primary marsh the inhibiting action of decaying algæ so weakens the sward as to lead to pan formation. This view is scouted by Yapp† but still, according to my evidence, obtained by a careful consideration of the state of affairs in Greatham Marsh, it is nevertheless tenable. As was explained above, these marshes are only completely covered by the tide at widely separated periods; when they are, owing to local conditions, the tidal rush sweeps before it with irresistible might such huge piles of *Fuci* from the slag walls as to bury small hollows six inches deep in decaying algæ and other rubbish. Here, directly on the *Statice*, primary pans are immediately inaugurated when the vegetation beneath dies off.

Another very potent agent in determining pan-building is the blocking of drainage channels, and this may happen in many ways, to elucidate which the appended map of a small tract in the south of the marsh has been prepared. In this map the various stages from channel to pan are very clearly seen, and such pans by their general shape very frequently advertise their origin. To such pans the term "channel" pans may be applied.

Let us consider the position of affairs in one of the secondary channels of which F forms a part. From many indications, we soon discover that it is in a period of decline.

* Warming, "Bitrag til Vaderns, Sandenes og Marskens Naturhistorie," *Mem. Acad. Roy. Sci. et Lettres de Danemark*, Copenhagen. Septième er., Sect. d. Sci., 2, 1904.

† Yapp, "Salt Marshes of the Dovey Estuary," Journal of Ecology, Vol. V., 1917, Page 87.

At several points in its steep sides erosion has taken place, and at no spot is this more marked than at X where the scooping motion, induced by the changing path of the inrushing tide, has bitten out a semicircular opening. Contemporaneously with this, whilst yet travelling in a direct line, the water has undermined both sides of the narrow neck at Y leaving the interlacing vegetation intact. Inevitably, both sides will collapse and by falling across meet to form an underground channel such as already exists at U. This will persist for some time only to be closed finally when some tide more powerful than usual drifts up sufficient rubbish to block it, just as has happened with that at U^1. At the same time as these events are happening, silt deposited at the angle opposite the rounded excavation will be consolidated by *Glyceria* roots; therefore, when the tide is forbidden access, we have formed a deep pool with an almost perpendicular bank on one side, and a partly colonised silt bank on the other. Then wind action plays its part, and swirling eddies, set in motion, displace the barer silt and convey it to level up the floor; thus a sharply cut edge appears to limit the *Glyceria* bed which, by its growth and decay, speedily raises the level on that side. By their swirl, aided by the contour of the stabler deeper portion, it will be perceived that these currents will tend to produce a pan of circular outline.

Still investigating the same system, let us consider the channel pans at D. These primarily appeared as local broadenings of the channel through tidal action and were, in consequence, when developed, continuous. When all advancement along their original path was impossible they overflowed, and the shallower lower set was formed as a single pan. But, as we have recognised, the outlet (and inlet!) at U fell in and was obstructed, and their water supply thus restricted to surface water. Retrogression set in, and the compound pan began to deteriorate into a series of pools. Just prior to this, when as yet the channel was provided with moving water, the division between the extreme member of the channel series and the primary pan E had been driven in to form the double pan H. However, we are not without signs that the whole system is, under the influence of the wind on the water, once again linking up.

It is well to note here that, long ago, the pan E very probably bore the same relation to G as F, in some future time, will bear to I.

Leaving this set, by the examination of those just above it we shall gain further hints as to how the cessation of current ending in relict channel pans may arise. Originally, when the broader channel was carved in the marsh, the western end of the larger island now visible had been strong enough to cause a bifurcation in the channel with the consequent boring of a side runner toward C. But although this promise of resistive power was not kept, the "isthmus" of the protruding finger held out long enough for local expansion indicative of future pans to be scoured out; then the break at B resulted, so that the flowing tide, instead of passing onward to C, simply resumed its original direction. With the lack of water, the channel was colonised by *Glyceria*, and the chain of pans at C isolated.

A further source of pans has been seen in the suncracks which cover the marsh like a network in dry hot seasons. Rarely such *may* be the explanation, but in my view it is very unlikely. In such a summer I have seen even the broader and deeper pans dried up, and the mud on the bottom contracted into a curiously regular reticulation of suncracks. These were submerged once again in August of the same year, and since then they have been examined at regular intervals; despite the gales and vicissitudes of several winters, the original cracks show few signs of change. If such be the case there, is it probable that suncracks on the firmer soil of the main marsh will serve as nuclei for huge pans?

The Vegetation.

We are now equipped for an examination of the various plant communities of the salt marsh. Considerable work on such formations has been done at odd stations on our coasts and estuaries, and though the phenomena awaiting elucidation here must perforce be of the same order as those studied elsewhere, the local problems offered by the peculiarities of Greatham Marsh and its distance from the sea form a rich field for work more intense than war conditions have allowed me.

Owing to the enormous length of time the main bulk of the marsh has been established within its present bounds, to a first glance no scope is given for the observation of the plant successions. Fortunately, all the necessary steps in the process of colonisation can be observed on the mudbanks and spits characteristic of the Creek and drainage channels, as well as on mud deposited when a high tide silts up a depression. In an equally satisfactory fashion, the developing secondary marsh yields material for the study of a certain phase of retrogressional movement.

Whether the bare ground offered as a site suitable for occupation is a muddy spit or a sandy scour, the very first colonists are green algæ of the genera *Rhizoclonium*, *Vaucheria* and *Chaetomorpha*, which not only form a favourable substratum for holding germinating phanerogams, but also have much value as soil binders. Deliberate tests to estimate their consolidating value were made by dragging up a handful; an astonishing amount of mud was lifted with them.

As soon as the ground is suitable *Salicorniae* appear in huge numbers, forming an open Salicornietum europaeae. Whether by chance or as a direct effect of the environment, I noticed that the invading hosts on the sandier ground tended to belong to the red form, whilst on the muddier, and possibly saltier tracts, the apple green variety prevailed. Against the view that colour and soil are correlated, can be advanced the fact that at minor stations, where colonisation is proceeding in the general area of the marsh, the colours form a mosaic of red, purple, and green. Viewed in its proper light, this latter fact would seem to suggest that the dominant colour in isolated assemblages depends essentially on the circumstance that the individual members were descended directly from one and the same ancestor. Furthermore, it gave us evidence that the purple green variety is heterozygous for colour and therefore a hybrid (in the Mendelian sense) between the red and the green forms.

In general, the species responsible for such primary colonisation is *Salicornia herbacea*, but one tremendous colony on a mud spit jutting into the Creek was solely composed of *S. dolichostachys*.

Very rarely, instead of *Salicornia* being the pioneer, *Glyceria maritima* appears in that rôle with marked success, although never on a large scale.

Sometimes succeeding *Salicornia* in the first phase, but often enough occurring simultaneously, *Suaeda maritima* forms an edging. Next, *Glyceria maritima* insinuates itself, until at length the open Salicornietum passes typically into the *Glyceria-Salicornia* association including nothing but the two dominant plants and a little *Suaeda*, although other segregates of *Salicornia europaea* like *S. disarticulata* and *S. ramosissima* may occur locally.

In the next evolutionary step the annuals practically vanish, and an almost pure growth of *Glyceria* forms the turf which, at the point where favourable conditions assisted the present observations, gradually merges into an Armerietum, a steady rise up the crumbling slopes leading us directly into that part of the marsh which must have persisted for ages and preserved this association in its stablest form. This includes:—

Armeria maritima	*d*	Plantago maritima	*f*
Glyceria maritima	*d*	Glaux maritima..................	*r*
Aster tripolium	*r*	Triglochin maritimum	*r*
Artemisia maritima ... (*on edge*)	*r*	Festuca rubra	*o*

Whilst the above represents the distribution, and in part the succession, in the west, to the eastward, events, which unfortunately can only be followed on a minor scale, pursue a different course. In newly colonised muddy hollows, soon after the joint dominancy of *Glyceria* and *Salicornia*, *Aster* gains a footing, followed hard by *Statice limonium*, until at length we have developed a sub-association, which is a form of Glycerietum worthy of the term *Glycerio-Staticetum*. In this we find

Glyceria maritima	*d*	Suaeda maritima	*o*
Statice limonium	*f–ld*	Armeria maritima	*o*
Aster tripolium	*o-a*	Spergularia marginata	*r*
Salicornia europaea (agg.)	*a*	Triglochin maritimum	*f*

Next in order arises the Staticetum, occupying the main body of the upper marsh and obviously the most stable of the varied associations liable to tidal immersion ; this resembles the stage just passed in composition, but the frequencies are very diverse. List :—

Glyceria maritima	*d*	Spergularia salina	*f*
Statice limonium	*d*	S. marginata	*f*
Aster tripolium	*a*	Plantago maritima	*a*
Artemisia maritima (*on edge of pools*)	*la*	Armeria maritima	*f*
Salicornia europaea (agg.)	*r*	Statice humilis	*vr*
Suaeda maritima	*o*	Triglochin maritimum	*vr*

Gradually, as we proceed beyond the limits of immersion by all but the highest spring tides, whether toward the Creek or toward the edge of the marsh, both on the north and on the south, this community glides by degrees into an Armerietum differing very widely from that referred to above. Its more open nature is indicated, especially on the south side, by the presence of the various *Salicorniae*, and the general aspect of the community as a whole contrasts greatly in the mind's eye with the close dark green turf of the Armerietum higher up the Creek. Its usual elements are :—

Glyceria maritima	*d*	Plantago maritima	*f*
Armeria maritima	*d*	P. maritima, var. latifolia	*o*
Salicornia europaea (agg.)	*lf*	Spergularia spp.	*f*
Suaeda maritima	*o*	Aster tripolium	*o*
Triglochin maritimum	*r*	Statice limonium	*o*

This, and similar associations, present a pretty sight as they fringe the marsh with pink in June—a sight only equalled when the immense masses of *Statice limonium* flood the central areas with their deep lavender blossoms in August and September.

On the north side the *Armeria* zone is succeeded by a narrow band of *Artemisia vulgaris* which locally yields to *Obione portulacoides*, in the sole station for this very common saltmarsh plant on the Tees.

This thin line of *Artemisia* and *Obione* then is followed by a mixed association compounded of common weeds of cultivation, plants typical of a littoral meadow, and similar plants. Of these the most interesting are *Bupleurum tenuissimum*, *Cochlearia officinalis*, *Agropyrum junceum* and *Stellaria Boraeana*.

We must now turn our attention to the Secondary Marsh; this, we must remember, is simply a section of the fixed Primary Marsh which by tidal wash has been thrown down a foot or two below its former level. In consequence, it is now subject to periodic immersions in salt water so that plants, tolerant enough of salt in an ordinary way, but as we glean from their stations in the upper marsh objecting to it when in excess, now receive that excess. Practically immediately they fail before altered conditions which *Glyceria* can withstand, and that plant replaces them everywhere. In this fashion, a close, if undulating, turf of what I call a retrogressional Glycerietum is generated, often leading directly into the Staticetum of the marsh above.

This connection arises gradually as the new association establishes itself and accumulates soil, thus raising itself once again beyond the tidal influence. Then, and not till then, either by "peaceful penetration" down the slope or by regeneration from old roots, *Statice* forthwith proceeds to battle for its position in the former joint dominancy.

Greenabella Marsh.

Like Saltholme Marsh, this has been shut off by a sea wall, but in this instance the barrier is the very massive double slag wall retaining the lower half of Greatham Creek. In place of resulting in the severing of an immense fleet like Holme Fleet, holding a fine sheet of deep fresh water, here we have isolated a great stretch of shallow water very variable in its limits and always kept salty by the occasional accessions of sea water by indirect means. There are present also a brave array of pans which vary from those seen in Greatham Marsh in being founded on very sandy soil, and in being abundantly supplied with vegetation of an extremely interesting type. On rare occasions, the predominant sheet of water, when at its greatest limits (and this implies a rise of about a foot), overflows the whole area for the breadth of a hundred yards or so from the sea wall.

Outside the sphere of influence of the main pools and pans, the general level of the Marsh has undergone great changes in very recent times. Only a dozen years ago it rejoiced in the same grassy stells as Saltholme winding around grassy hummocks bearing such arenicolous plants as *Glyceria distans*, *Galium verum*, *Ononis spinosa*, *Astragalus Hypoglottis*, *Lotus corniculatus* and the like. Now all is transformed, stells and hummocks alike are gone, and with them the water birds they attracted; the Ruff and Reeve court here no longer. At the present time the vegetation displays the same general complexion as that of the highest levels of Saltholme Marsh.

The pans, however, as was pointed out, support a very peculiar Flora and one which seems destined to persist; not the least noteworthy fact about it is that one species, in many cases, forms the sole occupant of a single pan, but then almost uniformly it completely fills it. Another wonderful thing, too, is that adjacent pans very often produce dissimilar species. One, a special favourite of mine, yields nothing but *Ranunculus Baudotii var. marinus* which, when in full bloom, is well worth a visit; its neighbour, not a yard off, supports a pure growth of *Zannichellia maritima*. Again, not far away, *Potamogeton pectinatus var. salinus* is the sole tenant, whilst just a stone's throw from that, *Ruppia rostellata* alone populates the pans. Of course, occasionally, pans do produce more than one species when *Zannichellia* and *Ranunculus*, *Zannichellia* and *Potamogeton*, *Ruppia* and *Zostera nana* are associated pairs.

Of these plants, *Ruppia* alone is intolerant of shallow water and prefers a depth of about a foot. In the large saltwater lake (for it covers too great an area to be called a pool), *Ruppia* forms a Submerged Leaf Association belonging to the SALINE AQUATIC FORMATION and appears as a dense growth, first developed at a depth of nine inches, and therefore a yard out, extending as far into the water as the eye can see. The following are its members :—

Ruppia rostellata	*d*	Zostera nana	*o*
Ruppia spiralis	*r*		

Between the pans, the wetter and lower sandy soil maintains an open Salicornietum europaeae, amongst which algæ like *Rhizoclonium* flourish. As we approach more thickly colonised drier ground, first *Glyceria* and *Suaeda* (the latter toward the hummocks) appear, then *Glaux* and *Spergularia* join company. Next *Salicornia* wholly disappears and *Juncus Gerardi* steps in, until finally we have a mixed assemblage of plants reminding one strongly of the freshwater fen association. A typical area chosen for tabulation yielded the following species :—

Statice limonium	*vr*	Carex distans	*r*
Aster tripolium	*vr*	Triticum pungens	*o*
Salicornia radicans	*vr*	Glyceria maritima	*a*
Suaeda maritima	*r*	G. procumbens	*o*
Plantago maritima	*a*	Lepturus filiformis	*f*
Spergularia salina	*f*	Festuca rubra	*c*
Glaux maritima	*o*	Bryum spp.	*a*
Juncus Gerardi	*f*		

with very many plants found in an average coarse pasture. As the ordinary vegetation of the reclaimed pasture is neared, one by one the halophytes vanish, the last to go being *Glaux*, *Plantago* and *Spergularia* in the order named.

At times the Salicornietum, in place of passing into the above association, runs up to the barer sandy hummocks bordering the pans ; there a very curious society of the appended composition, frequently closed but often enough open, holds possession :—

Plantago maritima	*d*	Bryum Warneum	*f*
Spergularia salina	*r*	Bryum calophyllum	*f*
Erythraea pulchella	*sd*		

The only other point of interest in Greenabella Marsh is the sea wall itself, and it can display fine patches of the lichen *Physcia parietina* and the fern *Dryopteris aristata*—an important observation when one recollects how generally ferns and lichens have been exterminated within the radius affected by blast furnace smoke.

Over the embankment, and enclosed between the old and the new roads, lies a detached piece of land allied in its vegetation to that just discussed. Not so very long ago, this was covered by a shallow sheet of salt water falling into Greatham Creek lower down its course. At present, it is severed from that body of water by the new road, and as a result the pool is steadily drying up. Any interest that the nook claims depends not upon its rich Flora but upon its rather strange successions. In the earlier stages, when the receding water exposes a stretch of almost bare soil, nothing grows for a while except *Glyceria fluitans* and *Glaux maritima*, both of which, despite the saltness of the water, grow freely within it. Then as elsewhere *Rhizoclonium* appears, followed by the annual *Salicorniae*, but before these vanish, two curious liverworts gain a footing; to wit, *Aneura pinguis* and *Pallavicinia Flotowiana*. Next the *Salicorniae* lose ground rapidly, and we have in their stead an irregular open association of the foregoing plants and very stunted *Juncus Gerardi*, *Spergularia*, *Plantago*, *Triglochin*, until we reach what was the original water's edge. Here we encounter a Juncetum dominated by *Juncus Gerardi*, including :—

Juncus Gerardi	*d*	Glaux maritima	*f*
Glyceria maritima	*ld*	Triglochin maritimum	*r*
Salicornia spp.	*o*	Festuca rubra	*f*
Spergularia spp.	*o*	Aneura pinguis	*lsd*

Plantago maritima	*o*	Pallavicinia Flotowiana	*f*
Erythraea pulchella	*vr*	Bryum spp.	*c*

—a Florula greatly recalling that of dampish dune hollows.

VI.—CONCLUSION.

We are now in a position to review the results of our labours, and to make the desired comparisons with the lists given in Brewster's History of Stockton and Sharp's History of Hartlepool. It is impossible to repeat the latter lists here, and indeed there is no necessity for doing so, so very few of the old specialities in water and marsh plants having died out. In fact, the only absentees worthy of mention are *Hottonia palustris*, *Pinguicula vulgaris*, *Sagittaria sagittifolia*, and *Butomus umbellatus*. Of the first three, *Sagittaria* may yet be reinstated, but I am afraid that the constant clearing of the waterways to secure adequate drainage of the low-lying soils, added to the effect of works, has effectually stamped out the other two; this is rendered the more probable because all three reach their most northerly habitats on the eastern coasts. Besides, the same plants are extinct in the Middlesbrough Marshes on the Yorkshire side, although there the iron works are the most potent agencies in their suppression. Beyond the boundaries of the industrial area, the nearest station for *Hottonia* is Stokesley where it revels in old clay holes, but I know of no certain locality for the other two nearer than the Derwent at Malton.

Why *Pinguicula* has vanished I cannot pretend to tell. The habitats presented are for the most part quite untouched, and the ground remains precisely like that on which the plant flourishes elsewhere in the county. Still, deliberate searches conducted on my hands and knees to eliminate faulty observation, in the likeliest of localities, have been quite profitless. That its extermination depends on local vicissitudes appears certain, since *Pinguicula* grows as freely as one could ever wish to see it on Waldridge Fell, at Wolsingham, Blackhall Rocks and in Upper Teesdale—to name only a few of its haunts—and in the first-named conditions are certainly far from being so propitious as those offered here. My sole conjecture is that some long forgotten fire, helped by the choking action of fen vegetation, has so affected a plant almost destitute of roots as to prevent its recovery.

However, to balance these losses, *Statice humilis*, *Salicornia radicans*, *Erythraea pulchella* and *Potamogeton compressus* have been discovered to add to the local Flora. Of these, the existence of the first two could almost have been predicted in view of their presence in Coatham Marshes just opposite. And their detection was very opportune, so very precarious is their hold. Both hereabouts attain the limits of their northern range, and the tenure of plants favouring the Mediterranean cannot be a happy one here—a fact that the further northward extension of the genus *Statice* in the guise of *S. limonium* does not affect. Though *Salicornia* is not so definitely southern in its preference, of the two, it will be first to disappear; even now only a few straggling wrecks represent it.

How *Erythraea pulchella* eluded the eyes of the early observers I cannot understand, unless the reasons be its late flowering and lowly habit; in very many places it simply abounds. Furthermore, it appears to be *the* Tees Mouth speciality destined to survive, so easy is it to satisfy in its requirements, if only the soil contains a little salt.

In recording these additions I have not ventured to include such segregates as *Orchis incarnata*, *Stellaria Boraeana*, and the various *Salicorniae*, *Ruppiae* and *Zannichelliae*; no reflection is cast on older authors for failing to observe these. Only recently have the bulk of them been studied and separated from their aggregates with any certitude. In this category my discoveries include *Salicornia dolichostachys*, *S. disarticulata*, *S. ramosissima*, *Ruppia spiralis* and *Zannichellia maritima*.

Little as has been the time devoted to the Cryptogams they, too, have yielded their quota of rarities, several very rare mosses and hepatics having rewarded my restricted efforts; had time and opportunities permitted I feel confident that many novelties accruing would have served to augment our lists. My most noteworthy finds were *Bryum Warneum*, *B. calophyllum* and *Pallavicinia Flotowiana*.

Considering now the most interesting of Brewster's original records, we decide that *Trollius* is by far the most attractive. Generally looked upon as of montane proclivities, here it luxuriates not ten feet above sea level, and consequently one is spurred on to enquire as to what new characters have been acquired in response to its novel environment. To secure accuracy in such a determination, my friend Bolam sent me roots from two levels (1,000 ft. and 1,800 ft. respectively) near Alston, and others from about 500 ft. at Wark in Northumberland. These I grew alongside the local form. Wide divergences were at once perceptible between the Pennine and the Tees Marsh specimens; those from Wark, near as they approached to the mountain form, were nevertheless intermediate. To put them concisely the main differences between the two extremes may be tabulated as follows:—

Character.	Upland Form.	Lowland Form.
Flower Buds.	Greenish.	Reddish brown.
Colour of Flowers.	Yellow.	Slightly deeper.
Bracts.	Not so leaflike and few.	Leaflike and many.
Flowering Spike.	Short and rarely, if ever, branching.	Long and branching frequently enough.
Seedpods.	Rich deep purple in colour.	Only very faintly so.
Leaves.	Much more compact owing to the closeness of the segments; on an average not so long.	Freer in growth in all these characters.

For the lowland plant I suggest the name *relictus*.

Glaux maritima next claims our attention. The reader will have perceived that it thrusts itself upon one everywhere in Saltholme and the Saltmarshes; in water and out of it, nothing seems to inconvenience it, and soil long since deprived of even a modicum of salt satisfies it as well as the saltiest of salty water, although in the latter habitat it assumes a long ragged-looking habit. No other halophyte shows any such adaptive possibilities as this save perhaps, to a very slight degree, *Carex distans* and *Triglochin maritimum*; even *Armeria maritima* and *Plantago maritima*, recurring in the far west of Durham, show no tendencies like these to transgress their limits here.

As we have already seen, the prevalence of *Orchidaceae* at Billingham is quite remarkable; nowhere else in Durham have I seen such a plethora of forms. Even yet the related genera *Orchis* and *Gymnadenia*, with their various forms and hybrids, will amply repay study, as my discovery of *Orchis incarnata*, *Gymnadenia densiflora* and the hybrids previously recorded demonstrates. *Helleborine palustris*, now extinct at Blackhall Rocks, still draws our attention in the *Trollius* Marsh, and long ere its detection I had predicted its occurrence with other forms which will yet appear.

The same marsh can yet boast of *Thalictrum flavum*, another plant lost in many of its former stations, and there, too, the form *rufinerve* can be found; this likewise was a welcome reappearance long despaired of. I have a record for 1901 on the banks of the Team at Lamesley but that, as many other old habitats, will see it no more.

Floristically, it will be seen that my results have surpassed one's wildest hopes aroused by the rediscovery of *Trollius*. Independent of any influence of my Yorkshire experiences, my ambitions were toned down by the knowledge of the futility of efforts parallel to endeavouring to repeat Brewster's record of *Salicornia europaea* in Saltholme Marsh, or of the same plant at Samphire (!) Point. Not therefore expecting great things, correspondingly greater has been the surprise.

Ecologically, I had expected to do remarkable work but my expectations have been thwarted by influences beyond my control. Despite this, even in that branch, my labours have not been without their value. I have been enabled to present novelties in the way of associations and successions which some future worker may adequately expand. In the meantime an account of their presence and composition will not be valueless in stimulating the efforts of toilers far more favourably situated for such work than we on the North-East Coast can ever be.

Corrigenda:—On pages 101, 102, 103, 105, 106 for *Parnassius* read *Parnassia*.

APPENDIX.

The Uredinaceae of the Marshes.

In view of the production, in some future time, of a Fungus Flora of Northumberland and Durham, it has been considered advisable to give some account of the "Rusts" observed during the progress of the previous work.

Uromyces, Link.

1. *Uromyces valerianae*, Fkl. Very plentiful in the *Trollius* marsh, affecting the young leaves of *Valeriana dioica* and *V. sambucifolia*. So like are the latter in their young stages to those of *Parnassia palustris* that one can pardon the errors of De Candolle and Cooke in thinking that plant was affected too, and therefore describing a mythical species on the strength of their opinion.

2. *Uromyces limonii*, Lév. Extremely abundant in Greatham Marsh on leaves of *Statice limonium*, the leaves of almost every plant supporting crowds of teleutospores.

3. *Uromyces geranii*, O. & W. Quite rare in the Billingham Marshes on *Geranium pratense*.

4. *Uromyces ficariae*, Lév. Wide spread in Billingham Bottoms in May on *Ranunculus Ficaria*.

5. *Uromyces junci*, Tul. Very destructive to leaves of *Pulicaria dysenterica* in the *Trollius* Marsh, utterly destroying the plants so that new growth is necessary to secure their

flowering. Pycnidia and aecidia on *Pulicaria dysenterica*; uredospores and teleutospores on *Juncus glaucus*, and *J. effusus*. I have never seen the latter on *Junci* named by Massee.

6. *Uromyces scirpi*, Burr. Somewhat sparingly in the various Saltholme *Scirpus maritimus* beds furthest away from Greatham Fleet, but commoner on Mucky and Swallow Fleet; this perhaps explains the weakened condition of the plant there. Pycnidia and aecidia on *Glaux maritima*; uredospores and teleutospores on various forms of *Scirpus maritimus*.

7. *Uromyces poae*, Rabenhorst. Rather common near Norton Mill. Pycnidia and aecidia on *Ranunculus repens*; uredospores and teleutospores on *Poa trivialis*.

8. *Uromyces chenopodii*, Schroet. Rare on *Suaeda maritima* in Greatham Marsh. When I recorded this in the Vasculum, Dec., 1917, page 128, I did not know that this was a new British record; such is, however, the case.

Puccinia, Persoon.

1. *Puccinia absinthii*, D. C. Common enough on the *Artemisia maritima* on the north side of Greatham Fleet; not seen on the southern half.

2. *Puccinia centaureae*, Mart. Rather unusual on *Centaurea nigra* in Billingham Bottoms.

3. *Puccinia obtegens*, Tul. Very common throughout the area on *Cirsium arvense*; easily recognisable by its fragrant smell.

4. *Puccinia menthae*, Pers. Not common on *Mentha* spp., but generally distributed in the vicinity of Billingham.

5. *Puccinia epilobii-tetragoni*, Winter. Surprisingly scarce on *Epilobium hirsutum* in the osier bed at Billingham.

6. *Puccinia caricis*, Rebent. Once only, teleutospores on *Carex paludosa* in the Caricetum paludosae at Billingham; aecidia on *Urtica dioica*.

7. *Puccinia orchidearum-phalaridis*, Kleb. Sparingly at Billingham. Uredo-and teleutospores on *Phalaris arundinacea*; aecidia on foliage of various *Orchidaceae.*

8. *Puccinia trailii*, Plow. Very common in the *Trollius* Marsh. Aecidia on *Rumex acetosa*; teleuto-and uredospores on *Phragmitis vulgaris.*

9. *Puccinia magnusiana*, Koern. Common in Mill Lane, Norton. Aecidia on *Ranunculus repens.*

Phragmidium, Link.

1. *Phragmidium fragariastri*, Schr. Sometimes very injurious to *Poterium officinale* at Billingham.

Coleosporium, Lév.

1. *Coleosporium sonchi*, Lév. Extremely common on the *Petasites vulgaris* lining Greatham Beck but absent from Billingham.

2. *Coleosporium euphrasiae*, Wint. On *Rhinanthus crista-galli* in Cowpen Marsh.

Triphragmium, Link.

1. *Triphragmium ulmariae*, Link. Not very common on *Spiraea Ulmaria* in the *Trollius* Marsh and the Osier bed.

LIST OF FIGURES.

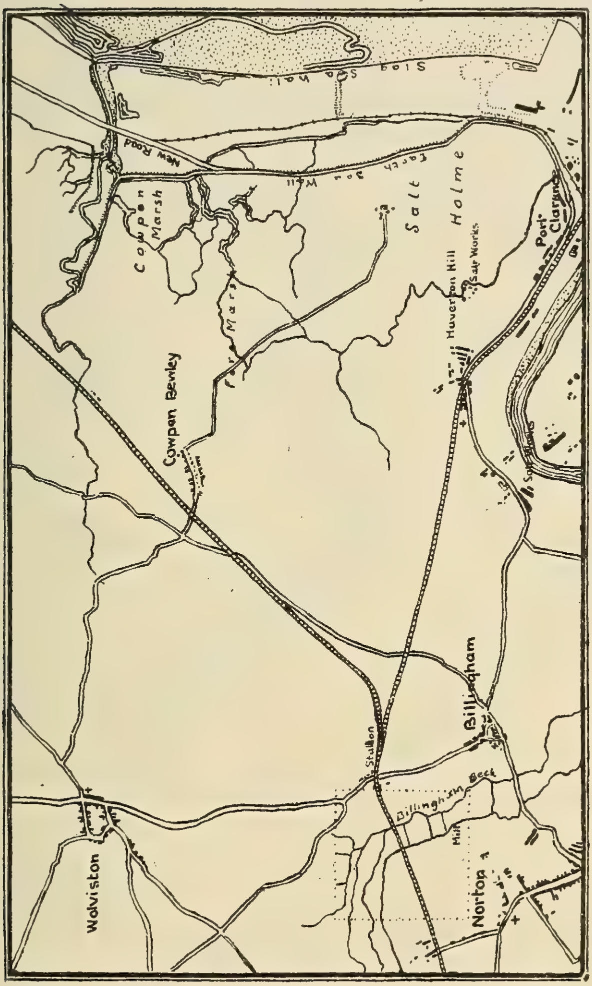


Fig. 1. A Sketch Map of the Area discussed in the Text.

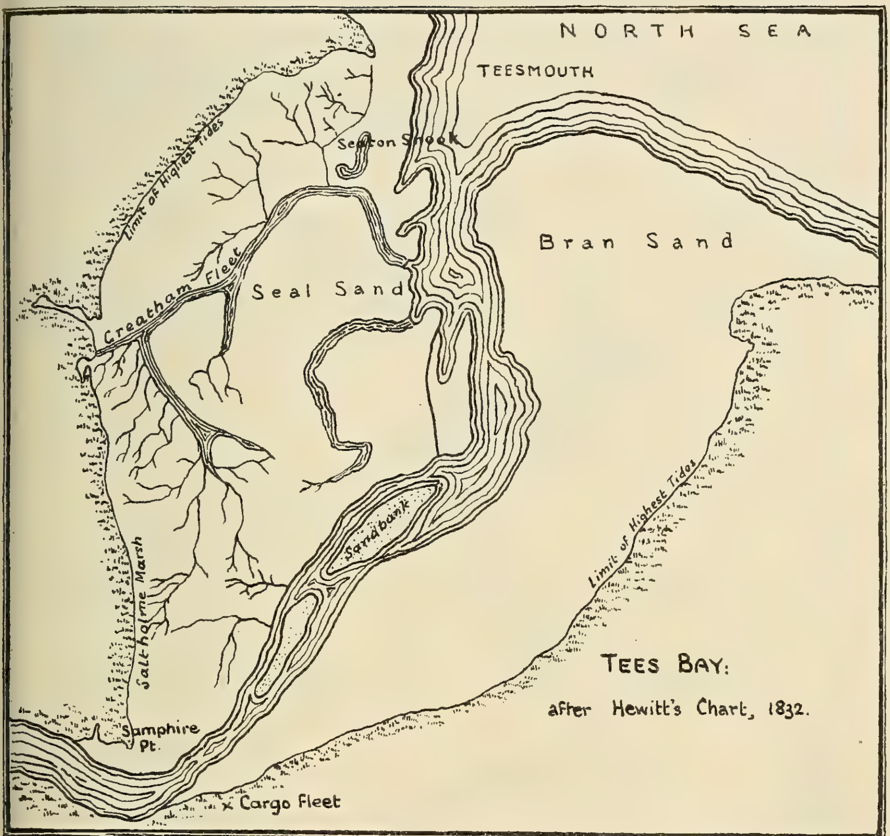


Fig. 2. Hewitt's Chart of Tees Bay.

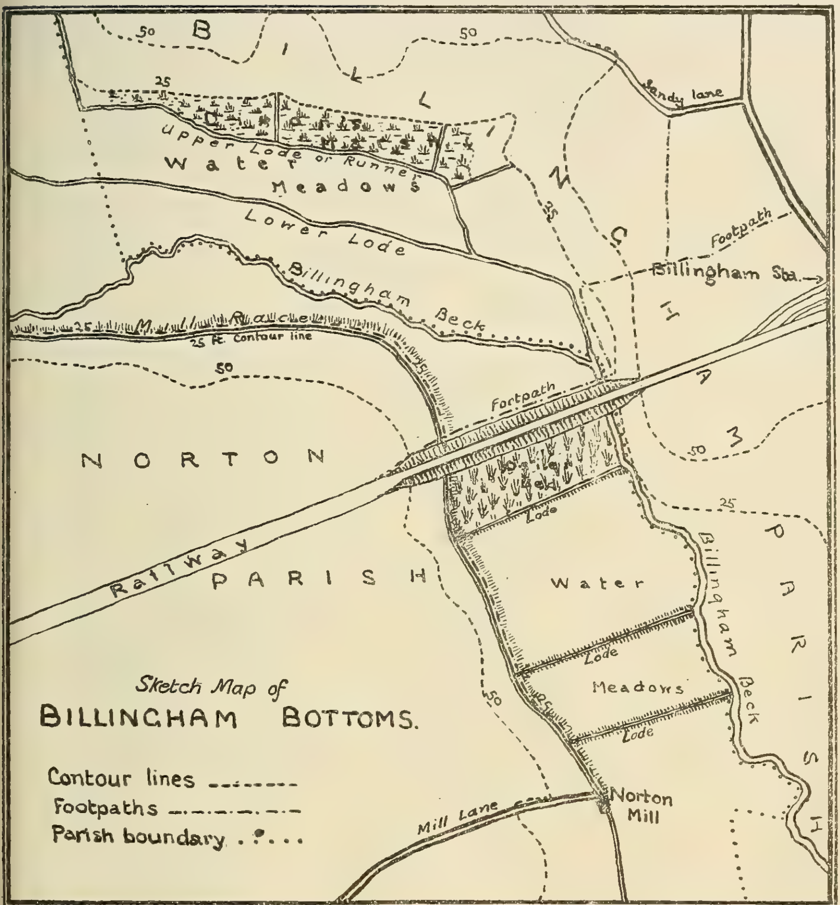


Fig. 3. Billingham Bottoms.

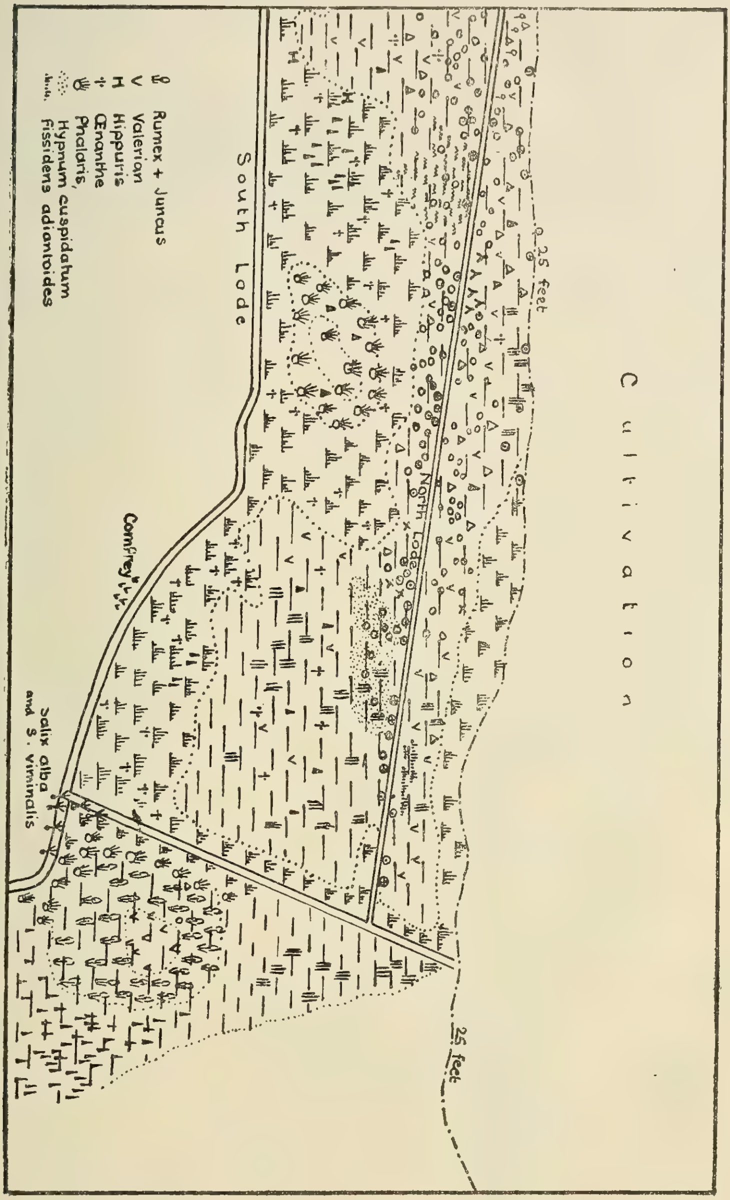


Fig. 4. Trollius Marsh: Eastern Half. For unexplained symbols see Map of Western Half.

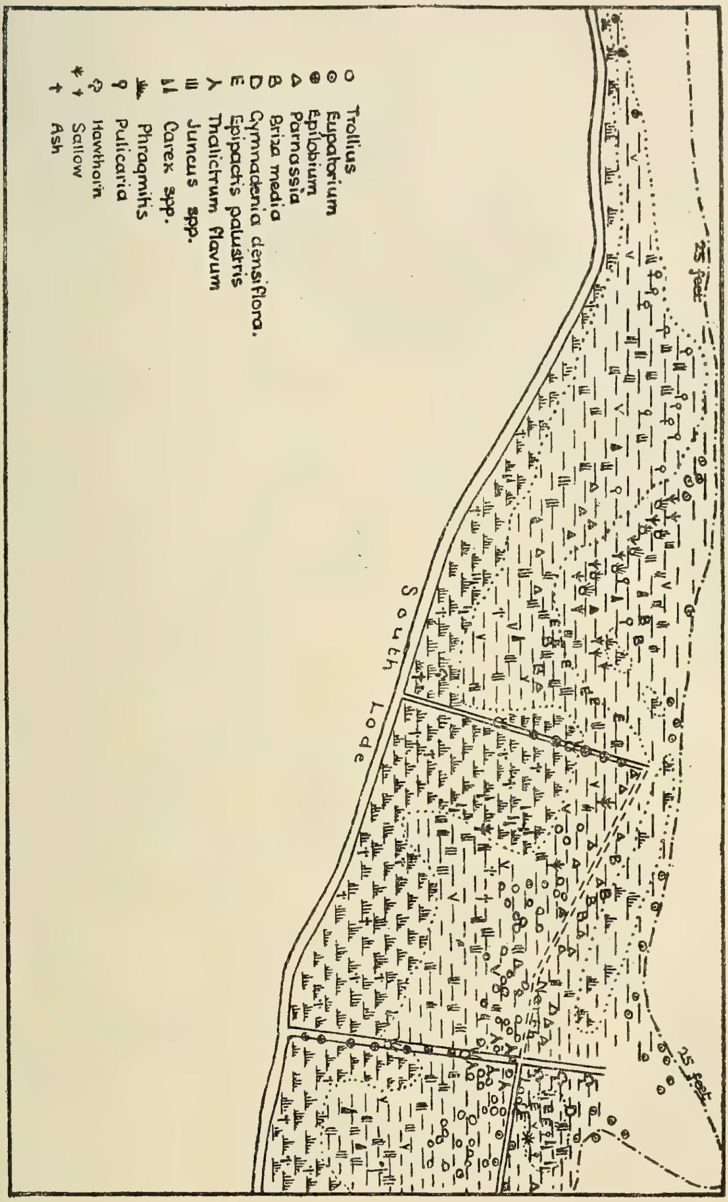


Fig. 5. Trollius Marsh : Western Half. For unexplained symbols see Map of Eastern Half.

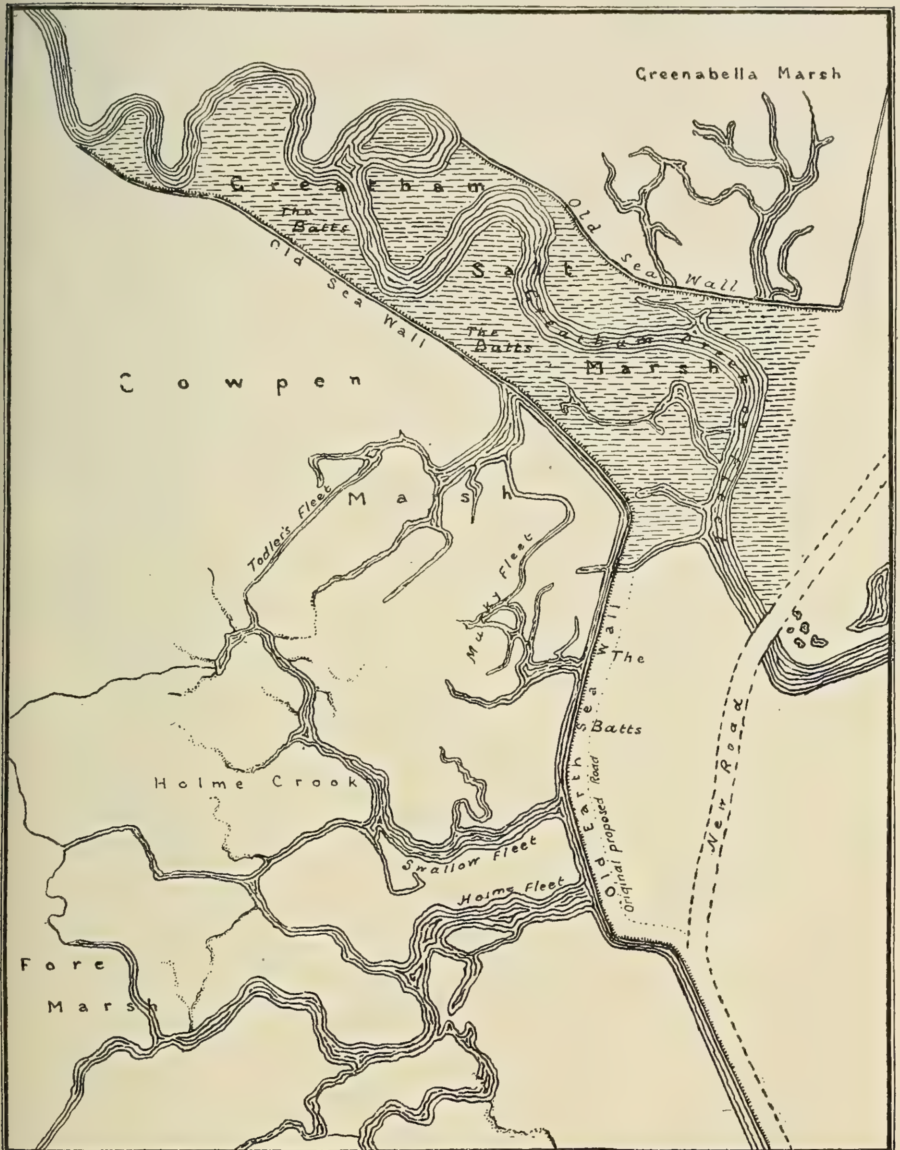


Fig. 6. Greatham Creek and Saltmarsh with the adjoining Fleets.

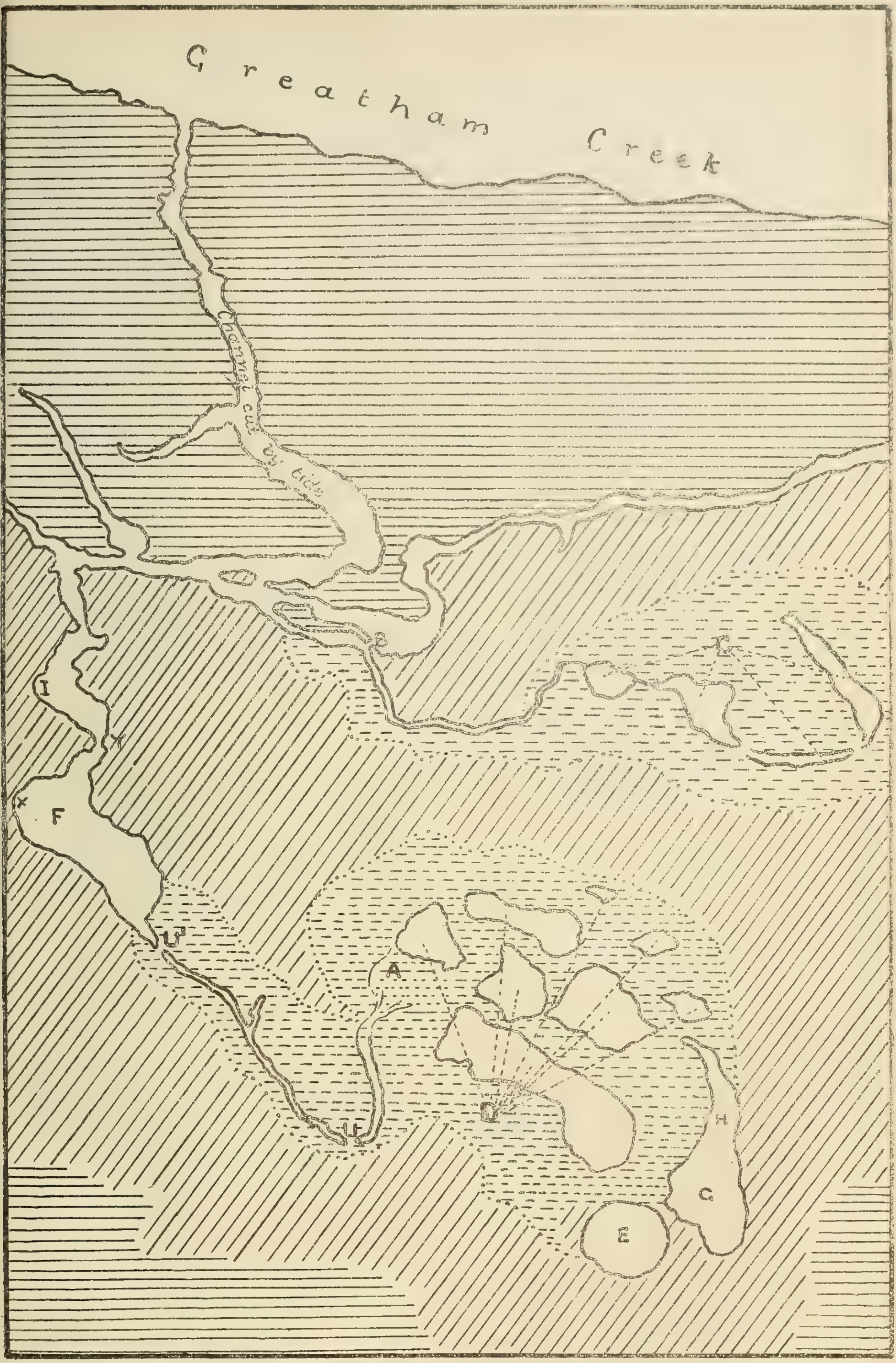


Fig. 7. Sketch Map of a portion of Greatham Marsh to illustrate Pan Formation
Horizontal lines = Armerietum. Oblique lines = Staticetum
Broken lines = Glycerietum or the Succeeding Association.

On Sections in the Lower Permian Rocks at Claxheugh and Down Hill, Co. Durham.

By David Woolacott, D.Sc., F.G.S.

The purpose of this paper is to describe two interesting areas of disturbed Lower Permian strata occurring on the escarpment of the Magnesian Limestone near Sunderland. The section at Claxheugh is seen along the south side of the River Wear about two miles west of Sunderland, while the exposures on Down Hill, near West Boldon, occur on the hill north of that river immediately opposite to Claxheugh. Both of these areas are worthy of study by geologists and by members of the Natural History Society; as they present exposures of the lower divisions of the Permian, of the Bryozoa Reef or Fossiliferous division of the Limestone, of disturbed rocks and breccias, and give a clear indication of the nature of the disturbances to which the Lower Permian rocks of north-east Durham have been subjected.

In a former paper in these Transactions I gave a detailed description of the section at Claxheugh* and while the account given is accurate, the explanation suggested is not a correct one †. When I wrote that paper the exact nature of the movements which had taken place in the Permian were not understood, but since then it has been shown that horizontal pressures acting on these rocks have produced a series of thrusts in them and so caused many of the structural peculiarities which form such an interesting feature of the

* Trans. of Nat. Hist. Soc , Vol. XIV., Pt. 2, 1903.

† It is there explained as being due to a cavern that had collapsed Horizontal movement was shown to have occurred, but it was suggested that the roof of the cavern had moved in this way on settling down. Howse had explained the section as being an unconformable junction of the Yellow Sands and Limestone series some years before.

district*. In this paper I desire to add some features of interest to the description of the Claxheugh section, and to give an explanation which is more in accordance with the evidence obtained from the study of the rocks of the district.

Dr. Trechmann has shown that a thick bed of anhydrite is interbedded with the main mass of the Magnesian Limestone at Hartlepool†, and suggests that anhydrite and gypsum were interstratified in other areas with that bed from which it has been subsequently removed. This would lead to a collapse of the rock, and thus some of the disturbance and brecciation of the Limestone, especially in its upper layers, may be due to that cause. It is also probable that the removal of the sulphates would enable the horizontal pressures that subsequently acted to produce much greater disturbances and brecciation than they would have on a rock that had not been rendered cavernous in that way. In my paper on "The Stratigraphy and Tectonics of the Permian" I state that sulphates and other salts were probably laid down with the main mass of the Magnesian Limestone, but as there was no direct evidence in the North of Durham of such deposition, and as I knew that Dr. Trechmann was working on the anhydrite deposit near Hartlepool, it seemed to me best not to lay too much stress on the probability of sulphates having been originally present in the Middle and Upper beds of the Limestone, until their occurrence at Hartlepool had been definitely proved in these horizons.‡

The breccias occurring in the Permian of the North of England have been produced in various ways, among which are:—(*a*) The Brochrams of the Vale of Eden were screes probably

* Proceedings of the University of Durham Philosophical Society—On a case of thrust and crush brecciation, Memoir No. 1, 1909, *ibid* 1912, Stratigraphy and Tectonics of the Permian of Durham (Northern area). Proceedings of Geologists' Association, London, 1912—Geology of North-East Durham and South-East Northumberland.

† Quart. Journ. Geol. Soc., 1913.

‡ Beds of anhydrite and gypsum have since been proved to occur in the Permian of South Yorkshire by borings through it.

washed down by torrential streams and mainly deposited under continental conditions. The breccias of Cumberland (Whitehaven district) were also deposited on a land surface*, (*b*) The fossiliferous breccias at Blackhall Rocks are composed of blocks that have rolled down the eastern edge of the Reef, *i.e.*, Vorreef †, (*c*) Some of the breccias were produced by thrusting (crush breccias) *e.g.*, those so well exposed at the south end of Marsden Bay, (*d*) others may be due to the removal of beds and intercalations of gypsum and anhydrite, as those exposed on the coast of Durham near Easington, (*e*) while the breccias at Raisby Hill Quarry appear to have been produced by hard calcareous beds (bluestones) becoming changed into soft cellular dolomite (the magnesia being derived from the dolomite above) and then the layer breaking up. The last three would be associated with disturbance in the strata, the two former would not.

It is thus clear that the causes of the brecciation and of the disturbed strata in the Magnesian Limestone are many, and that the evidence from each exposure must be carefully examined before an explanation of their mode of formation can be elucidated.

The disturbances at Claxheugh and Down Hill occur beneath the level at which sulphates were laid down (they affect the Yellow Sands, Marl Slate and Lower Limestone) and afford clear proof of having been produced by horizontal movements, and cannot be directly due to the Magnesian Limestone having contained gypsum or anhydrite, nor to the removal of beds of Limestone, Marl Slate and Yellow Sands by solution or underground mechanical action of running

* Dr. Trechmann and I have lately examined both of these beds and agree as to their mode of formation.

† In Thuringia a Bryozoa reef occurs in the Lower Zechstein, similar in nature and fossiliferous contents with that of Durham, and a Vorreef is present also. Geologisches Wanderbuch für Ostthüringien und Westsachsen by E. Kirste, page 141. Dr. Trechmann and I who examined the Thuringian beds in 1913 were struck by their resemblance to those of Durham.

water as stated in my former paper. They present many of the features that I have described as occurring in the Marsden district, and are specially interesting because of the masses of rock which can be shown to be thrust out of position. That the thrusting, of which the rocks of Claxheugh and Down Hill give such clear exposures, took place over large areas is evident from the sections of the Permian in Cullercoats Bay, Marsden, etc., and from the exposures of the Coal Measures along the south coast of Northumberland*.

The rocks seen in the two areas are in descending order (1) The Shell or Fossiliferous division forming the Bryozoa Reef, which runs in a series of knolls from the north to south of Durham (2) The Lower or regularly-bedded Limestone (3) The Marl Slate and (4) The Yellow Sands resting unconformably on the Coal Measures.

It is not proposed to describe these beds here as their features have been fully given in the papers referred to, but to give a short description of the structural features of the two areas.

The Claxheugh section will be understood from the photograph and detailed drawing of it†. It affords evidence at the western end of the exposure of the thrusting of the Lower Limestone (3a) over the unbedded limestone of the Reef. These disturbed beds are seen in the railway cutting immediately above Claxheugh rock. Howse and Kirkby collected Lower Limestone fossils from this place some 50 years ago. At the eastern end the Marl Slate and Lower Limestone are entirely thrust out of the section, and at X the Yellow Sands have been sheared and dragged up over a mass of breccia from west to east, thus affording evidence of the direction of the thrust movement. Between Y and D the base of the Fossiliferous Limestone is slickensided and grooved by being

* I have lately observed evidence of horizontal movement in the Coal Measures exposed in the river bank opposite to Claxheugh.

† Further details can be seen in the photographs and section given in my former paper in these Transactions, 1903.

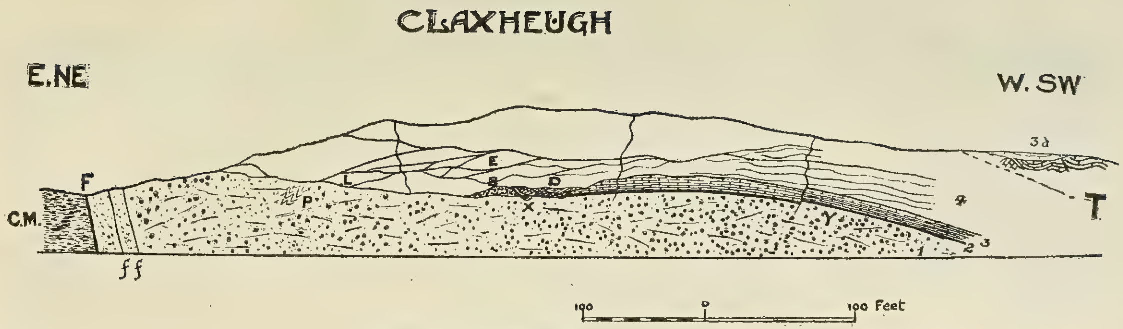


FIG. 1. Section at Claxheugh.

The rocks exposed are—

C.M. Coal Measures.

(1) Yellow Sands, 60ft. (2) Marl Slate, 3ft.

(3) Regularly-bedded Lower Limestone, 10ft. 8.

(3a) Portion of Lower Limestone thrust over Shell Limestone along minor thrust plane T. (exposed in railway cutting).

(4) Unbedded Fossiliferous or Shell Limestone, being a portion of the Bryozoa Reef of the Middle Magnesian Limestone.

F. Fault. f.f. fissures.

Towards the east end the Marl Slate and Lower Limestone are absent and the Middle Limestone rests in an irregular manner on the Yellow Sands. These rocks on being traced from the west do not end abruptly, but are succeeded by a series of disturbed and brecciated masses of the latter rock D and a breccia B, and the Yellow Sands are sheared at X and drawn up over the breccia. Pieces of the Lower Limestone occur at L, and the Yellow Sands are puckered at P. A considerable thickness of the Lower Limestone and of the lower layers of the Reef may also have been thrust out from the western end of the section. The main thrust plane lies between the Shell Limestone and the beds beneath.

The base of the Fossiliferous Limestone is slickensided and grooved between Y and D, and in that bed a series of horizontal shear planes E occur.

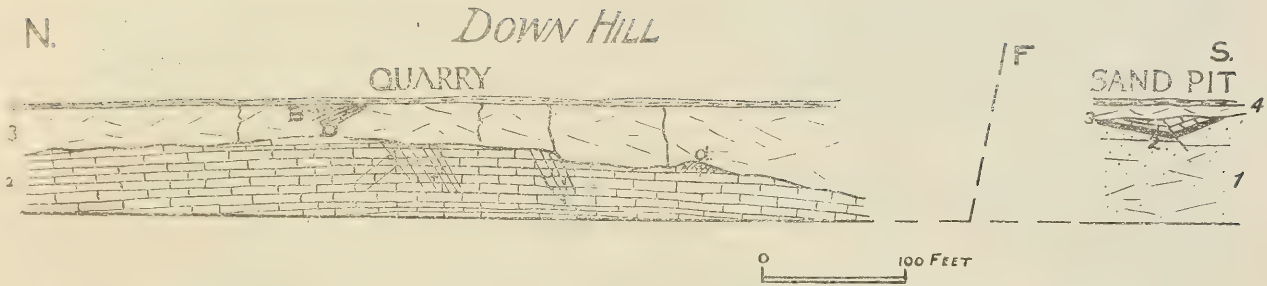


FIG. 2. Section exposed in Limestone Quarry and Sand Pit along the Permian escarpment at Down Hill.

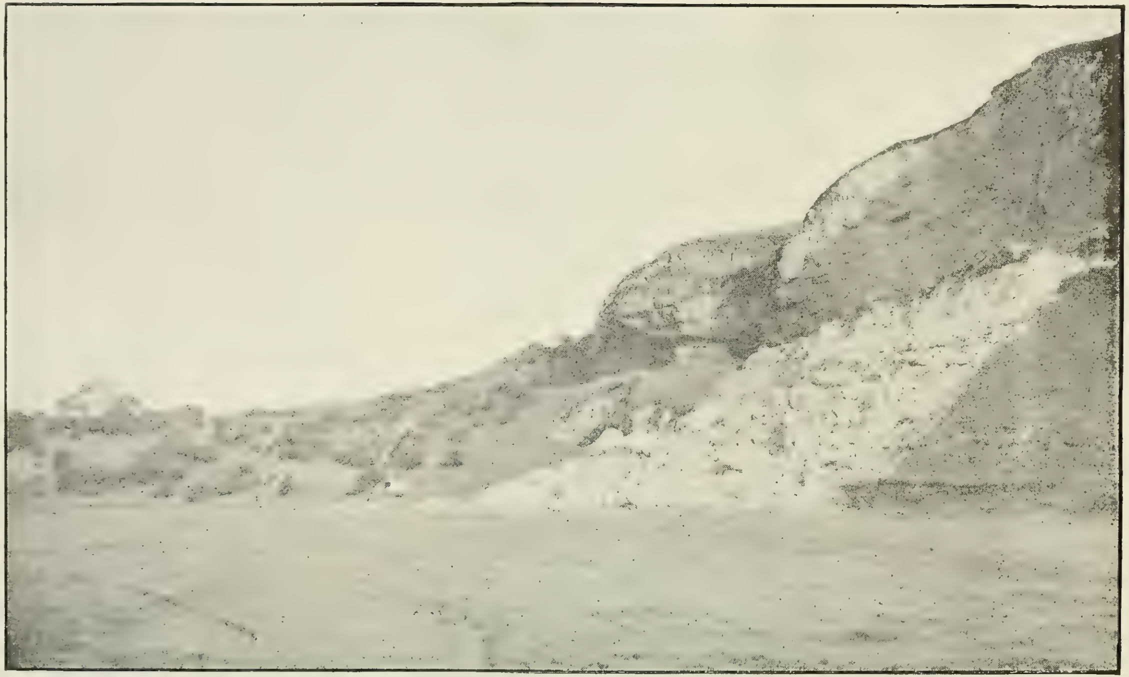
The rocks exposed in the Sand Pit are:—

(1) Yellow Sands.
(2) Small triangular mass of Marl Slate and Lower Limestone
(3) Unbedded Fossiliferous Magnesian Limestones.

Those exposed in the Quarry are:—

(2) Lower Limestone.
(3) Unbedded Fossiliferous Magnesian Limestone of the Reef.
(D) Disturbed mass of bedded Limestone, which is only shown diagrammatically as its exact relations cannot be made out.
(d) Fractured and disturbed Lower Limestone.
(B) Breccia.
(f f) Fissures in the Lower Limestone.
F. Fault.

Both exposures are covered by boulder clay (4).



1. Photograph of Claxheugh looking East.

(4) Unbedded Limestone of the Reef, some of the horizontal planes in it referred to in the paper can be seen.
(3) Lower Limestone. (2) Marl Slate. (1) Yellow Sands.
The landslip of 1905 is well shown. The house in the distance stands on the Coal Measures.

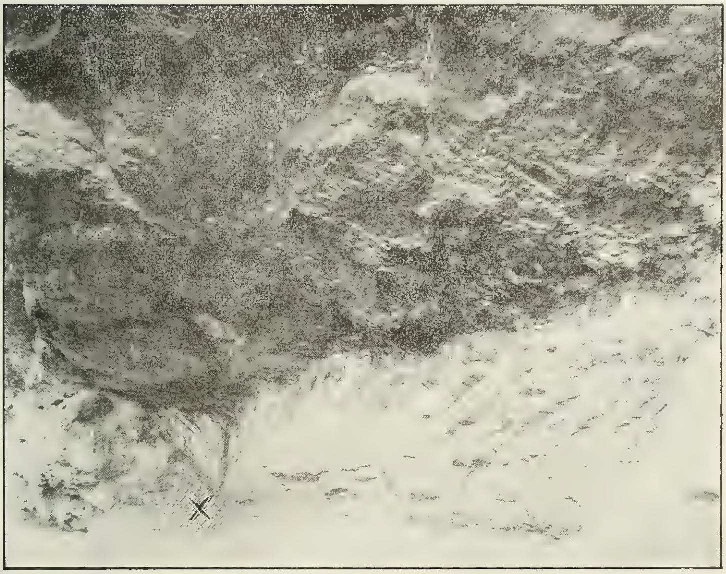
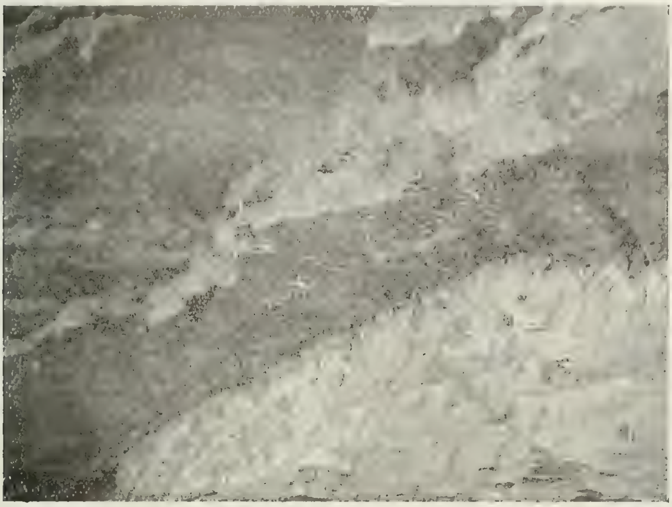


Photo. D.W.

2. *Disturbed Beds of Lower Limestone and breccia with Fossiliferous Limestone above.*

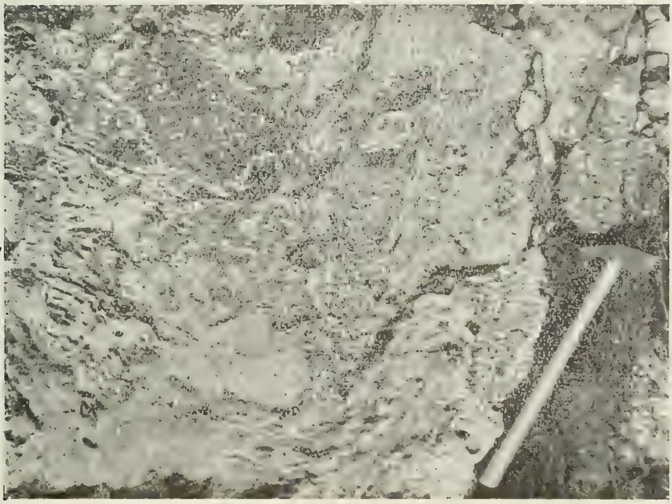
The Yellow Sands are sheared at X and drawn up over the top of the breccia from the west.

(See section Fig. 1. Claxheugh).



3. *Grooved and slickensided base of Fossiliferous Limestone at Claxheugh.*

The direction of the grooves is W S.W. to E.N.E. and the movement was in that direction.



4. *Minutely faulted and brecciated Limestone in quarry, south of Claxheugh.*

5. Sand Pit. Down Hill.

The Yellow Sands are here overlain by a small triangular mass of Marl Slate and Lower Limestone M, all of which are covered by unbedded limestones of the Reef. The rest of the Marl Slate and Lower Limestone have been thrust out of position.

6. Intrusion of Middle Limestone Breccias into regularly-bedded Lower Limestones. These beds are disturbed and contorted (near the hammer).

Small quarry, east of Church, West Boldon.

forced along the Lower Limestone. In the unbedded limestone a series of horizontal division planes have been produced, dividing this bed into a number of lens-shaped masses. From exposures of the Lower Limestone in the immediate neighbourhood many feet of this rock may have been thrust out of the western part of the section, and from a study of the fossils Dr. Trechmann thinks part of the Fossiliferous Limestone is missing. Unfortunately at the present time owing to the landslip which occurred in 1905*, some of the features described cannot now be so clearly seen as when I first described this section. In the old quarries in the Claxheugh district there are good exposures of the Lower Limestone, of minutely faulted beds, of breccias, and of a very fossiliferous portion of the Reef, from which a collection of Magnesian Limestone fossils can be made.

Several quarries have been worked on Down Hill, and this area affording evidence similar to Claxheugh is worthy of a short description. It is only by comparison with the features of the latter and other exposures that the details of the sections on the flanks of these hills can be understood. The detailed section given is of two quarries on the western face of the Permian escarpment near Down Hill House. The principal feature to which I wish to refer is that in the sand pit a small triangular mass of the Marl Slate and Lower Limestone, resting on the Yellow Sands is overlaid by the unbedded limestone of the Reef, while in the limestone quarry some 50 yards away the Lower Limestone is 40 feet thick. It is evident that a considerable thickness of Lower Limestone has been thrust out of position in the exposure at the sand pit. There is also evidence of movement in the limestone quarry in the fissuring of the Lower Limestone and in the disturbance of the upper beds of that division. Near Hylton Castle on the south side of the hill about one mile away highly tilted and displaced beds of Lower Limestone occur, from a study of which it is possible to understand the way in

* Described in these Transactions, New Series, Vol. 1, Part 3.

which the lower beds have been thrust out at Claxheugh and from the sand pit*. On the opposite side of the hill in a small old quarry to the east of the Church at West Boldon (in a field immediately behind the school) breccias belonging to the Middle Limestone have been thrust into the beds of the Lower Limestone, which are disturbed in a peculiar way (photograph No. 6). On the top of the hill near West Boldon non-fossiliferous calcareous breccias occur, which originally formed part of the highly-magnesian limestone of the Reef. They are peculiar in being cut into blocks by a series of sloping fissures.

Both of the areas described are fossiliferous. Fish remains can be obtained from the small exposure of Marl Slate in the Down Hill sand pit, one of the few fossiliferous exposures of Lower Limestone in the district occurs in the railway cutting at Claxheugh, while from the unbedded limestones of the Bryozoa Reef excellent collections of the typical fossils of that formation can be made.

* A general section of this hill is given in the paper on the Stratigraphy and Tectonics of the Permian of Durham, page 260.

A valuable addition to the British Lichen—Flora.

By the Rev. W. JOHNSON.

It was my good fortune to discover recently an interesting addition to our British Lichen—Flora.

I have beside me considerable lichen-material gathered years ago, and which, up to the present I have not found time to work up. But being confined to the house I have recently turned my attention to this material, and in a gathering from St. Bees, Cumberland, I found on examination, what turned out to be not only a new lichen to Great Britain, but a new genus also, which is that of *Sarcopyrenia* Nyl. This genus only contains one species which is named *Sarcopyrenia gibba* Nyl. It is a very distinct and interesting lichen, having a sort of double clavate sporidia, unlike the sporidia of any previous British species.

Dr. Nylander records this lichen as previously found in Algiers, Switzerland, and Germany. It grows on arenaceous and limestone rocks. In growth my specimens are associated with *Lecanora vitellina* Ach., the yellow thallus of which must not be confused with that of *Sarcopyrenia*. I found this new lichen on the shore rocks St. Bees, and on the Whitehaven side of those rocks from the entrance from St. Bees Village. The rocks were large and flat, and almost on the sand level.

I sent a specimen of this lichen to the British Museum, where Miss A. L. Smith, F.L.S., confirmed my discovery, a notice of which appears in her new volume which completes the New Monograph on British Lichens; published under the direction of the Trustees of the B.M.

I may also say, that this new lichen is included in the 13th Fascicuous of my "North of England Lichen-Herbarium."

REPORT OF THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1914.

READ 30TH MARCH, 1915, BY MR. J. J. HILL, CHAIRMAN OF THE FIELD MEETINGS COMMITTEE IN 1914.

LADIES AND GENTLEMEN,

With the exception of the September Coast Meeting, which was cancelled during the early stages of the war, the whole of the Meetings indicated on the year's programme were successfully carried out. The weather, which is such an important factor, was particularly kind to us, and it is pleasing for me to report what I believe is something in the nature of a record, namely, that at each and all of our Meetings, we were favoured with excellent weather, and without a drop of rain on any occasion.

During the season, the following ladies and gentlemen attended our Meetings :—

Mr. Richard S. Bagnall, F.E.S., F.L.S., Penshaw
Mr. W. E. Beck, Newcastle
Miss Beddows, B.Sc., Newcastle
Mr. W. J. Bellerby, Newcastle
Mr. C. C. Cadman, Barrasford
Mr. Isaac Clark, Newcastle
Mr. R. B. Cooke, Corbridge
Master M. Davidson, Heaton
Mr. W. Dixon, J.P., Rowlands Gill
Mr. Dixon, jun., Rowlands Gill
Miss Edmunds, Newcastle
Mr. P. Gordon, Newcastle
Mr. Newbey Green, Newcastle
Mr. W. Guthrie, Rowlands Gill
Mr. J. J. Hill (Field President, 1914) Heaton
Miss Doris Hill, Heaton
Mr. C. Ismay, Newcastle
Mr. J. Jeffreys, B.Sc., Newcastle

Mr. John Losh, Newcastle
Mr. J. Ford Maling, Saltwell
Mr. Edward Potts, Cleadon
Mr. R. Pyle, Whitley Bay
Miss Roberts, Blaydon
Mr. C. E. Robson (Hon. Secretary) Newcastle
Miss Joyce H. Robson, B.Sc., Newcastle
Mr. George Sisson, Hexham
Mr. Nicholas Temperley, Low Fell
Mr. W. Leonard Turner, Low Fell
Master C. Waite, Newcastle
Mr. J. D. Walker, J.P., Newcastle
Rev. Arthur Watts, F.G.S., Witton Gilbert
Misses Wilson, Rowlands Gill
Mr. Cuthbert B. Wilson, Newcastle

Our Opening Meeting was held at BARRASFORD, on the North Tyne, on Saturday, the 2nd of May, 1914. We had an excellent attendance, many of our members taking this their first opportunity of engaging in actual field work after the somewhat inactive months of winter. From the very beginning circumstances combined to make this Meeting a thoroughly enjoyable one. Friends met at the station who had lost sight of each other for many months, and now showed an eagerness to once more link up companionship in the pursuit of their favourite studies. The weather was gloriously bright and the scenery on the west line, interesting at any time, to-day provided the party with ample material to discuss during the short time spent in the train. After getting well away from the town and beyond Blaydon, one could not help but admire the glorious array of colour on either side of the track. The earlier trees had already got their new foliage, while others were just budding and in that interesting half stage which so delights the eye. Not only in the woodlands but in the meadows too the spirit of early summer was abroad, and features which in an ordinary way might be considered commonplace were on this bright May morning transformed into objects of beauty and interest. In this way, a familiar meadow patch skirting a farm near Hexham station delighted the eye with its fresh greenery of deep luscious grass, starred with the brilliant yellows of the dandelions.

On arrival at Barrasford, the party spent a pleasant hour or two in a woody dingle on the banks of the Swin Burn, after which they made their way down to the Fish Hatcheries, where, by the kind invitation of Mr. C. C. Cadman, the establishment for the rearing of trout was inspected. We were fortunate in having Mr. Cadman himself as guide, and he conducted us through every branch of the establishment, and explained carefully every detail of the rearing and management of the stock, from the egg to the mature fish. First the eggs were viewed on their trays in the spring run water; later the frail young life was seen emerging from the egg; then in the open garden ponds, graduated in accordance with age, fish in thousands were disporting themselves, in all sizes from the mere brown streak of early youth to the goodly fish of several pounds, which in natural surroundings must be the envy of every angler. Every stage was highly interesting, the ponds containing the myriads of "yearlings" particularly so. Here the water seemed almost to vibrate with life, and when food was thrown in, the surface simply "boiled" with the voracious youngsters scrambling for their food.

After leaving Barrasford, the party crossed the Tyne by the ferry, passing the imposing pile of Haughton Castle, and made their way down the west side of the river to Chollerford. The walk was a delightful one, though somewhat hurried, and the only incident worthy of note was perhaps the finding of a robin's nest with young, ingeniously concealed beneath an old spade in a wayside wood. Here the young birds seemed to be in happy security, safe from the eye of the ordinary passer-by and well sheltered from possible storm.

On reaching Chollerford, tea was partaken of at the "George Hotel," where the events of the day were reviewed, notes compared, and lists drawn up of the day's finds. Later, a pleasant hour was spent in the evening's cool by the river, while some of the more adventurous of the party pushed on and inspected the remnant of the Roman Bridge on the Tyne banks below the "Chesters," thus completing a very full and interesting programme before train time.

Flowers in Bloom.

Wood Anemone	Leopard's Bane
Marsh Marigold	Butterbur
Globe Flower	Wood Forget-me-not
Hairy Cress and Bitter Cress	Germander Speedwell
Lady's Smock	Ground Ivy
Dog Violet	Purple Dead Nettle
Mountain Pansy	Horse Mint
Red Campion	Primrose
Greater Stitchwort	Cowslip
Wood Sorrel	Oxlip
Whin	Spring Orchis
Water Avens	Garlic
Strawberry-leaved Cinquefoil	Hyacinth
Golden Saxifrage	Cuckoo Pint
Wood Meadow Saxifrage	Great Woodrush
Moschatel	Sedge
Sweet Cicely	Wall Rue
Beaked Parsley	Brittle Bladder Fern
Yellow Crosswort	

Birds.

Sandpiper (numerous, nests and eggs)	Black-headed Gull
Dipper (nest and young)	Wood Pigeon
Willow Warbler	Spotted Flycatcher
Curlew	Pied Flycatcher (3 males)
Swallow	Grasshopper Warbler (heard)
Sand and House Martin	Ring Ouzel (nests and eggs)
Blue and Great Tit	Wheatear
Lapwing	Whinchat
Carrion Crow	Stockdove (2 young)
Pied and Grey Wagtails	Wren (and eggs)
Coot	Tree Creeper
Waterhen	Tree Pipit
Green Finch	Robin (and young)
Starling (with eggs)	Swift
Mallard	Ring Dove
	Sedge Warbler (seen and heard)

Our Second Meeting was held in the district between Aycliffe and Bradbury, in the county of Durham, on Saturday, June the 6th, and again the members were favoured with good weather, the somewhat cloudy conditions of the morning changing to sunshine as the day wore on.

Out beyond the village of Aycliffe the river Skerne winds on a reedy bed through luxuriant meadows varied by marsh and scrub, providing in all a happy hunting-ground for the field naturalist. Here the river was gay with a deep margin of bright yellow rocket in full bloom, backed by dark-green thorns and other shrubs. The placid surface of the water was broken at intervals with patches of outgrown reed, amongst which, here and there, were seen just out of harm's way occasional waterhens' nests with their tempting clutches of browny-speckled eggs. Birds generally were somewhat scarce, and nothing of special interest was observed, with the exception of the reed-bunting with his black cap and conspicuous white collar, and in the later day a few pairs of red-shanks on the flats of Morden Carrs.

A delightful walk of a mile or more by the flower-fringed stream led to the mill, in the neighbourhood of which the botanists had rather a good time; including among their finds blooms of that somewhat rare plant in the north—the water violet (*Hottonia palustris*). It was hereabouts also, on a marshy patch, that our botanists discovered something in the nature of a puzzle; which on later investigation proved to be one of the creeping yellow cresses, either *Nasturtium sylvestre* or *Nasturtium palustre*.

Following a strenuous scramble over a colliery railway, we found ourselves in a quiet retreat by the river which was splendidly isolated by high embankments and other obstacles, affording just the sort of place for natural history research. It was here that a number of orange-tip butterflies were found flitting along the river banks in the bright bursts of sunshine. The orange-tips are most difficult to locate when at rest, the mottlings on the undersides of their wings harmonising exactly with the greenery upon which the butterflies alight. Here it was we had lunch, after which we followed the stream and Carr to Bradbury, which was the real goal of the day's excursion, where there is an ancient disused railway embankment clad with a great variety of interesting wild plants.

After leaving Bradbury the party followed the road to Sedgefield, where they were excellently catered for by Mrs. Walton of the "Hardwick Arms."

During the day the party was somewhat hampered by want of a definite programme and proper guidance over the district, as the ground was new to us all. The uncertainty of new ground fraught with all kinds of possibilities is attractive to the rambler with unlimited time and no trains to catch; but our experience on this occasion, with the knowledge of a big day's mileage ahead, was rather disconcerting, particularly on the wide stretches of the Carr, where we might have fared much better with a guide. Apart from the disappointment of the Carr, however, the remainder of our ramble was enjoyable in the extreme.

The botanical finds of the day included :—

Meadow Lady's Smock	Bitter Lady's Smock
Globe Flower	Water Figwort
Great Burnet	Water Violet
Lady's Mantle	Water Avens
Brooklime	Yellow Rocket or Winter Cress
Bistort or Snake Weed	Garlic Mustard (white)
Bugle	Red Campion
Goatsbeard	Jagged-leaved Geranium
Marsh Marigold	Creeping Yellow-cress
Wild Mignonette	Marsh Valerian
Water Crowfoot	Meadow Rue
Wood Geranium and others	

The Midsummer Meeting consisted of a three days' sojourn in North Northumberland on the 23rd, 24th and 25th of June, with Belford as a centre; when, escaping the storms that prevailed further south, the party were favoured with delightful weather throughout.

On leaving Newcastle a typical Race-week rainstorm was raging, the whole place being in a deluge; but as our train sped north we ran into better weather, and on arriving at Belford we were delighted to find that the district had escaped the rains altogether. After the drenched conditions under which we left Newcastle, the balmy evening air in the Belford lanes was a pleasant contrast, and as we drove leisurely to the village, we conjured up all sorts of pleasant possibilities for the days to come.

The first day was devoted to Spindleston and neighbourhood. Warren Mill nestling at the corner of the peaceful bay, the bridge, the rippling burn with its darting trout, the rugged crag of Spindleston towering from a base of close-clad wood, all combine in forming a most charming picture. From the tops of the crags an extensive view is obtained, with Holy Island away in the north, like a jewel set in an ever-changing sea.

Leaving the beetling crag of Spindleston with its clamouring daws, the party wended their way homewards by the fields, passing the stately Hall of Belford in its woods and parks; thence by a quiet meadow stream decked with silver-flowered cress and yellow flag, and so on to the village while the blackbird sang his mellow evensong.

The programme for the second day included Ross Links, Budle Bay, and the heights of Chesterhill, and although perhaps not quite so picturesque as Spindleston the ground was highly interesting, and produced a number of welcome additions to the botanist's list.

That corner of coast by the bents of Ross and the flats of Budle Bay, though wild and weird, is a fine setting for the bird life of the district. Here the party were treated as unwelcome intruders, and the scolding note of the disturbed redshank, the pipe of the ring plover,, and the wail of the uneasy lapwing were a constant accompaniment until the party were well beyond the jealously-guarded haunts of these wary birds. The mellow pipe of the curlew was heard on every hand as small parties settled down to probe the soft ooze by the margin of the bay; out on the water a number of gulls were resting, and every now and again a group of shell-duck would rise and file out to sea with their clean-cut plumage flashing in the sun.

By special permission, the party were enabled to spend the third day in the neighbourhood of Craggyhall and Swinhoe, a country presenting a most delightful variety of field, wood. lake and crag. The Lake with its sun-lit waters and encircling woods was the centre of attraction, and here the hours sped pleasantly along. On the waters' surface the white lilies lay open to the sun; by the margin the rosy flower-spikes of the amphibious persicaria stood bravely amid its floating leaves, the ruddy flowered marsh cinquefoil flourished on the banks, and a profusion of other plants bloomed and fruited in all directions. The crags were ablaze with the purple bell heather or fine-leaved heath, enlivened with the brilliant yellow flowers of the rock-rose. Ripened gorse-pods crackled in the sun, and butterflies, tiny heaths and blues, flitted here and there. Over a moory spot close by an anxious curlew hovered and piped to its young, and a little search revealed the long-legged youngsters striding away to security.

At the close of day, in the cool rooms of the "Blue Bell Inn," Belford, where the party were excellently catered for, notes were compared, specimens identified, and the three days' list drawn up, which in addition to the commoner finds, included :—

Plants.

Watercress	Smooth Heath Bedstraw
Acrid Buttercup	Stonecrop
Goatweed	Field Madder
Greater Celandine	Nipplewort
Meadow Vetchling	Yarrow
Tufted Vetch	Eyebright
Bush Vetch	Wild Sage
Woundwort	Scorpion Grass
Bugloss	Comfrey
Mallow	Sea Milkwort
Sow Thistle	Seaside Plantain

Hemlock and Sea Storksbill
Herb Robert
White and Bladder Campion
Red Campion (masses)
Dog Rose (masses)
Wild Thyme
Tormentil
Yellow Iris
Dyer's Rocket
Hop Trefoil
Fumitory
Scurvy Grass
Dyer's Weed
Wild Pansy
Milkwort (blue, white and variegated)
Corn Spurrey
Prickly Saltwort
Dwarf-tufted Centaury
Seaside Sandwort Spurrey
Greater, Lesser and Wood Stitchworts
Goatsbeard
Black Medick
Silver-weed
Glasswort
Sweet Gale or Bog Myrtle
Burweed
Marsh Cinquefoil
Scarlet Pimpernel
Yellow Pimpernel
Amphibious Persicaria
White Water Lily
Water Crow Foot
Speedwell
Mountain Veronica
Foxglove
Herb Bennet
Sweet Briar
Square-stalked St. John's Wort
Wood Sage
Rock Rose
Sun Spurge
Wormwood
Wood Sanicle
Early Spring Orchis
Ivy-leaved Toadflax
Marestail
White Field Pansy
Juniper
Wood Geranium

Birds.

Wheatear
Whinchat
Blue Tit
Rook
Jackdaw
Carrion Crow
Curlew
Redshank
Ring Plover
Dunlin
Lapwing
Skylark
Meadow Pipit
Yellow Bunting
Black-backed Gull
Black-headed Gull
Mallard
Shellduck
Owl
Corncrake
Waterhen
Coot
Sandpiper
Rockdove
Wood-pigeon
Sparrowhawk
Heron
Magpie
Pied Wagtail

Our Field Section was courteously invited by the Vale of Derwent Field Club to join them in their Meeting at BLANCHLAND on Saturday, July 11th, and a few of our members availed themselves of the opportunity to visit this interesting neighbourhood.

The drive was of course one of the chief features of the day, but although enjoyable in the extreme it did not afford much opportunity for close field work, except at those points where the party were compelled to alight to relieve the horses at the heavy hills. Perhaps the most successful collector during the day was one of our entomologists, who simply revelled in the wide stretches of moor, beating here and there with his net, and capturing all sorts of unexpected specimens. So interested did our friend become on these little by-excursions, that eventually the party lost him altogether and he had to complete the distance to Blanchland on foot, while the remainder of us proceeded by brake in the orthodox manner.

On our return journey from Blanchland, a pleasant incident at Edmond Byers might be noted. Here we met quite unexpectedly little Miss Mamie Richardson, aged 12 years, who a short time previously had submitted to our Society a notable nature essay, accompanied by wonderful drawings, for which she was awarded the Hancock Junior Prize. To-day at Edmond Byers her father showed us a further collection of recent drawings executed by her, from subjects taken locally in the moors and by-ways; and these works certainly reflected the greatest credit upon the young artist, both in the matter of line and sense of colour.

Our Fourth Meeting was held on the 15th July at HOWENS' GILL, county Durham, when we were fortunate in having as our guide the Rev. Arthur Watts, F.G.S., who has made a special study of the district. The beginning of our walk led through the works-grounds of the Consett Iron Company, which, though unattractive from a naturalist's point of view, were interesting in other ways. Just before leaving the grimy precincts of the works, we had a pleasant surprise in the discovery of a huge bed of viper's bugloss on the cindery waste of a railway embankment. The plants were at their very best, the striking blue of the blooms arresting one's attention from a considerable distance.

Just a little way from here our route led us through a sheltered railway cutting, which was profusely clad with a variety of wild flowers which thrived in the shelter of the deep banks. In addition to many common plants, there were one or two species of St. John's wort, and a patch of an unusual convolvulus with small white flowers.

Following the railway track we arrived at the viaduct which spans the head of Howens' Gill, and from the rail level of which a most charming view of the countryside is obtained. From this point of vantage the history of the Gill was explained by Mr. Watts, who described the leading features and outlined the geological history from the glacial periods onwards, giving a most lucid account of how the various strata had been formed and how the retreating ice had left a deposit of some 40 feet or more of alluvium in the bed of the now deserted watercourse. He explained how stones of such widely different character as the Cheviot porphyry and the Shap and Criffel granites were borne by the moving ice from different directions and left as a deposit when the ice receded, and how the then river in the Gill was fed by the melting ice in the highlands until a later time when the Derwent Valley became the natural channel for draining the area, and the ancient river in the Gill ceased to exist.

Leaving the railway track we wound our way down the steep slopes of the Dene, and finding a shaded spot in the shadow of the great piers of the bridge, rested awhile. Here Mr. Watts gave us the history and a number of interesting details connected with the erection of this noble viaduct. One of the outstanding features from a constructional point of view is the successful use of the inverted arch in the foundations of the piers. By this means the stupendous load of the bridge is taken and distributed over a great area, in a manner admirably adapted for binding together the whole foundation, correcting eccentric stresses, and dispersing the weight uniformly over the soft deposit of alluvium below. Standing about a quarter of a mile from the bridge, one obtains an admirable view of the structure, which is graceful in the extreme, spanning the Dene with thirteen arches at a maximum height of some 150 feet from rail level to the bed of the Gill.

A short stroll from the Viaduct brought us to the Caves, which are really old quarries worked from the face, but which in their decay and rustic setting, have all the beauty of natural caves. Down in the depths of the Gill there was a noticeable change in temperature from the highlands above, and this, due to the shelter afforded by the winding banks, partly explains the profusion of wild plants for which the Gill is famous. In parts it is a veritable garden, the marshy bed luxuriant with a multitude of tall grasses, meadowsweet and ragged-robin; the hidden runner silvered with the white blooms of cress and bedstraw; the broader stream tinkling over a gravel bed with the bright yellow mimulus nodding on its half dry margin: all enfolded and sheltered by the high wooded slopes of the Dene.

Gradually as we emerged from the deep-cleft Dene into the gentle wealds of more open country, we were able to appreciate Mr. Watts' description of the ancient river, the now dry bed of which was easily discernible. Hereabouts was plenty to engage the attention of the botanist, from the substantial rich blooms of the marsh cinquefoil in the hollows, to the delicate flowers of cow-wheat on the banks. The proceedings were enlivened by a spice of adventure, for the regular foot tracks were obliterated by the luxuriant greenery; and it was not without sundry wadings through marsh and leapings over streams, that we were able finally to recover the beaten track of the ordinary pedestrian.

In the meadows, a pleasant diversion was afforded by the tracking of one or two redstarts among the thorns, while one of our party attempted a little primitive trout-fishing with his hands among the boulders of the shallow stream. Leaving the meadow-lands we passed the old mill, and so on to the highway.

After tea, Mr. Watts exhibited two remarkable prehistoric weapons of the Stone Age, an axe-head and a hammer-head, which had been discovered during recent excavations in the neighbourhood; and an instructive account followed by general discussion brought a most successful meeting to a close.

The finds of the day were :—

Plants in Bloom.

Milkwort
Ragged Robin
Bladder and White Campion
Lesser Stitchwort
Cathartic Flax
Wood Geranium
Herb Robert
Kidney Vetch
Tufted Vetch
Hop Trefoil
Meadow-sweet
Marsh Cinquefoil
Great Burnet
Lesser Willow Herb
Enchanter's Nightshade
White Heath Bedstraw
Water Bedstraw
Yellow Bedstraw
Greater Valerian
Field Scabious
Small Scabious
Goatsbeard
Mouse-eared Hawkweed
Nipplewort
Tansy
Wall Lettuce
Golden Rod
Common and Marsh Ragwort
Ox-eye Daisy
Harebell
Small White-flowered Bindweed
Cow-wheat
Knotted Figwort
Yellow Mimulus
Foxglove
Wood Sage
Self-heal
Viper's Bugloss
Yellow Pimpernel
Spotted Orchis

Birds.

Carrion Crow
Kestrel
Grey Wagtail
Jay
Willow Warbler
Yellow-hammer
Blue Tit
Missel Thrush
Redstart

Butterflies and Moths.

Meadow Brown	Spotted Burnet (numerous)
Small Blue	Brimstone Moth
Tortoise-shell	Sweep
Cabbage White	Hawk Moth
Yellow Underwing	

The Closing Outdoor Meeting of the Session was held on Wednesday, October 7th, in the neighbourhood of BAMBURGH, where the party were again favoured with fine weather.

Starting from Belford station, the first mile or so of the road was quickly covered, and Waren Mill reached well before noon. The hamlet here, always a restful spot, was particularly so on this quiet October morning, and a long pause was made at the bridge, from which was viewed that picturesque corner of the burn where it winds past the mill and the old boats, away over the broad flats of Budle Bay. Birds were plentiful, and the tide being low, an excellent opportunity was afforded the party of examining at close range a variety of sea and shore birds, mingled with the waterhen and other familiar forms of the burn side.

Leaving the highway beyond the mill, the south shore of the Bay was skirted, and a number of interesting finds noted. Far out on the mud flats groups of birds kept coming and going, and although most of these were out of range of the field-glass, yet the conspicuous shellduck was easily distinguishable among the number. Nearer at hand on the ooze were numbers of gulls with a sprinkling of waders and wheeling groups of restless dunlin; and it was here that the find of the day, a pomatorine skua, was made. Well out of harm's way stood a lonely group of heron spaced at almost regular intervals, erect and motionless, like so many sentinels on guard.

Rounding the rocky point that divides the shaly shore of Budle Bay from the firm sands of the coast proper, the party were fortunate in catching both tide and sun at a happy stage for displaying the beauties of the place. Fringed by golden sand, the quiet river merged into the livelier waters of the sea;

dark greens and blues mingled with the whites of the breakers, and the bright sun of noon tempered by a slight haze, gave a delightful opalescence to the picture. Within the bar on the deep water of the river, a cormorant fished; and just outside beyond the breakers a number of gannets ranged and dived for their prey, emerging from the water with their dripping plumage flashing brilliantly white in the sun.

Along the rocky part of the coast approaching Bamburgh, several groups of eiders were seen close to the shore, and further out a number of other duck, including scoter. On the inner fringe of the rocks an occasional wagtail was seen, together with a few stonechats in their handsome array of chestnut and black.

Just on entering Bamburgh, the discovery of masses of an unusual plant in full bloom on the dunes somewhat nonplussed us. One's first impression was that the plants might have been escapes from a neighbouring garden; and although our botanists were unable to determine the origin of the plants, they were satisfied in identifying them as soap-wort, *Saponaria officinalis*.

Only a short halt was made at Bamburgh, after which the party crossed the sand-dunes, and regaining the shore traversed the firm stretch of sands to Seahouses, where *en route* numerous flocks of autumn shore birds were encountered, wheeling and settling in their characteristic fashion just a little way ahead of the wayfarer.

Seahouses reached, tea was partaken of at Mrs. Cuthbertson's, the events of the day reviewed, and a pleasant Meeting brought to a close.

Birds.

The birds noted were :—

Waterhen	Herring Gull
Coot	Pomatorine Skua
Redshank	Shellduck
Curlew	Eider
Lapwing	Scoter

Oyster-catcher	Rook
Dunlin	Jackdaw
Ring Plover	Heron
Turnstone	Cormorant
Godwit	Gannet
Knot	Rock Pipit
Kittiwake	Stonechat
Black-headed Gull	Pied Wagtail
Black-backed Gull	Wren

Plants in Bloom.

The flowers noted were :—

Sow Thistle	Yarrow
Hogweed	Sea Aster
White Nettle	Sea Sandwort Spurrey
Red Campion	Ragwort
White Campion	Rough Hawkbit
Hedge Woundwort	Sheep's Bit Scabious
Common Veronica	Scurvy Grass
Knapweed	Centaury
Mugwort	Soapwort
Viper's Bugloss	Sea Buckthorn, in fruit.

In addition to our Outdoor Summer Meetings, we have held informal "Round Tables" during the winter at the Museum on the last Wednesday evening of each month. The object of these meetings is to provide members with an opportunity for exchanging notes and discussing field matters of current interest, the intention also being that members should, if possible, bring some object of interest upon which to base the evening's discussion. I think the idea of the Winter Evening "Round Table" is capable of still further development, and I hope we shall have a more numerous attendance as time goes on.

This report would not be complete without reference to the work of our excellent Secretary, Mr. C. E. Robson, upon whom falls the whole of the administrative work of our Field Section, namely, negotiations for permission to visit the various places, arrangements for trains and teas, circulars and the like. As your chairman for the year, therefore, I would here place on record our sincere appreciation of the courteous and ever-attentive services of our esteemed Secretary, Mr. Robson.

I believe it is customary for a Field President at the conclusion of his year of office to offer in his report any suggestion which he may consider useful for the general welfare of the Field Section of the Society. In matters of programme, system, or routine, I have nothing to add to what my predecessors in office have already set forth; but I think that the question of membership, and the source from which we expect to recruit new members is one that is worth some consideration.

True naturalists do not compose a very large section of the community, and one rarely discovers a "grown-up" who makes an enthusiastic supporter of our Society, unless that "grown-up" has, in his youth, been in some way associated with the study of natural history. It seems to me, therefore, that to ensure the success of our Society in the years to come, we ought to offer some encouragement to the young people of to-day, who in the natural course of things will become the members of to-morrow. Let us invite them to our Field Meetings occasionally, give them opportunity—opportunity which might reveal qualities which in course of time would develop to their own good, and fit them for useful membership of our Society in the days to come.

I should be very sorry indeed to introduce anything in the way of an innovation which might disturb the more quiet proceedings of the "grown-ups"; but I think it quite possible to encourage the young folk a little without interfering with the regular programme of the older members. For instance, we might have one or two additional outdoor meetings in the summer, say on Saturday afternoons, when it would be understood that the young folk were especially welcome. These could be held at short inexpensive distances, and I venture to predict that not only would such meetings be of the greatest value to juniors, but that they would give peculiar pleasure to many of our older members, who, in turning awhile with the young people to the simpler stages of nature study, would revive many pleasant reminiscences of their own youth.

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Where brevity is desired in directing exchanges, etc., the following is a sufficient address:

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The Siphonaptera (*Fleas*) *of Northumberland and Durham.*

By Richard S. Bagnall, F.L.S.

a. General and Historical.

The flea, as a type of insect, is perhaps more familiar to the non-entomological public than members of any other obscure group. Moths have continually been misnamed butterflies, and butterflies and caddis-flies loosely called moths; the loathsome cockroach, belonging to the Order Orthoptera, is widely known as a beetle, whilst the name 'bug' covers a multitude of sins. But the flea is known as a flea throughout the country; therefore a general description is unnecessary, the name alone conjuring up the image to the reader.

Recent researches, however, have shown that fleas are very important insects indeed, bearing, as they do, a large and unenviable part in the carrying and dispersion of the Bubonic Plague bacillus.* So we must raise the creature's status, and lift it beyond the pale of unseemly merriment and indelicate jokes!

Some years ago I attempted to lay the foundations of a catalogue of our local species. Until 1911, when I received the warm co-operation of my friend Mr. Wm. Hall of Fatfield,

* There were 7,000,000 deaths between 1896 and 1911 from bubonic plague in India alone.

my collecting was of a very haphazard nature, but in that year great strides were made and the following records will show how much I am indebted to Mr. Hall for his enthusiastic collaboration. I am also very grateful to other friends, whose names appear in the following list, for the trouble they have taken in forwarding me material in the shape of mammals and birds or their nests and occasionally tubes of fleas. Such assistance I am glad to say has swollen our list appreciably; without it *Ceratophyllus columbæ* and the two bat fleas *Ischnopsyllus octactenus* and *I. simplex* would not have been known to us. For various reasons my list was never published, and in going over these old records in preparing them for publication my mind dwells upon the many pleasant excursions I made in search of fleas and other ecto-parasites; to the Farne Islands with Messrs. Gill and Hall, under Mr. Paynter's kindly guidance and hospitality, and later with members of our Natural History Society; to Bradbury with Messrs. Gill, Wallace and E. L. Turner in search of moles' nests which we brought home in sacks to the distress of my household, and to Stocksfield with Mr. Walton, and Corbridge with Mr. Walton Lee in quest of house martins' nests and bats. And lastly and more recently, a visit to Mr. George Bolam at Alston, where we examined some living examples of the whiskered bat for its treasures. Here I should also gratefully acknowledge the numerous parcels of moles' nests that Mr. Noble so kindly collected for me in the Irthing district.

At this time there was no comprehensive literature on the subject, only odd papers in various entomological magazines, etc., and mostly from the pen of the Hon. N. C. Rothschild, the chief authority on the *Siphonaptera*; and the whole of my material has been very kindly examined and identified by Mr. Rothschild. Without his help and friendly encouragement this work could never have been undertaken, and I am grateful to an extent that is difficult to express but which I feel sure he will realize, for his unfailing patience and courtesy in dealing with my material.

b. Literature.

Now things are changed. Mr. Rothschild has published a "Synopsis of the British Siphonaptera" in the "Entomologist's Monthly Magazine" (1915, pp. 49–112) with very useful tables and 8 plates; Mr. Harold Russell has published in the "Cambridge Manuals of Science and Literature" series a volume entitled "The Flea" (1913), and Mr. James Waterston is responsible for a brochure published by the British Museum (1916) on "Fleas as a Menace to Man and Domestic Animals, their life-history, habits and control." For a student of the plague flea the researches of Bacot and Martin (which one feels will be regarded as classic) will be found in the Journal of Hygiene.

c. Bubonic Plague.

Waterston's brochure epitomises these researches, and though the literature above cited is accessible to all, I make no excuse in quoting him as follows:—

"The greatest danger of the flea's attack, however, is that through it plague may be contracted. Bubonic plague is a kind of blood poisoning, characterised, among other features, by an enlargement of the glands (buboes). This disease, caused by the presence of a specific organism (*Bacillus pestis*) in the victim's blood, is more or less always to be found in certain parts of the world. From these regions, under conditions as yet imperfectly understood, plague becomes virulent and spreads over the world (*e.g.*, 1894–1900). Rats and fleas are the chief factors in the propagation of the disease, the insects conveying plague from rat to rat, and from rat to man. While it is impossible to give here the detailed evidence on which these statements rest, one may state shortly the ways in which the plague bacillus is conveyed by the flea. The problem has proved to be by no means a simple one.

(1) Arguing from the analogy of malaria, etc., the earliest efforts were made to find plague bacilli in the salivary glands

of the flea. All attempts have signally failed, however, to establish such a connection.

(2) It also appeared that, except just after a flea had been feeding on a plague-stricken animal, no bacilli could be detected in the alimentary tract between the mouth and the gizzard. The bacilli were numerous, so numerous as to prove that multiplication had taken place, within the stomach, but the valve formed by the gizzard is so tight that no one believed in the possibility of bacilli *from the stomach* entering the host *via* the mouth parts of the flea.

(3) It was noticed that during a meal the contents of the gut were discharged from time to time. These fœcal drops contain numerous bacilli, and experiment showed that infection might be brought about either by the movements of the flea itself, on the completion of its meal, or by the host's rubbing at the angry spot. This first method of infection received a very qualified support, even by its discoverers, because in spite of the evidence from dissection, infection by bite alone appeared to be taking place.

(4) Recently (1914) a new light has been shed on the matter by the discoveries of Messrs. Bacot and Martin, of the Lister Institute. In experimenting with *X. cheopis* and *C. fasciatus* a certain number of the insects were found to be suffering from obstruction of the alimentary canal. Further investigation showed that, in such cases, the plague bacilli had multiplied so excessively in the gizzard and stomach as to form an impassable jelly-like mass. Fleas affected in this way were thirstier and more reckless than normal individuals. When placed on a host they sucked vigorously for a time, but the blood taken up failed to pass into the stomach. Then, when the sucking effort ceased, the blood which had been imbibed, now contaminated with plague bacilli, was forced back into the wound, and infection took place. The first two methods—the first comparable to vaccination, the second to inoculation—are amply sufficient to explain how fleas convey

plague. It is only necessary to add that the flea, in all cases, becomes infected itself by feeding on an infected animal."

d. LIFE CYCLE AND NOTE ON REARING FLEAS.

Fleas are not true parasites; they undergo a distinct metamorphosis and the earlier stages are not attached to the host. The life story is a short and simple one, the cycle embracing the four distinct stages—egg, larva, pupa and the perfect insect. In suitable climates the eggs are laid throughout the year, being deposited, a few at a time, indiscriminately on floors of buildings, or in the nest, burrow or haunt of the host-bird or animal. The eggs, which are oval or elongated oval in shape, translucent, and, as regards texture, smooth and wax-like, are large when compared to the insect laying them. The larva, a very active creature, is of a dirty white colour, blind, bristle-set and legless, and exists on the varied organic debris of its larval home. The first-stage "grub" is furnished with a special knife-like spine on the head, which it uses to break through the egg-shell. There appear to be but two larval moults, and at the end of the third stage the larva spins a cocoon in which it pupates, and in due course emerges as a perfect insect. Such, then, is a brief outline of a typical life-history—occupying in all perhaps a month, perhaps six weeks.

Hints on collecting and preserving fleas are given by both Rothschild and Russell in the above-cited memoirs. Apart from the securing and examining of the various mammals and birds, their nests should be taken and placed in glass-topped boxes, when, by keeping the nest slightly damp the fleas can be reared, and "will frequently keep emerging from their pupæ in the nests for six weeks or two months after the nest has been taken." Scrapings from the burrows of animals, and the dung of bats (wherein the larvæ of bat-fleas live) should be similarly treated.

Often a number of quite different animals harbour the same species of flea, whilst predaceous animals acquire the fleas of their prey, a fact that is illustrated more than once in the records hereafter, such as in the occurrence of the hedgehog and rabbit fleas on foxes, and those of other creatures upon the stoat or weasel.

In my list I have quoted, under each species, from Rothschild's "Synopsis," and I have also given a list of those species we have not yet met with as a guide and incentive to others.

e. Distributional Note.

As regards the occurrence of the various species from rodents, etc., it will be noticed that a very large proportion indeed have not been recorded from Ireland. In most obscure groups such a statement would imply that such part of the British Isles had not received attention—in fact, the geographical distribution of the members of most obscure groups is represented by the geographical distribution (and opportunities of travel) of the workers in that group! But the distribution of ecto-parasites is also naturally limited to the distribution of the host-animals, and in this connection we must remember the peculiar paucity of the Irish mammalian fauna, due to the earlier separation of that island from the European Continent and the consequent isolation from the later migratory flows of mammals, more especially the Siberian element.

I do not remember having met with any account of the occurrence of fossil species of fleas in my researches into the literature of fossil arthropods, and in the nature of things the discovery of such fossils was scarcely to be expected. In 1910, however, Dampf described a species of *Palæopsylla* (*P. klebsiana*) found fossil in Baltic amber.

f. List of British Fleas.

An asterisk denoting those known from Northumberland and Durham.

Family PULICIDÆ.

1. *Xenopsylla cheopis* Roths.

*2. *Pulex irritans* L.

*3. *Archæopsylla erinacei* Bouché.

*4. *Ctenocephalus canis* Curtis.
*5. " *felis* Bouché.
*6. *Spilopsyllus cuniculi* Dale.
7. *Ornithopsylla laetitiæ* Roths.

Family CERATOPHYLLIDÆ.

*8. *Ceratophyllus gallinulæ* Dale.
*9. " *styx* Roths.
10. " *rothschildi* Waterst.
*11. " *hirundinis* Curtis.
*12. " *rusticus* Wagn.
*13. " *farreni* Roths.
*14. " *garei* Roths.
*15. " *columbæ* Gerv.
*16. " *vagabunda* Boh.
17. " *borealis* Roths.
*18. " *gallinæ* Schr.
*19. " *fringillæ* Walk.
*20. " *fasciatus* Bosc.
21. " *londiniensis* Roths.
*22. " *sciurorum* Schr.
*23. " *penicilliger* Grube.
*24. " *walkeri* Roths.
*25. " *mustelæ* Dale.
*26. " *melis* Walk.
*27. *Ctenophthalmus agyrtes* Heller.
*28. " *bisoctodentatus* Kolen.
29. *Rhadinopsylla isacanthus* Roths.
*30. " *pentacanthus* Roths.

Family LEPTOPSYLLIDÆ.

*31. *Doratopsylla dasycnemus*, Roths.
*32. *Palaeopsylla sorecis* Dale.
33. " *kohauti* Dampf.
34. " *minor* Dale.
*35. *Leptopsylla musculi* Dugés.
*36. " *spectabilis* Roths.

Family HYSTRICHOPSYLLIDÆ.

37. *Typhloceras poppei* Wagn.
*38. *Hystrichopsylla talpæ* Curtis.

Family ISCHNOPSYLLIDÆ.

39. *Ischnopsyllus elongatus* Curtis.
40. ,, *intermedius* Roths.
*41. ,, *octactenus* Kolen.
*42. ,, *simplex* Roths.
43. ,, *hexactenus* Kolen.
44. *Nycteridopsylla longiceps* Roths.
45. ,, *lusarca major* Roths.

g. Species to Look For.

It will be observed from the above list that we now record 32 out of the 45 known British species. More attention and research—especially amongst sea-birds, small rodents and bats —will still further increase our list and probably add to our knowledge of the Order. It is therefore advisable briefly to review the 13 species we have not yet succeeded in securing locally :—

BIRD-FLEAS, 3 species.

Ornithopsylla laetitiæ Roths. (1908).

"Only recorded from the Scilly Islands, where it frequents the nests of sea-birds. The real host is probably the Manx shearwater (*Puffinus anglorum*). Not yet observed on the Continent."

Ceratophyllus rothschildi Waterst. (1910).

"A very rare species apparently confined to Great Britain. A few examples were found by the Rev. James Waterston in the nests of the house martin (*Chelidon urbica*), in Kincardineshire."

Ceratophyllus borealis Roths. (1907).

"A rare species, apparently confined to Great Britain, and so far only recorded from Scotland from the nests of the rock pipit (*Anthus obscurus*), the gannet (*Sula bassana*), and some other birds."

MAMMAL-FLEAS (other than Bat-fleas), 5 species.

Xenopsylla cheopis Roths. (1903).

The plague flea. "A scarce vagrant to the British Isles, introduced by port-rats. Occurs on the black rat (*Epimys rattus*) and the brown rat (*E. norvegicus*). Recorded from Plymouth and London."

Ceratophyllus londiniensis Roths. (1903).

Allied to *C. fasciatus*. "A rare Mediterranean species, probably introduced by port-rats; has occurred on the house mouse (*Mus musculus*) and possibly on the brown rat (*Epimys norvegicus*), in London, Dover and Aberdeen."

Rhadinopsylla isacanthus Roths. (1907).

"Very rare, and not recorded from Scotland or Ireland. A few examples were taken at Lyndhurst, New Forest, from the bank vole (*Evotomys glareolus*), and a few at Abinger Common, near Dorking, from the same host, and from the mole (*Talpa europæa*)."

Palæopsylla kohauti Dampf (1907).

"A rare species in England and Scotland, not recorded from Ireland. It occurs on the mole (*Talpa europæa*)." On the Continent another species, *P. similis* Dampf, occurs on the mole, and may be expected to be found with us.

Typhloceras poppei Wagn. (1903).

"A rare species in England and Scotland. Also found in Ireland. The usual host is the long-tailed field mouse (*Apodemus sylvaticus*); but it has been found on the house mouse (*Mus musculus*) in the Shetlands."

BAT-FLEAS, 5 species.

Ischnopsyllus elongatus Curtis (1832).

Has occurred in Yorkshire. "Apparently confined to the noctule bat (*Nyctalus noctula*). It is common in England, but unrecorded from Scotland and Ireland."

Ischnopsyllus intermedius Roths. (1898).

"A rare species, probably confined to the serotine bat (*Eptesicus serotinus*). Only recorded from England, not from Scotland or Ireland."

Ischnopsyllus hexactenus Kolen. (1856).

Has occurred in Yorkshire on the long-eared and Natterer's bats. "A common species in England and Ireland, but not recorded from Scotland. The chief host is the long-eared bat (*Plecotus auritus*), but specimens have been found on other species of bats."

Nycteridopsylla longiceps Roths. (1908).

"An uncommon species, unrecorded from Scotland or Ireland. Specimens have been taken from the pipistrelle (*Pipistrellus pipistrellus*), and the long-eared bat (*Plecotus auritus*), in several localities in England."

Nycteridopsylla eusarca major Roths. (1908).

"A rare species not recorded from Scotland or Ireland. Has been found at Cambridge, and at Yalding in Kent on the noctule (*Nyctalus noctula*)."

Two European species, *N. pentactenus* Kolen., and *I. unipectinata* Tasch., the latter of which occurs commonly on the Continent on the horse-shoe bats (*Rhinolophus*), have not yet been found in the British Islands, whilst it is almost certain that an examination of the rarer species of British bats would add to our known flea fauna.

h. Records of our Local Fleas.

Order SIPHONAPTERA.

I Sub-Order INTEGRICIPITA.

Family PULICIDÆ.

Genus PULEX L.

Pulex irritans L. Common flea.

Common.

"Common on man, and often found on the badger; also on the fox."

GENUS ARCHÆOPSYLLA Dampf.

Archæopsylla erinacei (Bouché).

On hedgehogs (*Erinaceus europæus*), Swalwell, Winlaton, Lintz Green, Wylam-on-Tyne and Fatfield. One specimen on a fox (*Vulpes vulpes*) with *Spilopsyllus cuniculi*, Fatfield.

"Common on the hedgehog and occasionally on the fox."

GENUS CTENOCEPHALUS Kolen.

Ctenocephalus canis (Curtis).

Common on dogs and cats, but, according to Rothschild, much rarer than *C. felis*.

Ctenocephalus felis (Bouché).

Also common on dogs and cats; the first specimens I ever took of this species were found in a box of foreign stamps.

GENUS SPILOPSYLLUS Baker.

Spilopsyllus cuniculi (Dale).

=*goniocephalus* Tasch.

In rabbit burrows (*Oryctolagus cuniculus*), Gibside, Winlaton, Corbridge and Seahouses. Common on rabbits and once from a hare (*Lepus europæus*) at Fatfield (W. Hall). On foxes, Fatfield (W. Hall) and Houghton-le-Spring.

"Common on the rabbit and the hare, especially on the ears. Also found on the wild cat (*Felis silvestris*), and rarely on the cormorant (*Phalacrocorax carbo*)."

FAMILY **CERATOPHYLLIDÆ.**

GENUS CERATOPHYLLUS Curtis.

A.—BIRD-INFESTING SPECIES.

Ceratophyllus gallinulæ Dale.

=*newsteadi* Rothsch.

In nests of tree creeper (*Certhia familiaris*), 1 ♂, Gibside; and wren (*Anorthura troglodytes*), Holystone, Northumberland. In yellow hammer's (*Emberiza citrinella*) nest, Fatfield (W. Hall). Other records have unfortunately been lost.

"Widely distributed in the British Islands in the nests of birds such as the wren, grouse, the moorhen and many others."

Ceratophyllus styx Roths. (1900).

Swarming in nests of sand martins at Winlaton Mill, Blaydon, Wylam, Hexham, Blanchland and near Harbottle.

"Very common in the nests of the sand martin (*Cotile riparia*); occasionally found in numbers in the nest of the dipper (*Cinclus aquaticus*). Not recorded from Ireland."

Ceratophyllus hirundinis Curtis (1826).

In nests of the house martin. Well over a hundred specimens in a nest from Stocksfield, August 11th, 1911, and about two hundred examples from another nest taken at Dilston Farm, near Corbridge-on-Tyne, in the same month, and from which latter nest two to three hundred further examples were reared in the following September and October. This nest, in addition to three other species of flea, also harboured several well-grown larvæ of the Dermestid beetle *Attagenus pellio* and a few examples of the curious Hippoboscid fly *Stenopteryx hirundinis*.

This flea has also occurred at Stanhope and Edmundbyers.

"Common and widely distributed in the nests of the house martin (*Chelidon urbica*). Not recorded from Ireland."

Ceratophyllus rusticus Wagn. (1903).
=*palumbi* Dale (partim); *dalei* Rothsch. (1903).

29 examples, both sexes, from a nest of the house martin, Dilston Farm, Corbridge, August 1911, and others reared later.

"A more or less rare species found in the nests of the house martin. Not recorded from Ireland."

Ceratophyllus farreni Roths. (1905).

Also from house martins' nests; 37 in a nest from Stocksfield, and only 4 in a nest from Dilston Farm where this species seemed to be replaced by *C. rusticus*.

"A fairly common species in the nests of the house martin. Not recorded from Ireland."

Ceratophyllus garei Roths. (1902).

1 ♂ and 2 ♀♀ in haystack refuse on the moors near Hunstanworth, county Durham; 3 in a puffin's (*Fratercula arctica*) burrow (W. Hall), and 1 in nest of eider duck from which numerous examples were bred later, Farne Islands, July, 1911.

"Very common all over England and Scotland in the nests of birds. Among the many hosts may be mentioned the lark, the bearded tit, and several gulls. Also found in Ireland."

Ceratophyllus columbae Gervais (1844).

Newcastle, 1 ♀ taken by Mr. E. Leonard Gill from the body of a domestic pigeon.

"Not uncommon both in England and Scotland in the nests of both the wild and domestic rock dove (*Columba livia*). Not recorded from Ireland."

Ceratophyllus vagabunda Boh. (1866).

=*digitalis* Wahlg. (1903).

=*insularis* Roths. (1906).

Farne Islands, 5 examples, 4 in a nest and 1 on the body of the cormorant (*Phalacrocorax carbo*), July 1911, both sexes.

"A rare species found in the nests of seabirds, such as the kittiwake and the herring gull in Scotland. Of doubtful occurrence in England and not recorded from Ireland."

Ceratophyllus gallinæ Schrank (1803).

Common on fowls. In numbers under bark of beech trees at Hylton, and by sweeping a cruciferous plant, May 1909, (2 ♂ and 3 ♀), Gibside.

In nests of house martin, Stocksfield and Dilston; golden crested wren (*Regulus cristatus*) Gibside, 1 ♀; black-headed bunting (*Emberiza schoeniclus*), Hexham; robin (*Erithacus rubecula*), Winlaton, 1 ♂; swift (*Cypselus apus*), Newcastle, and hedge sparrow (*Accentor modularis*), Penshaw.

Common in nests of the common house sparrow (*Passer domesticus*), Gibside, Winlaton, Fatfield and Penshaw. In nests of stock dove (*Columba œnas*) 1 ♀; mistle thrush

(*Turdus viscivorus*) and yellow hammer (*Emberiza citrinella*), Fatfield (W. Hall). Several records without data. Rothbury on dipper (*Cinclus aquaticus*), July 1906 (in coll. Rothschild).

"Very common in England and Scotland in the nests of most birds, and in hen-houses. Not recorded from Ireland."

Ceratophyllus fringillæ Walker (1856).

In nests of the house sparrow and hedge sparrow, Winlaton, Fatfield, Penshaw. On a man (!) Fatfield. Two examples in a swift's nest from Newcastle submitted by Mr. Alaric Richardson.

" Fairly common in the nests of the house sparrow, also on other passerine birds. Not recorded from Ireland."

B.—MAMMAL-INFESTING SPECIES

Ceratophyllus fasciatus Bosc. (1800).

Common in a rat's nest, Fatfield (W. Hall); also at Gibside, infesting rats and house mice.

"Generally common in the British Islands. The chief hosts are the Norway rat (*Epimys norvegicus*) and the house mouse (*Mus musculus*). More rarely examples have been found on several species of field mice and on the weasel (*Mustela nivalis*), as well as the stoat (*Mustela erminea*)."

Ceratophyllus sciurorum Schr. (1803).

One specimen on a stoat, Wylam-on-Tyne (Douglas Clague); one on a fox, Houghton-le-Spring, and common on squirrels, Gibside. Presumably common on squirrels throughout the area.

"Common in England, Scotland and Ireland on the squirrel (*Sciurus vulgaris*), the dormouse (*Muscardinus avellanarius*), and occasionally on the pine marten (*Martes m rtes*), the stoat, and the weasel."

Ceratophyllus penicilliger Grube (1852).

In small rodents' nests, Gibside, Hollinside and Fatfield. In moles' nests, Bradbury, and on the Irthing.

" A common species in England and Scotland; not recorded from Ireland. Has been found on many hosts."

Ceratophyllus walkeri Roths. (1902).

From nests of various small rodents in the Derwent Valley (Winlaton, Gibside, Hollinside and Blanchland); Stocksfield and Hart. On two occasions from specimens of the field vole (*Evotomys agrestis*), Fatfield (W. Hall).

"A common species in England and Scotland, not recorded from Ireland. Chief hosts are the stoat, the weasel, and the bank vole (*Evotomys glareolus*). *C. walkeri* has not been recorded from the Continent."

Ceratophyllus mustelæ Dale (1878).

Two examples from the field vole (*Evotomys agrestis*), Fatfield (W. Hall).

"Common in England and Scotland, not recorded from Ireland. Occurs on many hosts; amongst which may be cited long-tailed field mouse, bank vole and the stoat."

Ceratophyllus melis Walk. (1856).

Two or three friends have reported having seen a largish flea upon badgers in the Derwent Valley (Spen Banks and Ebchester), in one case swarming. I think this can only be *C. melis*, but have not seen actual specimens.

There are specimens in Mr. Rothschild's collection from Middlesbrough, 6. viii. 1903.

"A rare species, recorded from England and Ireland. The host is the badger (*Meles meles*)."

Genus CTENOPHTHALMUS Kolen.

Ctenophthalmus agyrtes Heller (1896).

Common in moles' nests at Bradbury, county Durham, near Hartlepool and on the western borders of Northumberland. One example in a rodent's nest, Harperley in Weardale. Common on rats, once in nest of shrew (? water shrew *Crossopus fodiens* Wagl.), once on a house mouse and several on a field vole, Fatfield (W. Hall). Numerous examples in a rat's nest, Gibside.

"Perhaps the commonest species in England and Scotland, also received from Ireland. It occurs on the brown rat and the house mouse living in fields, and on the bank vole, the common shrew and others."

Ctenophthalmus bisoctodentatus Kolen. (1863).

Common in moles' nests with *C. agyrtes* as recorded above, and once in a rat's nest, Gibside. One on a field vole, Fatfield (W. Hall).

"Not common in England and Scotland, and unrecorded from Ireland. Occurs on, and in the nests of, the mole (*Talpa europæa*). Very rarely examples are found on the weasel and the polecat (*Putorius putorius*)."

Genus RHADINOPSYLLA Jord. and Roths.

Rhadinopsylla pentacanthus Roths. (1897).

On moles and in their nests, but apparently rare. A few, Bradbury, near Hartlepool and on the Irthing.

"Fairly common in England and Scotland. Not recorded from Ireland. The chief host seems to be the weasel; it also occurs on the long-tailed field mouse, on the mole, and some other small mammals."

Sub-Order FRACTICIPITA.

Family LEPTOPSYLLIDÆ.

Genus DORATOPSYLLA Jord. and Roths.

Doratopsylla dasycnemus Roths. (1897).

Not uncommon in moles' nests, Bradbury, and on the Irthing.

"Common in England and Scotland. Unrecorded from Ireland. The host is the common shrew (*Sorex araneus*)."

Genus PALÆOPSYLLA Wagn. (1903).

Palæopsylla sorecis Dale (1878).

=*gracilis* (partim).

One ♀ example on a shrew (*Sorex araneus*), Fatfield (W. Hall). Another on the same host (H. S. Wallace) and also at Winlaton.

"Common in England and Scotland. Unrecorded from Ireland. Occurs on the common shrew."

Palæopsylla minor Dale (1878).

=*gracilis* (partim).

In moles' nests, Bradbury, near Hartlepool, and on the Irthing.

"Very common in England and Scotland, on the mole. Not recorded from Ireland."

GENUS LEPTOPSYLLA Jord. and Roths.

Leptopsylla musculi Dugés (1832).

Once from a house mouse with *C. agyrtes*, Fatfield (W. Hall); Newcastle-on-Tyne (E. L. Gill) and Gibside.

"Common in the British Islands on the house mouse (*Mus musculus*)."

Leptopsylla spectabilis Roths. (1898).

2 ♀♀ on a field vole, Fatfield (W. Hall).

"A fairly common species in Scotland, rare in England, and unrecorded from Ireland, perhaps confined to the British Islands. Specimens have been taken from the bank vole, the stoat and other hosts, at Cheddington, Bucks, and in several Scotch localities."

FAMILY HYSTRICHOPSYLLIDÆ.

GENUS HYSTRICHOPSYLLA Taschenb.

Hystrichopsylla talpæ Curtis (1826).

The giant mole flea. In nest of long-tailed field mouse, etc., Gibside, Winlaton and Spen Banks. Common in moles' nests, Bradbury, near Hartlepool, in Teesdale, Weardale, Team Valley and on the Irthing. In nests of brown rat, Gibside.

"Commonly found in the nests of the mole (*Talpa europœa*), and on the bank vole (*Evotomys glareolus*). It also occurs on shrews and other small mammals."

FAMILY ISCHNOPSYLLIDÆ.

All the species of this family are attached to various bats.

Genus ISCHNOPSYLLUS Westw.

Ischnopsyllus octactenus Kolen. (1856).

On a pipistrelle bat (*Pipistrellus pipistrellus*), taken by Mr. Walton Lee at Corbridge-on-Tyne.

"A common species, recorded from England, Scotland and Ireland. The usual host is the pipistrelle, but it also occurs on the whiskered bat, Daubenton's bat and the hairy-armed bat."

Ischnopsyllus simplex Roths.

On a whiskered bat (*Myotis mystacinus*) taken by Mr. George Bolam in Hexhamshire, 1916.

In a letter dated September 25th, 1916, Mr. Rothschild says:—"The four fleas you were good enough to send me from the whiskered bat are *I. simplex*, the species generally found on Natterer's bat. This is very interesting as it is a new host."

"A rare species, unrecorded from Scotland and Ireland. Has been found in several localities in England and Wales, always on Natterer's bat (*Myotis nattereri*), apparently its only host."

REPORT ON THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1915.

READ 23RD MARCH, 1916, BY MR. HUGH P. ANGUS, CHAIRMAN OF THE FIELD MEETINGS COMMITTEE IN 1915.

War conditions are unfavourable to natural history pursuits and especially to organized field work, and there was consequently some hesitation in regard to arranging a programme of field meetings for the summer season of 1915. A programme did take shape, however, and it has happily proved possible to carry out practically the whole of it with a fair measure of success. The experiment was tried of holding a special meeting for young people, apart from the ordinary series, and the result was certainly encouraging enough to make further experiments in the same direction worth while.

The FIRST FIELD MEETING of the season was held on MAY 13th, at DIPTON, when a party of about twenty members assembled.

Leaving Corbridge station, we made our way by the footpath up to High Town, where we were joined by Mr. Randle Cooke, who acted as guide. Owing to the lateness of the spring, botanists missed many flowers that would otherwise have been seen on our leisurely walk through the woods. A halt was made halfway through the wood for lunch, at a spot where we had a magnificent view of the surrounding country

After a short rest we continued our way and came out on the Slaley road; following this for a short distance we again turned into the woods. Here the fine larch trees were a striking feature. The course of the Dipton Burn was then followed to the Falcon Crag. After a stiff climb away from the burn we made our way back through the wood, coming out close to where we entered in the morning. Subsequently we were most kindly entertained to tea at Kilbryde by Mrs. Cooke. After tea we inspected the garden, where the surprise of the day awaited us in the wonderful collection of rock plants. After spending some time in admiring these we had to make our way to the station and so home.

The weather was beautifully fine and in the shelter of the wood quite warm, but in the open there was a bitterly cold wind.

Among the birds seen were the heron, curlew, green plover, redstart and tree creeper.

The plants found in bloom included :—

wood anemone	broom
marsh marigold	wood bitter vetch
lesser celandine	strawberry-leaved cinquefoil
lady's smock	lady's mantle
Jack-by-the-hedge	bilberry
dog violet	golden saxifrage
marsh violet	ground ivy
milkwort	bugle
greater stitchwort	Omphalodes verna
wood sorrel	primrose
whin	cowslip
needle whin	dog's mercury

Of the trees, the birch, larch, bird cherry, and wild cherry or gean were in flower; and the following ferns were noticed : oak fern, hard fern, male fern and bracken.

The SECOND MEETING was held, by kind permission of Mr. Hugh Richardson, at WHEEL BIRKS, on 5th JUNE. At first the weather was rather threatening, but it improved as the day went on.

Leaving Stocksfield we took the foot-path up the burn, where we noticed the sandy cliff riddled with sand-martins' holes, now apparently tenanted by starlings only. It would be interesting to know if the starlings had turned the martins out.

Leaving the foot-path at the ford by Ridley Mill, we followed the road up-hill to Apperly Bank and thence to Wheel Birks. Here, after having lunch, the party divided; some went round the gardens, glasshouses and woods, conducted by Mr. Richardson (the fruit houses being particularly interesting); others followed their own particular bent. After a most enjoyable afternoon we returned to Stocksfield by the road past Hindley, where the colour effect of the bluebells in the woods was most striking. After having tea at Stocksfield we returned to Newcastle by train.

Among the birds seen were the swift, house-martin, swallow, whitethroat, redstart and curlew.

The following were some of the flowers found in bloom :—

wood geranium	water avens
jagged-leaved geranium	wood loosestrife
wild hyacinth	common arum
sweet cicely	lady's mantle
evergreen alkanet	common moschatel
red campion	early purple orchis
white campion	cow-wheat
bird cherry	tuberous bitter vetch
wood sorrel	

THIRD FIELD MEETING, HOLY ISLAND, 26th JUNE.

For the third outing it was originally intended to hold a three days' meeting from June 25th to 28th at St. Bees, but as no members could be sure of being able to attend, it was decided to change it to a day-meeting at Holy Island. Unfortunately I was unable to attend. The weather was most unfavourable, heavy rain falling all day.

My best thanks are due to Messrs. R. Cooke and I. Clarke for supplying me with interesting lists of plants and birds respectively.

Plants seen in flower on Holy Island, 26th June, 1915.

sea bladder campion	goat's-beard
common mallow	sea spurrey
round-leaved mallow	buckbean
slender thistle	lesser spearwort
welted thistle	common beaked parsley
thrift	water crowfoot
henbane	watercress
houndstongue	rest harrow
dyer's rocket	yellow bedstraw
water forget-me-not	biting stonecrop
dove's-foot cranesbill	common bugloss
hemlock-leaved storksbill	scarlet pimpernel

thyme
cathartic flax
hop trefoil
eyebright
mouse-ear hawkweed
common hemlock
good King Henry
viper's bugloss (this was very fine)

Birds seen on Holy Island, June 24–25, 1915.

Mistle Thrush (3)
Blackbird (5)
Stonechat (1)
Willow Wren (1)
Pied Wagtail, several pairs
Greenfinch, a few pairs
Rock Pipit ,,
Meadow Pipit
Tree Sparrow, three pairs. These were about the castle. There are probably many more than were seen
Wheatear, at least twenty pairs with young on the wing
Linnet, several pairs
Corn Bunting, several pairs
Starling, numerous
Jackdaw, several pairs
Carrion Crow
Rook, numerous
Skylark ,,
Swift (3)
Gannet (5)
Heron (6)
Mallard (3)
Shoveller, 2 males
Eider, 15 pairs
Teal (1)
Shield Duck, about 30. One pair had 5 young, two pairs 6 each, and one pair had 13 chicks. One of the broods appeared about a month old, the other much older
Ring Dove (3)
Stock Dove (2)
Domestic Pigeon (8) in wild state; none very much like stock dove (rock dove not seen)
Partridge, several pairs
Ring Plover, about 30 pairs; no evidence of young. Eight nests had 4 eggs, and 1 in another. All appeared fresh.
Lapwing, about 10 pairs. One nest with 3 fresh eggs
Turnstone, 4 birds
Oystercatcher, in flocks of 3 to 10; about 40 altogether
Curlew, about a dozen
Redshank, a few single birds
Black-headed Gull, numerous
Herring Gull, small flocks
Kittiwake, chiefly single birds

The FOURTH MEETING was held on 22nd JULY at FELTON. Leaving Acklington station we at once struck into the large pine wood through which runs the path to Felton. Here the entomologists were soon at work beating the bushes and hunting under stones and logs. At the far end of the wood a marshy opening gave the botanists a busy time, some of the best flowers of the day being secured here.

We now made our way through the fields to the banks of the Coquet, beloved of anglers. In a copse that we passed through a squirrel was seen, and we caught sight of two kingfishers up the course of a brook. A halt was made for lunch, after which a short walk brought us to Felton. Here, by kind permission of Sir R. Lord, we entered the grounds of Felton Park. On the way up the avenue of stately trees we stopped to examine the church of St. Michael, one of the party giving its history and explaining its altered outline. Making our way through the park in front of the Hall we entered the woods which here clothe both banks of the Coquet. Fine beech trees were a notable feature of these woods. A pleasant hour was spent wandering about, here and there catching a glimpse of the river below. After tea at Felton we returned leisurely to Acklington by the same path that we had followed in the morning.

Some time was spent by the entomologists at this meeting in the examination of galls caused by various insects, a study which has not received much attention from local naturalists. Galls caused by midges (*Cecidomyidæ*) were found on the ash, hawthorn, rose, meadowsweet, bracken and different species of willows; galls caused by mites on birch, alder and willow; and other mites were associated with witches' brooms. The pineapple-like galls caused by *Chermes abietis* on spruce were very noticeable. Thrips were taken from elm, pine and alder. Various species of froghoppers were also taken.

On July 31st a Special Meeting for Younger Members was held at Lockhaugh, near Rowlands Gill. A most interesting afternoon was spent in the large marshy haugh by the river. Here botanists had a very good time, one young lady finding no less than 64 different flowers. Some meadow brown and green-veined white butterflies kept another young enthusiast busy with his net. After tea there was an examination of and general discussion on the various specimens collected.

The success of the meeting was in a great measure due to Mr. Hill, who kept the young members interested in everything seen and found.

Among the birds seen were the magpie, kestrel and heron. The flowers included three species of St. John's wort, wild rose, meadowsweet, field madder, tansy, marsh ragwort, lesser skullcap.

Fifth Field Meeting, Northumberland Lakes.

On September 4th the expedition was to the Northumberland Lakes. Much to my regret I was unable to be present, and I have to thank Mr. Robson for the following account.

A short walk from Bardon Mill station soon brought us to a point whence one could leave the high-road and strike the field paths, the hedgerows in passing showing their autumn beauty of golden ragwort, purple knapweed and lavender scabious. Once inside the upland meadow it was seen to be decked with rich display: deep-tinted devil's-bit scabious, starry tormentil, field gentian and delicate eyebright; dotted in the background here and there the graceful towering golden rod and St. John's wort, and the brown-purple of the burnet. Here, too, was gathered the burnet saxifrage, one of the less common members of the umbelliferous group. As the path led upwards to the wooded ravine where the Chinley Burn comes down its rocky bed, a few belated specimens of foxglove and red campion were to be seen, and under the shady trees our route took us past Chesterholme, built largely with stone from the adjacent Roman camp, near which is still seen one of the milestones standing in its original position on the grass-grown Stonegate. Not far from here was found the sheep's-bit, a distinctive member of the bell-flower family, and then the hare-bell itself suggested that the hilly pasturage had been reached. Soon after, the rugged outline of escarpment was spread before our eyes, which were directed towards the wooded fringe behind which lies Crag Lough.

After the stiff climb it was decided to rest and discuss lunch here, the party then dividing, one section going along the

Roman Wall to Borcovicus, the remainder working the swampy edges of the lough, or scrambling along the foot of the beetling crags. A duck was seen to rise from the water, too far off to identify, and in the bushes of the cliffs numerous wrens—possibly a family party—were flitting in and out. The short swampy grass was starred with scabious and the delicate grass of Parnassus, while the ragwort was visited by many tortoiseshell butterflies; meadow browns and blues were also seen, and the rapid darting flight of one or two dragonflies. The long fringing grasses and reeds, touched by the hand of approaching autumn, had assumed a bright orange tint under the brilliant sunshine; along the cliffs several varieties of fern were nestling, and in the water more than one species of potamogeton or pond weed; the reed mace rearing its stately head at the far end of the lough.

A few of the fresh-water shells were collected, and then a halt was called to examine the plants, of which nearly fifty were found in bloom, and identify them. The party was then reunited and an adjournment made to Hot Bank Farm, where an excellent tea was provided by Miss Pattinson. Round the farm buildings were a number of wagtails, the quaint antics of which were watched with interest; and then the homeward journey was begun, but with lingering steps, the charm of the evening sun over the crag and the lough bringing out its beauty of form and colour.

Dipping down by Bradley Hall, the route led a short distance along the cross road, where the martins were hawking merrily and the starlings gathering in flocks, until a stile gave entrance to the heather-clad hill of Borcum. As we crossed the summit a heron flew overhead in leisurely flight; the sun cast its dying rays over the purple heather, shedding a beauty over the scene as our last steps brought us back to Bardon Mill after a day of interest and enjoyment in the open country.

Our thanks are due to Sir Hugh Blackett of Matfen and Mrs. Clayton of the Chesters, who so kindly granted facilities for the holding of the meeting in the district.

The SIXTH and last FIELD MEETING of the season was held at Dunstanburgh on OCTOBER 5TH. The weather was gloriously fine. Leaving Embleton, the party made their way northward by the beach, round Newton Point to Beadnell Bay. The usual shore birds were seen, and a few eider duck some distance from land.

Having had lunch, the party returned by the links to Dunstanburgh, and then back to Embleton by Dunstan Steads, concluding a most enjoyable day's outing.

Among the birds seen were :—

Wheatear	Redshank
Bullfinch	Turnstone
Swallow	Dunlin
Lark (in song)	Partridge
Lapwing	Heron
Ring Dotterel	Comorant
Curlew	Eider Duck

In conclusion I wish to thank those members who have supplied me with lists and other information, and especially Mr. Robson who has done so much to make things easy for me.

REPORT OF THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1916.

READ BY MR. RICHARD ADAMSON, CHAIRMAN OF THE FIELD MEETINGS COMMITTEE FOR 1916.

LADIES AND GENTLEMEN.—I very reluctantly accepted your kind offer of the Presidency of the Field Section for the second time. In spite, however, of ill-health and of the greater demands on my leisure time made by my professional duties, several considerations assisted me in giving a favourable reply: the meetings of the ensuing season were all to be Saturday appointments and were all to take place more or less locally, whilst pleasant recollections of bygone outings and the opportunity of revisiting some of my lifelong haunts in your company, were further inducements.

The following were the Meetings appointed for the 1916 Session :—

1. 20th May—Sheepwash and Bothal.
2. 3rd June—Riding Mill.
3. 24th June—Warkworth.
4. 8th July—Lockhaugh (for young people).
5. 22nd July—Gibside.

I attended the whole of the series, and at each of the meetings the weather, which was delightfully fine, added greatly to the enjoyment of the outing. On each occasion there was a good attendance of enthusiastic naturalists.

MEETING AT SHEEPWASH AND BOTHAL ON MAY 20TH. A large party detrained at North Seaton, where a commencement was made in proceeding towards Sheepwash. Immediately after starting, the day's pursuits began at a pond by the wayside, rank in vegetable growth, of which the water crowfoot (*Ranunculus aquatilis*) was greatly in evidence with its masses of floating white blooms. Its two-fold form of leaves was noticed, the submerged, finely dissected ones, and the oval or kidney-shaped kind floating on the surface. Some of the members who were anxious to obtain aquatic forms of animal life took samples of the contents of the pond for investigation at leisure. Traversing by a footpath the length of several fields, specimens of plants in bloom were collected for identification. Amongst these the following were often seen :—

Cuckoo Flower, *Cardamine pratensis.*
Lesser Celandine, *Ranunculus Ficaria.*
Greater Stitchwort, *Stellaria Holostea.*
Lesser Stitchwort, *Stellaria graminea.*
Vernal Sandwort, *Arenaria verna.*
Danish Scurvy Grass, *Cochlearia danica.*

The songs of many of the commoner birds were frequently heard. Skylarks especially were numerous and tuneful. The chaffinches also seemed very happy. On reaching the woodland path a halt was made to partake of home-prepared luncheon. The botanists had a good time at this stage of the ramble in noticing some of our commonest spring flowers of woodland habitats, a few of which may be enumerated :—

Primrose, *Primula vulgaris.*
Wild Hyacinth, *Scilla nutans.*
Golden Saxifrage, *Chrysosplenium oppositifolium.*
Ramsons, *Allium ursinum.*
Ground Ivy, *Nepeta Glechoma.*
Red Campion, *Lychnis diurna.*
Wood Anemone, *Anemone nemorosa.*
Marsh Marigold, *Caltha palustris.*
Water Avens, *Geum rivale.*
Lady's Mantle, *Alchemilla vulgaris.*
Wood Sanicle, *Sanicula europæa.*
Sweet Cicely, *Myrrhis odorata.*
Wood Sorrel, *Oxalis Acetosella.*

A footpath close to the stream was followed through fine woodland scenery, consisting chiefly of a sturdy growth of beeches, elms, ashes, oaks and alders, almost to the village of Sheepwash, which is situated about 2½ miles east of Bothal. After noticing the bridge of four arches, by which the Wansbeck is crossed at Sheepwash, the party hastened through the village and proceeded through some pasture land, and then down hill through a very fine avenue of trees, chiefly beeches, to the main road. This soon brought us to Bothal, which came into view quite suddenly owing to its surroundings forming a spot of great seclusion. A short time was spent in visiting the Church, which stands amidst a great variety of shrubs, many of which were in full bloom. The older masonry of the church that had been spared on restoration appeared to be of the Early English style.

Afterwards a hurried visit was paid to the park grounds and arboretum of Bothal Haugh, by kind permission of the Hon. and Rev. J. W. Ellis. Here a veritable paradise was offered to the naturalist. Intermixed with almost all kinds of British trees were seen growing a very large assortment of foreign trees and shrubs, deciduous and evergreen. The various kinds of azaleas, some in full flower, were greatly admired, as was the common barberry as well as several foreign relations in full golden bloom, and weigelias in many varieties and shades of blossom. Two or three shrubby varieties of veronicas were in fine foliage. Vincas (periwinkles) of the major, minor and variegated kinds seemed to flourish in a great many situations. Brooms of exotic varieties had been carefully planted in special spots. Several sorts of hawthorn (some in bloom) were very fine and showy. In addition to the common elm, the Scotch, golden and Cornish elms were seen in fine foliage. Lilacs in great variety, and some of tree-like proportions, all showed a healthy growth, and the various kinds of rhododendrons received much attention. The hollies, both plain, spiny and variegated, all showed vigorous growth. Much admiration was expressed at the handsome white bloom of the snow-drop tree (*Halesia tetraptera*). Various kinds of pine trees appeared to be in flourishing condition; and there were some fine lime trees of large growth. Some of the oaks appeared to be of a great age.

The ornithologists were interested in the discovery of the nest of a mute swan; the mother swan was sitting on a very large nest, consisting of dried stems of aquatic plants, procured in the neighbourhood of the nest, which was built near the water's edge. The male bird was gliding up and down on the water near the nest, apparently keeping sentry. The mute swans live in a semi-wild state on the Wansbeck owing to the immunity from molestation extended to them by the people dwelling near the river.

Leaving the Bothal grounds and re-crossing the river, the party started for Morpeth through the Bothal woods, by a winding footpath which in places almost touched the river. As there was no time left for leisurely rambling along this beautiful sylvan walk, the remainder of the outing became a kind of walking competition until Morpeth was reached, where the members partook of refreshments previous to entraining.

Meeting at Dipton Woods, 3rd June, 1916.

The weather during the early morning, as well as that of the previous day, was unfavourable, but a decided improvement took place which induced a good number of members to join in the day's proceedings. Travelling by the 9.50 train from Newcastle the party gained an early start from Corbridge station. A long and circuitous path, in a southerly direction, uphill, was followed through fields and country lanes in a leisurely and enjoyable manner, till the woods were reached. During the early part of the ramble the visitors had opportunities of seeing a number of late spring plants in bloom, a few of which may be mentioned :—

Bush Vetch, *Vicia sepium.*
Spring Vetch, *Vicia lathyroides.*
Common Comfrey, *Symphytum officinale.*
Early Orchis, *Orchis mascula.*
Archangel, *Lamium album.*
Lesser Spearwort, *Ranunculus Flammula*
Awlwort, *Subularia aquatica.*
Wintercress, *Barbarea vulgaris.*
Pansy Violet, *Viola tricolor.*
Dovesfoot Geranium, *Geranium molle.*
Petty Whin, *Genista anglica.*
Water Avens, *Geum rivale.*
Water Forget-me-not, *Myosotis palustris.*
Field Veronica, *Veronica agrestis.*

Of the above, the Petty Whin was by far the rarest plant observed. The discovery of an Adder's Tongue fern in the pasture field before entering the wood was noteworthy, as owing to its growth amongst the grass, this fern often goes unnoticed. Among the birds seen or heard during the walk through the fields were skylarks, lapwings, green linnets, starlings and corncrakes.

On entering Dipton woods, the trees and shrubs were the first objects of study. From a botanist's point of view, however, the visit was much too late to see the most interesting stage of the majority of our forest trees, when the copious showers of pollen are wafted by the March winds to pistils separately borne on branches of the same tree, or to pistils growing on other trees of the same species.

The ant hills, which were found chiefly in the neighbourhood of the pines, proved a great attraction. Many of the hills are from 4 to 6-ft. in circumference and 2 to 3-ft. or more in height, each hill being inhabited by a very large population of ants which consist of the red ant (*Formica rufa*). Their homes are built chiefly of chips of bark from the pine trees, placed together on the roofs in a very methodical manner, like the slates on the roof of a house, thus defying the storms of all seasons. On disturbing the habitation rudely with a stick the crowded community became greatly agitated and seized the pupæ or baby ants, which they carried instantly to a place of greater safety.

Next a large area of very damp land was visited, bearing young birch timber trees in an advanced stage of decay, and more or less covered with the growth of a large destructive fungus, the 'Birch tree Polypore' (*Polyporus betulinus*). No doubt these young birches became weak and diseased owing to the marshy state of the soil, which would render them liable to attacks of this destructive fungus, as plants can only defend themselves against these most deadly foes by maintaining a healthy growth. To meet the destructive attacks of their hosts of fungoid foes (the spores of which are omnipresent) our woodland trees are naturally provided with various weapons of defence, as gums, resins, oils, poisonous juices, tough skins, corky barks and the like.

It is greatly to be deplored that there are so few mycologists amongst our local naturalists, as the study of the fungi is most interesting and important.

In passing down a long boggy road we had many opportunities of observing marsh plants growing in damp spots. The following are a few of these we noted :—

Ivy-leaved Crowfoot, *Ranunculus hederaceus.*
Pilewort, *Ranunculus Ficaria.*
Common Watercress, *Nasturtium officinale.*
Water Avens, *Geum rivale.*
Yellow Pimpernel, *Lysimachia nemorum.*
Spotted Orchis, *Orchis maculata.*
Common Rush, *Juncus communis.*
Lesser Jointed Rush, *Juncus uliginosus.*
Toad Rush, *Juncus bufonius.*
Separate-headed Sedge, *Carex dioica.*
Wood Melick Grass, *Melica uniflora.*
Wood Meadow Grass, *Poa nemoralis.*
Wood Horse-tail, *Equisetum sylvaticum.*

At the end of this long but very interesting walk, a halt was made at the brink of a precipitous bank, where a home-prepared luncheon was enjoyed. Afterwards the party descended the very steep slope to the Devil's Water, the course of which was followed for a considerable distance.

The vegetation was exceedingly rank and luxuriant. Amongst the plants in bloom were the following :—

Marsh Violet, *Viola palustris.*
Wood Stitchwort, *Stellaria nemorum.*
Mountain Ash, *Pyrus Aucuparia.*
Moschatel, *Adoxa Moschatellina.*
Water Bedstraw, *Galium palustre.*
Sweet Woodruff, *Asperula odorata.*
Bilberry, *Vaccinium Myrtillus.*
Cuckoo Pint, *Arum maculatum.*
Great Pendulous Sedge, *Carex pendula*

On both banks of the burn several kinds of ferns were growing in great profusion. Some of these were—

Oak Fern, *Polypodium dryopteris.*
Common Polypodium, *Polypodium vulgare.*
Shield Fern, *Polystichum spinulosum.*
Buckler Fern, *Lastraea thelypteris.*
Male Fern, *Lastrea Filix-mas.*
Lady Fern, *Athyrium Filix-foemina.*
Hard Fern, *Blechnum boreale.*

The Oak Fern, which was growing in large tufts and patches, was greatly admired.

Bird life was rather scarce. The wood wren was heard sometimes; song thrushes and blackbirds were seldom in song, but the willow wren, whitethroat and chiffchaff were heard more frequently. A pair of tree creepers were noticed on a tree by the edge of the burn.

As it began to rain very heavily, the party at this point left the burn and separated for their respective destinations.

Meeting at Warkworth, 24th June, 1916.

A large party left the Central station by the 10.27 train to Acklington, where the day's proceedings began. On leaving this quiet little village a lane was followed until the hamlet of Morwick was reached, where a very good view of Warkworth was obtained. After proceeding for some distance along a path to the left, the stream was crossed by a wooden bridge, where a halt was made for luncheon. In this neighbourhood a very luxuriant growth of umbelliferous plants was noticed, including the following observed in bloom :—

Hemlock, *Conium maculatum.*
Earth Nut, *Bunium flexuosum.*
Hog's-fennel, *Peucedanum Ostruthium.*
Cow Parsnip, *Heracleum Sphondylium.*
Hedge Parsley, *Torilis nodosa.*
Beaked Parsley, *Anthriscus vulgaris.*
Chervil, *Chaerophyllum temulum.*

The large-flowered Bittercress (*Cardamine amara*) was noticed growing abundantly in some damp places, and the Winter Cress (*Barbarea vulgaris*) was seen several times.

Through the kind permission of Mr. G. Tate, the party were allowed to ramble through the Brotherwick Woods, by a rough path by the side of the Coquet. During this delightful part of the ramble the botanists had the pleasure of seeing fine, and in many instances very extensive growths of the subsequently noted plants, mostly in bloom :—

Red Campion, *Lychnis diurna.*
Wood Stitchwort, *Stellaria nemorum.*
Bog Stitchwort, *Stellaria uliginosa.*
Wood Geranium, *Geranium sylvaticum.*
Milk Vetch, *Astragalus glycyphyllos.*
Purple Milk Vetch, *Astragalus hypoglottis.*
Wood Sanicle, *Sanicula europæa.*
Cowbane, *Circuta virosa.*
Wild Angelica, *Angelica sylvestris.*
Great Valerian, *Valeriana officinalis.*
Bell Flower, *Campanula latifolia.*
Mountain Speedwell, *Veronica montana.*
Water Forget-me-not, *Myosotis palustris.*
Loosestrife, *Lysimachia vulgaris.*
,, ,, *nemorum.*
Ramsons, *Allium ursinum.*
Great Sedge, *Carex paniculata.*
Great Pendulous Sedge, *Carex pendula.*
Fescue Grass, *Festuca sylvatica.*
Wheat Grass, *Triticum caninum.*
Frog Orchis, *Habenaria viridis.*

Continuing our walk we came to the historic ruins of the Hermitage, which was originally hewn out of the solid free-stone rock. From a naturalist's point of view the woodland scenery of the surroundings was of the greatest interest, but all were interested in inspecting the square room with walls of rough masonry, the six-foot fireplace of the fourteenth century and the architectural skill shown in the chapel, dormitory and confessional of these romantic remains of the past.

On leaving the Hermitage grounds the party reached the opposite bank of the river by the ferry and followed a very fine sylvan walk to Warkworth. Many of the plants already mentioned were again observed in great profusion. Just before ascending the path leading from the river to the village, the Fly Honeysuckle (*Lonicera Xylosteum*) in bloom was observed overhanging the water. This shrub, although quite common in our shrubberies, is seldom found really in a wild state in the north. It does not possess climbing habits like its near family relation the Woodbine, but it has an erect style of growth. Its fruit hangs as twin scarlet berries in September.

On passing the Castle gates some of the party paid a short visit to the historic Castle of Warkworth, while the remainder went directly to the Sun Inn for refreshments, as the weather became gloomy and it subsequently began to rain heavily.

In defiance of the elements, the more ardent botanical members proceeded towards the coast, where specimens of the following characteristic plants were gathered in bloom :

Small Bugloss, *Lycopsis arvensis*.
Hound's-tongue, *Cynoglossum officinale*.
Knawel, *Scleranthus annuus*.
Sea Milkwort, *Glaux maritima*.

Of the above plants, the Hound's-tongue is more or less common on roadsides and other habitats near the sea in northern Northumberland. It is not a favourite with botanists owing to the disagreeable smell of the whole plant, but it is a good anodyne, demulcent and astringent, and owing to these properties it once had a place in the pharmacopœias of Edinburgh and London.

Subsequently the party returned to Warkworth station and entrained for Newcastle.

Meeting at Lockhaugh, 8th July, 1916.

This outing was intended and arranged for "young people," but on joining the party at Rowlands Gill (where the members detrained), I found that with one or two exceptions the party consisted of 'children' of other years.

On leaving the station, the turnpike road was followed in an easterly direction for about three-quarters of a mile, and then a lane was entered on the right, which led to Lockhaugh.

On coming to the farmhouse, the lovely scenery of a wide stretch of the Derwent Valley, with a fine view of the woods and lands of the Gibside estate, was revealed. To my mind, "Ye Banks and Braes of Bonny Doon" is quite a tame landscape when compared to this beautiful spot on the Derwent, which only requires a poet of the Scottish ploughman stamp to immortalize it. The picturesqueness of this locality is entirely due, from a geological standpoint, to the copious deposits of glacial drift transported from other regions by the glaciers of the Ice Age. To the same natural causes the diversity and luxuriance of the flora of the Derwent Valley are due.

The great interest in the afternoon ramble, chiefly of a botanical nature, lay in the low-lying grounds or haughs near the stream. On account of the cold and backward season, many of the plants usually in bloom in spring and early summer were still in full bloom, while plants generally flowering during the month of July were still in an early stage of growth. Of the numerous plants in flower perhaps the most remarkable was the patch of pure white Milkwort (*Polygala vulgaris*) which is seldom met with in white petals (the usual colour being blue or purple, and now and then pink as it grows in Chopwell Woods). The Foxgloves (or better, according to their older designation, Folksgloves) were in showy purple masses on the earlier portions of their spikes. As a medicinal plant the Foxglove is at present in great demand, owing to the stoppage of the supplies of its leaves (which contain the stores of digitalis) from the central countries of Europe. Happily there is already a large acreage of this useful plant under cultivation on our drug farms, to meet the requirements which otherwise would in time bring about its annihilation. As a cardiac tonic it is unsurpassed in the vegetable kingdom.

The Galiums, or Bedstraws, viz. :—

Marsh Galium,	*Galium*	*palustre.*
Hedge ,,	,,	*Mollugo.*
Crosswort Galium,	,,	*cruciatum.*
Heath ,,	,,	*saxatile.*
Cross-leaved ,,	,,	*boreale.*

were frequently observed, all in fine waxy blossoms. The Water Ragwort looked very handsome with its reddish and golden yellow composite blooms, growing close neighbours in the swampy spots to the patches of Meadow Sweet now on the point of opening. The dark red spots of Red Campion (*Lychnis diurna*) growing on both margins of the river had a very pleasing effect. The Water Forget-me-Not (*Myosotis palustris*) was growing profusely in the wet ditches, and Ragged Robin ornamented the boggy situations.

The Great Valerian or All-Heal (*Valeriana officinalis*), so much prized for its certain and quick restoration of shattered nerves, was growing plentifully on the wet banks of the copse wood, just commencing to unfold its pale-pink petals.

Meeting at Gibside, 22nd July, 1916.

I joined the party on detraining at Swalwell station. After ascending Whickham Bank for a short distance the party entered a narrow lane which leads to Old Axwell Farm. Much attention was given to the wild flowers which were growing profusely in the hedgerows. Among them were :—

Dog Violet, *Viola canina* (still in bloom in places).
Spurry, *Spergula arvensis*.
Common St. John's Wort, *Hypericum perforatum*.
Creeping Potentil, *Potentilla repens*.
Wild Strawberry, *Fragaria vesca*.
Honeysuckle, *Lonicera Periclymenum*.
Yellow Bedstraw, *Galium verum*.
Scabious, *Scabiosa arvensis*.
Hawkbit, *Leontodon hispidus*.
Mouse Ear Hawkweed, *Hieracium Pilosella*.
Hairbell, *Campanula rotundifolia*.
Wall Speedwell, *Veronica arvensis*.
Wild Sage, *Teucrium Scorodonia*.
Wood Betony, *Stachys Betonica*.
Spotted Orchis, *Orchis maculata*.
Cuckoo Pint, *Arum maculatum*.

Fine views of the northern banks of the Derwent were obtained from many points as we proceeded along this elevated walk. After crossing the Clockburn, which separates the Clavering and Gibside estates, we followed a road through a copse which proved of great interest to the botanists, as it contained immense growths of digitalis, greater valerian, spotted orchis, red and white campions, betony, wood sage, cow-wheat, water and knotted figworts, marsh bent grass, common reed grass, water whorl grass, wood meadow grass, wood fescue grass and hairy brome grass.

Going forward through a hayfield we came to Hollingside farm, where we asked permission to visit the old ruins of Hollingside Castle and to ramble in the fields where no damage would be done to the crops. Interest was now centred in the ruins, which were closely inspected by the antiquaries of the party. The history of the castle dates back to 1317, when it was owned by the Hollinside family. It changed hands frequently until it fell into the possession of the Hardings of Newcastle, who owned it until 1730, when it became the property of the Bowes family of Gibside. Its architecture as seen in its present condition shows that in all probability it was erected in the 13th century. From all appearances the castle must have been used as a kind of peel tower for defensive purposes.

A halt was now made to partake of a substantial home-made luncheon. Immediately afterwards a very swampy field was visited just below the ruins. This was a delightful place botanically, as a great many aquatic plants were growing in great luxuriance. A few of these may be mentioned, as follows:—

Common Rush, *Juncus communis.*
Hard Rush, *Juncus glaucus.*
Toad Rush, *Juncus bufonius.*
Lesser-jointed Rush, *Juncus uliginosus.*
Oval-spiked Sedge, *Carex ovalis.*
Great Sedge, *Carex vulpina.*
Tufted Bog Sedge, *Carex stricta.*
Slender-leaved Sedge, *Carex filiformis*
Common Reed, *Arundo Phragmites.*
Marsh Sow-thistle, *Sonchus palustris.*
Marsh Hawkweed, *Crepis paludosa.*

Sneeze-wort, *Alchillea Ptarmica.*
Marsh Bedstraw, *Galium uliginosum.*
Rough Horse-tail, *Equisetum hyemale.*
Great Horse-tail, *Equisetum maximum.*

In crossing an old pasture field, a fine view of the semi-circular curve of the Derwent was obtained, as it flows round Gudgeon's Haugh, as well as a panorama of the huge deposits of boulder clay and glacial drift which form the precipitous declivities of the northern banks of the river. They are seen in section at several places, particularly at the Scar Banks near Winlaton Mill.

Resuming our walk we soon reached Gibside Wood. We had to wade through immense growths of woodland grasses, mostly 3 to 4 feet in height. These included reed fescue, upright bromus, bent grass, false oat grass, wood melica and tall fescue, the month of July being by far the best time to study the grasses. On our way through the wood, the botanists had opportunities of seeing a great variety of woodland summer flowers, as well as fine specimens of many of our British trees, including ashes, oaks, elms, beeches, pines, larches and limes. Amongst the herbaceous plants, by far the rarest was the Marsh Helleborine, one of the orchid family. It was seen growing close to the footpath in a very damp and shady situation, where the soil consisted of decayed leaf-mould underneath beeches. This plant was in advanced flower bud. On leaving the main road, a footpath, in places over-run with bramble bushes, was followed, until we reached the Monument, which was erected about 1750 as an ornament to the park.

After a few minutes rest we descended to the old fish pond, which is now choked with a great vareity of aquatic vegetation, much of which is exceedingly interesting to the botanist. The following are a few of the plants :—

Great Water-plantain, *Alisma plantago.*
Marsh Arrow-grass, *Triglochin palustre.*
Reddish Pond-weed, *Potamogeton rufescens.*
Slender-leaved Pondweed, *Potamogeton filiformis.*

Gibbous Duckweed, *Lemna gibba.*
Floating Bur-reed, *Sparganium natans.*
Branched Bur-reed, ,, *ramosum.*
Blunt-flowered Jointed Rush, *Juncus obtusiflorus.*
Lake Club Rush, *Scirpus lacustris.*
Great Panicled Sedge, *Carex paniculata.*
Smooth Horse-tail, *Equisetum limosum.*
Water Lily, *Nymphæa alba.*

After walking some distance on the grassy avenues we came to Gibside Hall, now apparently in a state of decay, not having been fully occupied since the late R. O. Lamb vacated it a great many years ago. The older portions of the hall were built in the time of James I. whose royal arms are still seen above the entrance porch, and beneath these are the Blakistone arms and "W & J. B., April 12, 1620." (Wm. and Jane Blakiston).

Along the old race course another of the helleborine orchids was discovered, growing amongst the long grass underneath the line of trees which runs along the margin of the course. This orchis on examination proved to be a variety of the Broad-leaved Helleborine (*Epipactis latifolia*), which is a near relation to the Marsh Helleborine, discovered earlier in the ramble.

The party now moved towards the Derwent Bridge gate for exit, by paths through luxuriant growths of ferns, which indeed had been greatly admired throughout the journey through the woods. Amongst these the following frequently came under obervation :—

Angular Shield Fern, *Polystichum angulare.*
Prickly Shield Fern, *Polystichum aculeatum.*
Mountain Buckler, *Lastrea montana.*
Crested Buckler Fern, *Lastrea cristata.*
Male Fern, *Lastrea Filix-mas.*
Broad Prickly Fern, *Lastrea dilatata.*
Lady Fern, *Athyrium Filix-fœmina.*
Hard Fern, *Lomaria Spicant.*

The oak fern, which still grows in a few spots, was not seen on this occasion.

Perhaps the ornithologists were somewhat disappointed with the scarcity of bird life. Throughout the journey some of the commoner birds were noticed now and again; but it was too late in the season to hear the song birds in full tune. At one spot in the wood the clouded magpie moth (*Abraxas ulmata*) was seen several times, and in the fields near Hollingside the large meadow brown butterfly was frequently seen.

Before closing I would like to mention two or three particulars which have come to my notice recently.

1ST NOTE.—The Gorse or Whin (*Ulex europæus*) in my neighbourhood is brown and withered, and appears to have been entirely destroyed by the frosts. This is the first time in my life that I have noticed similar destruction to this hardy evergreen, which adds such beauty to our waste places and barren hill sides, and at the first sight of which the great Linnæus fell prostrate for joy, the whin not being found in Sweden as the climate is too severe for it. It is greatly to be deplored that the blight on the whin has happened at present, as in our time of scarcity it would have made excellent fodder for our team horses and cattle when bruised by a mill, as of olden days.

2ND NOTE.—Many of our birds have fallen victims to the long and severe winter—the robins and redwings in particular have suffered. Both, being insectivorous in their diet, soon showed signs of distress.

3RD NOTE.—The lapwings or peewits which returned to their old haunts in the early days of March have almost entirely disappeared recently from the district, owing presumably to the cold frosty weather of April. Should these very useful birds fail to return to the fields, the crops of the neighbourhood will suffer great destruction in their young growth, particularly from the slugs and snails which infest our damp clayey soils in such numbers—the snails and slugs being the chief food of the plovers.

In conclusion, I wish to thank the members of the Field Section for the indulgence shown to me during our pleasant session of rambles, and I also desire to thank our indefatigable secretary, Mr. C. E. Robson, for the successful manner in which he arranged the many appointments which contributed so much to our comfort and enjoyment.

REPORT OF THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1917.

READ BY MR. NICHOLAS TEMPERLEY, CHAIRMAN OF THE FIELD MEETINGS COMMITTEE FOR 1917.

These out-door meetings have again been restricted to short distances from town. The numbers attending them were not so large as in peace times, but there were much keenness and enthusiasm among the members, and it is very evident that it is desirable to continue the field meetings on a similar basis.

CHOPWELL WOODS, MAY 19TH.

These woods form now a demonstration area, where the forestry students of Armstrong College can have practical experience in most of the details of their work. The woodlands extend to about 900 acres, and are Crown property. They have had a checkered career. In the days of timber ships, oak was grown here, and it was used to build "the wooden walls of Old England." When iron took the place of timber in the construction of ships, Chopwell Woods were neglected and ill-used for years, and fell into a bad state. Since the revival of interest in forestry as a national necessity, Armstrong College has been entrusted with their care, and a transformation is being gradually effected. A working system has been arranged, and the whole area divided into sections, so that a portion is to be dealt with and planted annually. Hence there will be, when the timber arrives at maturity, a regular supply for the local market each year. Each section is being planted with young trees, either pure of one species, or with a mixture of two or more species. The choice is based on the soil, moisture, and exposure of each plot. Various exotic species of trees are being tested as to their adaptability for local climatic and other conditions. In a sheltered clearing in the wood are situated the forest nursery, residences for the chief officials, class-rooms, museum and laboratory for the students. In the museum are specimens of timber, pieces of trees showing the ravages of insects, fungi, etc., as well as cones and other seeds. The whole has been, and is, under the skilful control of Mr. J. F. Annand, M.Sc. As soon as he began operations a few years ago, he had all the rabbits exterminated. They are fatal to forestry. He cut out the worthless trees and let light in. At once the effect of these two operations was seen in the springing up of self-sown youngsters, chiefly sycamore and ash. That is, "natural regeneration" was established, which is much cheaper than having to raise in the nursery, or buy, and plant out young trees. Among the conifers in the nursery are Scots and Corsican pine, Douglas fir, spruce, larch, both European and Japanese species, and thuja. Deciduous seedlings include elm, chestnut, willows of various species, and beech. On a former visit twelve months ago we had seen a plot of young spruce attacked by *Chermes abietis*, which produces a ball like a small pine-apple or pseudo-cone that arrests the growth of the young twigs. These young trees had been so vigorous that they had been able to throw off the evil effects of this attack, and looked little the worse. In contrast to this, elsewhere serious damage had been caused by this Chermes.

The establishment is provided with a modern apparatus for the distillation of wood, yielding charcoal, tar, acetic acid and potash. This is an economic disposal of wood of almost any kind and size, including branches that are otherwise unsaleable. These products have a good market. Unfortunately the war has caused here, as elsewhere, a lack of labour and a lack of students, so all forestry operations are at a standstill—distillation, nursery-work, planting out, etc. The only activity in the woodlands of Great Britain at present is the rapid felling for the needs of the war and of collieries.

The late cold spring was emphasised by the limited variety of flowers in bloom. These included lesser celandine, wood anemone, lady's smock, vernal whitlow grass, shepherd's purse, dog violet, wood violet, mountain violet, greater stitchwort, wood sorrel, gorse, bitter vetch, golden saxifrage, bilberry, the red and the white dead-nettle, dog's mercury, the field, the hairy and the great woodrush, and the primrose.

Few birds were observed. The absence of thrushes was attributed to the large number that perished in the severe winter just past. Those seen included: willow warbler, great tit, bluecap, jay, jackdaw, chaffinch, greenfinch.

On one path a few nests were noticed of the red wood-ant; these and the bombardier beetles were the only insects specially noted as showing activity at this date.

It will be interesting for local naturalists to observe what changes in flora and fauna may take place in Chopwell Woods, as year by year they are reduced from rank disorder to well regulated and trim silvicultural conditions, affecting large areas closely covered with flourishing young trees of new species.

Plessy Woods, June 9th.

This typical Northumbrian Dene, through which runs the river Blyth, looked its best in the bright summer sunshine. The foliage was very fine; it had developed late, and was in perfect condition. The floor of the woods was gay with the flowers usually found in such a place. Here and there by the waysides were in flower hawthorn, beaked-parsley, broom, bedstraw, stitchwort, rose campion, etc. At Hartford Bridge, pink hawthorn, lilac and Chili pine were seen. The most striking thing of beauty was a few acres on which the trees had been cut down three or four years ago, where the wild hyacinths had developed lavishly. They were in full bloom in the sunshine, a sheet of blue flame, picked out here and there with a rose campion, and relieved by green ferns and twigs of green foliage growing from the stools of the trees that had been removed. In some other parts of the woods wild garlic was in possession with its strong and unpleasant odour.

At Stannington the party divided; one section continued the exploration of the valley of the river Blyth westward (by the kind permission of the agent of the Blagdon estate). The other members visited the church and vicarage, where the incumbent, the Rev. A. G. Dodderidge, M.A., courteously showed them the plants of interest that flourish in his charming garden. He then acted as cicerone to the fine modern church of St. Mary, rebuilt in 1871. Very few traces are left of the 12th century building which preceded this. There is some beautiful stained glass of recent design, and the marble monument with bronze effigy of the first Viscount Ridley is truly magnificent and artistic.

The number of persons visiting these attractive woods may account for the few birds seen. Those noted were:—

corn crake	pied wagtail and young
common wren	dipper
wood wren	martin
grey wagtail	chaffinch
swallow	yellow hammer
willow wren and nest	

The only butterflies reported were whites.

The entomologists captured several species of ground beetles, spiders, gall-mites, gall-midges, centipedes and millipedes; some of them quite rare.

WALDRIDGE FELL, JUNE 23RD.

This piece of original unreclaimed moorland, about a mile across, has great variety of surface, both as to elevation, soil and moisture. In its area are streams, pools, bogs and marshes that are rich in botanical specimens; in addition to which there are plants peculiar to the higher and drier parts of the ground. There are also insects to be found that live only on such vegetation. On the steep sides of the two denes of the Cong Burn and the South Burn are found woodlands, some of spontaneous natural growth, others planted by the hand of man. The natural species include: alder, birch, sallows, juniper, hawthorn, rowan, crab.

In some of the bogs the smooth water-horsetail, *Equisetum limosum*, grows profusely, and among it were patches of the white tassels of the broad-leaved cotton-grass. Several species of *Carex* were abundant, including *C. paniculata*, *C. stellulata*, *C. pulicaris*, *C. panicea*, *C. leporina* and *C. remota*.

Portions of the bog were dominated by *Carex goodenowii*, others by *Scirpus palustris*. In our brief exploration we observed *Juncus squarrosus*, *J. articulatus*, *J. effusus*. Other bog-plants were—

butterwort (abundant)	marsh pennywort
marsh arrow-grass	valerian
purple orchis	marsh valerian
marsh thistle	bog stitchwort
marsh lousewort	hemp agrimony
marsh ragwort	

Elsewhere there were in flower: guelder rose, wild rasp, figwort, foxglove, bladder campion; and the spear-thistle was identified. The visit was just too late for the bloom of the bog-bean and the cuckoo-flower, but the first wild roses were seen.

On some of the drier parts of the moor bracken dominated everything, and little or nothing could grow beneath it. In other places were seen patches of furze, of common heather, bilberry, crowberry, and odd plants of fine-leaved and cross-leaved heath. Interesting problems of such areas are afforded by the observation and consideration of plant associations, as regulated by the varying conditions of subsoil, moisture, exposure, etc. This aspect of Waldridge Fell has been treated amply by Mr. Harold Jeffreys, D.Sc., in the *Journal of Ecology* for December, 1916. Among the grasses that have possession of different parts of the ground are waved hair-grass (*Aira flexuosa*), crested dog's-tail (*Cynosurus cristatus*), mat-grass (*Nardus stricta*), brown bent-grass (*Agrostis canina*). To these may be added the purple moor- rass (*Molinia cærulea*) which flowers rather later.

Among the insects captured were the small heath butterfly (*Coenonymphia pamphilus*) and the silver-ground carpet (*Melanippe montanata*). The cocoon of the drinker moth (*Odonestis potatoria*) was also found. This moth, once so widespread with us, is now confined to boggy ground (not necessarily heathland) and to coast sandhills.

The following flower midge-galls were observed: *Contarinia anthobia* in hawthorn flowers; *C. viburni* and *C. lonicerarum* in guelder-rose flowers. There were also seen caterpillars of two kinds of moths on cotton grass.

Among birds observed were—

starling	snipe
missel thrush	green plover
willow wren	thrush
blackbird	meadow pipit

The species of plants recorded here are only a few of the many that occur on this interesting bit of moorland. Frequent visits will be found quite profitable.

Vale of Derwent: Shotley, Sneap and Allansford, July 14th.

At the Sneap the Derwent's course is in a deep and wild wooded gorge, that serpentines in a most accentuated fashion. The "Sneap" itself is the long and narrow rocky bastion that projects on the north or Northumbrian side and causes one of these violent sweeps of the river. From various commanding points delightful views are obtained of this romantic valley and of the Derwent in its stony bed amid profuse foliage on either bank. Beyond, to the south, is the lovely ravine of the Hisehope Burn, and to the west stands the hamlet of Muggleswick, with considerable remains of a large manor-house built by a Prior of Durham in the thirteenth century.

On the north bank of the river, much of the timber has been felled to supply the wants of collieries. The soil is of the poorest—sand or clay—mostly dry, but marshy in places. Here find a habitat many plants of a northern type, that survive where there is no cultivation and only a small population. Among them are *Pyrola minor* and *P. media*, *Trientalis europaea* (in seed), the oak fern, twayblade, butterfly orchis, frog-orchis, spotted orchis, melancholy thistle.

The grasses were mostly in flower and very beautiful: of these the wavy-hair-grass densely covered many patches and was very conspicuous.

Close to the Sneap, we enjoyed the friendly hospitality of the Crooked Oak farm, a name that recalls the time when an oak tree with a crook in its stem or branches had a special value to form the rib or the knee in the keel of one of our "wooden walls." This Jacobean house, though not large, has been in its day the residence of persons of importance. Its finely moulded doorway in the style of that period is dated 1684, and a somewhat similar stone chimney-piece, rather big for its place in the parlour, is dated 1717. In both stories there are stone-mullioned windows. Outside there were several bee-skeps, whose inhabitants were as busy as the proverb describes. All round, the hay harvest was progressing rapidly under the unusually good conditions : the quality was perfect, if the quantity was on the light side. Some was already in pike, other just being cut.

Among the many botanical attractions on the Sneap itself, there was a record crop of wild strawberries. Bilberries, too, were ripe. Wild roses were at their best; the bushes had grown luxuriantly and every spray was covered with blossoms, which varied in colour from almost white to bright pink on different plants. Honeysuckle was also fine, and the cross-leaved heather. The blue festoons of the tufted vetch were abundant in several places.

In and near the marshy spots were found several species of *Carex*: *panicea*, *pallescens*, *sylvatica*, *palustris*, *leporina*, *vesicaria*, *remota*, *flava*; also *Juncus articulatus*, *bufonius*, *effusus*. In other localities were observed wood club-rush (*Scirpus sylvaticus*), great spearwort, meadow-sweet, adder's-tongue, centaury, devil's-bit-scabious, and the dark mullein

(*Verbascum nigrum*) which is not plentiful in our district. Many other more usual plants were found which need not be enumerated here. Botanically this meeting was very successful, both as to the number of species and their comparitive rarity.

By the kind permission of the owner, Sir Arthur E. Middleton of Belsay Castle, the party returned through the beautiful woods of Allansford. Here they saw forestry carried out on a modern scientific system. There are coniferous plantations of various ages and species, the trees grown in close order so as to produce tall straight timber with little taper in the trunk, and without side branches and knots. Among the species are Scot's pine, spruce, larch (western and Japanese), Douglas (Oregon and Colorado), a few Weymouth pines and others. All seem to be flourishing admirably, except that in places the larch are affected by the canker, a trouble for which there is yet no known specific.

In a clearing on the haugh-land there was a splendid display of thousands of foxgloves, brilliant against the background of brown stems and green foliage of the spruce. A delicate fringe of the path was here formed by the blue columbine, a plant rarely seen wild in the north, and the carpet was of purple and yellow wild pansy.

Birds: The period of song was past, but the following species were seen or heard : peewit, sandpiper, redstart, tree-pipit, willow-wren, blackcap, lesser redpole. swift, swallow, pied wagtail feeding its young. On a long farm building without spouts quite a large colony of house martins had built their nests under the eaves, and they were very busy feeding their young.

Insects : Although no rarities were reported by the experts, species usually characteristic were found in abundance, including meadow-brown butterfly, common blue, small tortoise-shell, small heath, the chimney-sweeper, dragon-flies, etc. Myriads of the green tortrix moth (*Tortrix viridana*) evidently just emerged from the pupa-state, were flying about over some oaks in the Sneap. The caterpillar of this moth is very destructive, completely destroying the foliage of oaks in early summer on the Sneap. Very conspicuous and lamentable were several cases of the entire defoliation of the bird-cherry or hackberry, by the gregarious caterpillars of the small ermine moth (*Hyponomeuta evonymellus*) that spin and live inside a veil-like web, well known to those interested in trees.

An attractive find was a living specimen of the quite harmless slow-worm.

The last two Field Meetings were held in October and took the form of Fungus Forays. They had the advantage of the leadership of Professor M. C. Potter, M.A., Sc.D.

Axwell Park, October 13th.

In these secluded woodlands a luxurious growth of many species of fungi was found. Some were photographed *in situ* by the Professor. The great variety of size, form, colour and habit was specially noted, also the wholesomeness or the reverse of each species for food. Besides those growing in the open on the ground under beech, ash, oak or pine, or living on trunks of trees or dead logs, others were found flourishing in the greenhouses very vigorously, to the annoyance of the custodian. The head gardener kindly conducted the party through the various hot-houses, flower garden, shrubberies, and lastly the kitchen garden for the benefit of allotment holders present. The few wild plants seen in flower included rayless chamomile, wood brome, tansy, yellow toadflax, feverfew, groundsel, white deadnettle, autumnal hawkweed.

Among the fungi were :—

Russula fellea
Nectria cinnabarina
Amanita rubescens (the blusher)
Lepiota rachodes (parasol mushroom)
Scleroderma vulgaris (vegetable tripe)
Lactarius turpis (base toadstool)
Collybia butyracea (butter collybia)

Xylaria hypoxylon
Tricholoma personatum
Boletus sp.
Hypholoma sp.
Coprinus sp. and many more.

GIBSIDE PARK, 27TH OCTOBER.

In spite of recent and continued tempestuous weather the autumn tints of foliage were very beautiful and varied. Mature beeches, chesnuts, etc., of noble growth were much admired. The hornbeam only appeared as a low-growing tree. A fine cedar of Lebanon displayed a big crop of staminate catkins standing erect on the upper surface of its branches. Acorns seemed plentiful in places, and the mossy-cupped acorns of the Turkey oaks were gathered.

Among the fungi identified were:—

Pesiza willkommii (the larch canker, in an early stage)
Pholiota squarrosa (the shaggy scaly-cap)
Ithyphallus impudicus (stinkhorn)
Stropharia aeruginosa (verdigris toadstool)
Stropharia semiglobata (half-sphere toadstool)
Lactarius trivialis
Hydnum repandum
Stereum hirsutum
Corticium colceum
Xylaria sp.
Fomes sp.

In moist places in the woods *Carex pendula* still stood up five feet high, handsome and graceful. By a pond, *Equisetum Telmateia* was quite dominant. *Lonicera xylosteum*, the fly honeysuckle, was seen in fruit.

A single species of moth, the winter moth (*Cheimatobia brumata*) was abundant, sitting on the bark of trees, where it was almost invisible from its protective colouring. The squirrel, jay, jackdaw, blue-tit, robin and chaffinch were seen, and the hooded-crow was heard.

There is much of interest in the Jacobean hall and the artistic erections in the park, each visible at the end of a long vista, the great column 140 feet high, crowned with a statue of Victory, the banqueting hall, the beautiful chapel in a classic style that reminds one of Seaton Delaval Hall, and internally of some of Sir Christopher Wren's London churches.

On the whole, we had a successful, if limited, series of field meetings, and we should be encouraged to continue them.

It is proper to record the help received both from Professor Potter and his two lady lecturers, Miss Cunnington and Miss Davy, as well as from our ex-President, Mr. Adamson, particularly in the fungus forays.

It is desired to record here the appearance in large quantities of *Goodyera repens* in Dipton pine woods, collected July 30th, 1917. It had been seen there by Mr. Randal B. Cooke in 1916, and Mr. R. Adamson remembers seeing it in the same place a few years ago. It had not been recorded nearer than Scotland and Cumberland.

Interesting habitats are being improved out of existence owing to war requirements. Tinkler Fell and Birtley Black Fell are ploughed out, and 200 acres of timber is being cut at Waldridge Fell.

Professor George Alexander Louis Lebour, M.A., D.Sc., F.G.S., Murchison Medallist, Geological Society of London.

By D. Woolacott, D.Sc., F.G.S.

The late Professor Lebour was born at St. Omer in 1847. His father was an artist of distinction from whom he inherited his essentially artistic temperament and the natural ease with which he drew illustrations and sections for his geological work and lectures. His mother was a highly cultured and accomplished woman, who took a great interest in the intellectual development of her only son, entirely directing his early studies.

Both his parents were French, but when Lebour was two years old they came to England and thus he grew up within the literary and artistic circle of the London of the middle part of last century. His interest in literature, art and music began early in life and continued with him throughout it. He seems, however, early to have shown in which direction his work was to lie, as when a boy he was quite exceptionally interested in natural objects, out of which developed that wide and profound knowledge of the subject he eventually made his profession.

He studied at the Royal School of Mines, and during the years he was a student came under the influence of the master minds of Tyndall the physicist, Huxley the biologist, Ramsay the geologist, and other leading scientists of the day, of whose peculiarities he delighted to tell.

In 1867 he received an appointment on the Geological Survey of England and Wales, and worked with Topley for some years in Northumberland. During these years he gained the foundations of a unique knowledge of north-east England, which, gradually developing, enabled him to write his book on the Geology of Northumberland and Durham. This work is full of accurate and original observations, and is a mine of

THE LATE PROF. G. A. L. LEBOUR.
(From a block kindly lent by the Editor of the *Vasculum*.)

facts, so that however much ideas on geology may change, it must always remain a standard work on the strata of these two counties. It placed the geology of this area on a scientific basis, and paved the way for future knowledge.

In 1870 he married Emily Nora, the daughter of Dr. Hodding, a London surgeon. He had known her from boyhood, and she became a real helpmeet to him in his lifework.

He resigned his post on the Geological Survey in 1873, entering into practice as a consulting geologist, and two years later was appointed Lecturer in Geological Surveying in the Durham College of Physical Science. On the death of Professor Page in 1879 he was elected to the Chair of Geology when 32 years old. He held this appointment until his death, and no man took a keener interest in the development of this institution into the present Armstrong College than Professor Lebour. All who have been in any way connected with the College regret that his genial and kindly presence is no more.

He had a philosophical grasp of the science of geology, and was a master of its broader principles, yet every new detail interested him. In his lectures he treated the subject from the historical standpoint, and as he had met in his early years some of the great pioneers of the science, his lectures were often illuminated by personal references to the workers who laid the foundations of the present-day views on the science.

To listen to his lectures was always a pleasure. He had the power of giving simple, clear and accurate statements of the most complex branches of the subject, and of putting clearly before his students the underlying principles. Combined with this power was a perfect command of English and a charming method of delivery. He had also a true gift of humour. Not only had he a store of anecdotes which he could tell so as to bring out their full quality, but his humour was also original and spontaneous. He delighted in a good pun, and brightened life by the many-sidedness of his wit.

The breadth of his knowledge, his general culture, his sense of humour, his interest in everything that was at all new were the qualities that endeared him to his students. Everyone who came under his influence was impressed by the charm of his manner, his love of science, and his interest in their welfare. All who attempted research found in him a willing and interested helper and a sure guide, no matter in what branch of the science the work lay. His inspiring influence is seen in the large amount of original work that has been done in various parts of the world by his old students.

Lebour was primarily a field geologist and had studied his subject in the field in many areas at home and abroad. He held that it was by direct appeal to nature that the secrets of the earth were to be gained. The lecture room and laboratory were to him necessary aids to the outside study of geology. He was at his best in the field, and all who studied the rocks under him along the Northumberland coast or at Appleby must remember with pleasure the days spent under his guidance. The charm of these excursions was largely due to the fact that he was a true student of nature himself, and thus field work was conducted in the spirit of research.

Nothing which had any bearing on geology was alien to his mind. He delighted in curious natural and artificial illustrations of geological phenomena. He was always working at some branch of his subject, and it is to be regretted that much of his work was never published, but the breadth of his interest is shown in the numerous subjects on which he wrote. They include work on stratigraphy, palæontology, physical, structural and applied geology. His original scientific work was the result of accurate observation and thus will bear the test of time, while more theoretical work—although perhaps more striking in its day—will pass away and be absorbed in later views.

The following are the more important results of his work:—(1) A geological map of Northumberland, which shows clearly the main outcrops of the strata of the two counties; (2) A geological handbook of Northumberland and Durham, a book full of original observations; (3) A geology of Durham in the Victoria County History, which gives a complete summary of the geology of that county (1907); (4) The proof (with Topley) of the intrusive character of the Great Whin Sill; (5) The division of the Lower Carboniferous rocks of Northumberland, and the fixing of the limits of the Tuedian and Bernician series: subsequent investigation has shown that there is a line of unconformity between these two divisions at the point taken by Lebour as their line of demarcation; (6) The proving (with Smythe) that two phenomena—a local unconformity and thrust—were associated in the Coal Measures at Whitley; (7) Numerous papers on the detailed stratigraphical, structural and palæontological features of the strata of Northumberland and Durham; (8) The determination (with Herschel and others) of the thermal conductivity of rocks, work which is recognised as of high value; (9) Several papers on foreign areas, and (10) Many papers on applied geology, including one on the distribution of goitre.

He did much original work at Skye, of which he allowed the Geographical Survey to make full use, and much of the results of his work on coal was given to a friend. The geology of coal and of the coalfields of the world was perhaps the subject he knew most thoroughly, and one must regret that he never completed for publication a book on Coal and the Coalfields at which he worked for years.

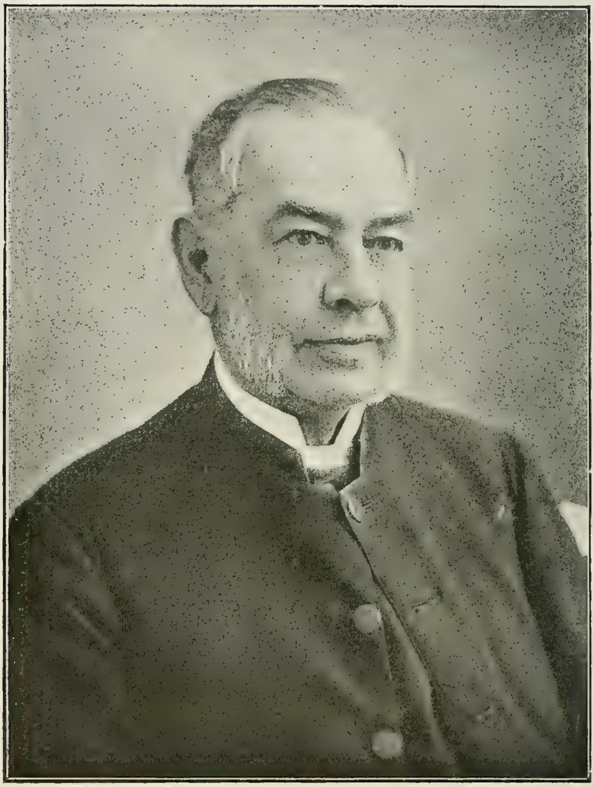
Besides this more original work he wrote many general papers, many reviews, edited and refereed many papers, assisted in editing the volumes of Borings and Sinkings in the Coalfield of Northumberland and Durham, and did much consulting work, writing many reports on technical geology.

In 1904 the Geological Society of London awarded him the Murchison Medal in recognition of the importance of his contributions to a knowledge of the Carboniferous and other rocks in the North of England.

He took a keen interest throughout his life in the University of Durham Philosophical Society, of which he was one of the founders. This society has fostered research in the Northern University, and has published much work of high scientific value in geology and other subjects.

He was always interested in Natural History Societies and in Field Clubs and often regretted that the amateur in geology was being largely displaced by the professional. He did all he could to foster the study of science for its own sake, and was always ready to help the least-experienced and humblest worker. One of his last papers—the Presidential Address to the Conference of Delegates of Corresponding Societies, British Association, 1916—was an appreciation of the work of Field Clubs and a plea for co-operation among Natural History Societies and Field Clubs in the investigation of certain geological problems.

By the death of Professor Lebour the geological students of Armstrong College lose one who was a guide, philosopher and friend, and his colleagues on the staff miss a wise counsellor, who always gave a warm welcome to any of them that consulted him, placing his mature judgement and wide knowledge freely at their disposal. He was a true-hearted gentleman, and a real man of science in the highest sense.



THE LATE CANON ALFRED MERLE NORMAN, F.R.S.
(From a block kindly lent by the Editor of the *Vasculum.*)

Canon Alfred Merle Norman, M.A., D.C.L., F.R.S.

By Prof. Alex. Meek, M.Sc.

Canon Norman was born in 1831 in Somerset and died on October 20th, 1918, at the Red House, Berkhamsted, Herts, but the greater part of his life was spent in the county of Durham. He came to Durham in the year 1857, and left for Berkhamsted in 1898. It was during the earlier part of this period that he gathered his unique collections, the study of which brought his name into prominence as a leading authority on the Invertebrate Marine Fauna of the North Atlantic.

A son of John Norman, D.L., of Iwood House, Somerset, he was educated at Winchester and Christ Church, Oxford. He was ordained in 1857, and was appointed to a curacy at Sedgefield in Durham. From Sedgefield he was transferred to Herrington, then to Newbottle near Fence Houses, and in 1866 he was appointed to the living at Burnmoor, which he held until 1895. His failing health was the cause of his departure from Burnmoor, his life having been in imminent danger more than once. He was then transferred to Houghton-le-Spring, but during the few years of his residence there he was not in the position to undertake further serious work. He removed in 1898 to Berkhamsted, where after some years he had many attacks of paralysis, ultimately quite disabling him. Even during these failing years at Houghton-le-Spring and at Berkhamsted he continued to give welcome help and advice to workers in different groups of Marine Zoology.

While he was but a child he was introduced to field botany by his brother, the Hon. John Paxton Norman, who was Acting Chief Justice of Bengal until his death in 1871 at the hands of a fanatic. At Winchester he began collecting Lepidoptera, and when he went to Oxford he devoted his spare time to a study of the land and fresh-water Mollusca of the district, an account of which he published. Before he came to the North of England—in 1854-55—he acted as tutor to the sons of the Earl of Glasgow at the 'Garrison', Millport, Cumbrae, and it was then that he began the systematic collection of marine life by dredging. The dredging expeditions commenced at this period, and the study and arrangement of the specimens occupied, almost without intermission, the greater part of his leisure time in after life, with results which are familiar to all naturalists here and abroad.

Shortly after his appointment to the curacy at Sedgefield he was elected a member of the Tyneside Naturalists' Field Club; his name appears in the list of members in 1858. He thus came into contact with the Hancocks, Alder, the Bradys, Bold, Atthey, Hodge, Howse, and so many others who, like himself, devoted their spare time to the study of the natural history of our northern counties. The Society had at the time attained a high degree of fame. The field and winter meetings were important and interesting gatherings of well-known naturalists, the work of whom was widely spread by the excellent papers which were published in the Transactions.

As has been apparent he had already acquired an interest in botany, in insects and in mollusca, and had begun the study of marine life which in future years was to be so serviceable as widening and co-ordinating our knowledge of the life of the sea. His early papers and notes contributed to the Tyneside Naturalists' Field Club Transactions illustrate the wide scope of his interests about the year 1860. They begin with an account of the species of Mysis, with the intention of bringing out the peculiarities of *Mysis spiritus* - afterwards raised to the genus of Schistomysis—which he discovered at Castle Eden. This was followed by papers on rare marine Mollusca, and a rare Ophiuroid of our coast, besides papers on Volvox, the local species of Polygonum and the botany of the ballast hills of South Durham.

At this period also, through grants from the British Association, dredging expeditions were organised at various regions around the British Islands, notably in the seas about

Shetland. In these he took a leading part, and was associated particularly with J. Gwyn Jeffreys. The lists of the captures made at the dredging expeditions off the coasts of Northumberland and Durham and as far out as the Dogger Bank were published in the Transactions, several of the members of the Field Club taking part in the work. The Crustacea were reported on by Canon Norman.

Dr. Norman was President of the Field Club in 1866 and again in 1881. His address in 1866 was devoted to a sketch of the history of the Field Club, but in 1881 he gave a survey of what was known of the Abysses of the Ocean. This is a noteworthy paper, for it is a clear statement of what was known then of the nature of the sea bottoms at great depths, and contains, in full, lists of the animals which had been proved to live at such depths, and a discussion of the relationships of these to the better known and richer fauna of moderate depths and the shore.

He made many friends amongst the naturalists of the North of England, but a community of interests brought him especially into association with Professor G. S. Brady. The friendship, started in 1858 and continued to the end, was productive of many papers dealing with marine and fresh-water Micro-Crustacea, culminating in the monograph on the Marine and Fresh-water Ostracoda of Britain, published in 1896 in the Transactions of the Royal Dublin Society, and in the publication, after many years, of the Catalogue of the Crustacea of Northumberland and Durham in the Transactions of the Natural History Society of Northumberland, etc., in 1909. Another noteworthy and exhaustive catalogue of the same kind—the Crustacea of Devon and Cornwall—was published in 1906 with the collaboration of the Scottish naturalist Dr. Thomas Scott.

His work brought him also into intimate friendship with the naturalists who during this period were attempting to get a knowledge of marine, and especially of deep sea life, as Sir Wyville Thomson, Sir John Murray, M. and G. O. Sars and

A. Agassiz. He took part at the invitation of the French Government in the dredging expedition of the "Travailleur" in the Bay of Biscay.

The investigation of marine life by systematic dredging was his hobby, and even those who have not taken part in it will understand its fascination. His vacations were spent in this work at various places on the coasts of the British Isles and the Channel, and he also extended his researches on several occasions to Norway and Madeira. His knowledge of marine life acquired in this manner was astonishing, and he retained his authoritative interest in practically every group during his life. He was able to publish critical revisions of the species of many groups of the North Atlantic, the papers for the most part having been published in the "Annals and Magazine of Natural History." In all these groups he discovered and described new species and genera, and his systematic papers have resulted in indicating the general distribution of the Marine Invertebrates of the North Atlantic region. The way in which that knowledge was built up is well illustrated in the series of papers published on the results of his dredging in Trondhjem Fjord. His labours also resulted in the discovery of several species of especial importance. Of these only one need be specified, Rhabdopleura, which was found in Shetland seas and described by Allman as *Rhabdopleura normani.* The position of this creature remained doubtful until Cephalodiscus was brought to light by the Challenger expedition, when it was brought into relationship with that genus and Balanoglossus.

During these years he amassed a vast collection of considerable value, including many type specimens which he or others had described, and species which for other reasons were interesting or important. This collection was presented several years ago to the British Museum. He also accumulated a rich and complete library of books, papers and pamphlets relating to the subjects of his life work, and these were presented to the University of Cambridge.

Dr. Norman was never much interested in the grades of life above the Invertebrates, and cared little for the general problems of physiology, heredity, evolution and the like. He was content to end his work as he began it, in a careful and painstaking study of specific characters and the inter-relationship of these in founding genera and families, with the result that the nation is richer by the acquisition of many important specimens and in the knowledge of the wealth of the Invertebrate Fauna around our islands. But, as has already been apparent his work has been the means of greatly enlarging our knowledge as to the distribution of the animals of the North Atlantic. He drew attention to the many examples from different groups which were found from Madeira and the Mediterranean to Norway, while others only reached as far as the Channel and our south and west coasts; and he pointed to many forms which had a wide range of depth. But the best testimony to his extensive knowledge is the fact that there is scarcely a naturalist of a younger generation who, in working at a marine group, has not asked for his advice and help. They received the help and advice together with encouragement, and a manifestation of interest which showed how keenly he followed the labours of others even when his active participation in the work had come to an end. All who came in contact with him found him a genial, sincere, earnest, and good-hearted man, loveable and endearing. Professor Brady writes of him to me as "our dear old friend Norman," and this he was to many of us.

I have written altogether in this notice of his work as a naturalist, but I may be allowed to add in conclusion, that in his work as a minister, especially at Burnmoor where he was Rector for nearly thirty years, his services were much appreciated, and he was highly esteemed by the pitfolk who constituted the greater part of his congregation.

The Genus Rosa, its Hybridology and other Genetical Problems.

By J. W. Heslop Harrison, D.Sc.

I.—INTRODUCTORY.

> Species rosarum difficillime limitibus circumscribuntur et forsan natura vix eos posuit —Linnæus, *Species Plantarum.*
>
> Species rosarum difficillime distinguuntur, difficilius determinantur; mihi videtur naturam miscuisse plures vel lusu ex uno plures formasse; hinc qui paucas vidit species facilius eas distinguit, quam qui plures examinavit.—Linn., *Species Plantarum*, 1753.

Although written more than a hundred and fifty years ago, to most botanists, even of to-day, the above extracts from the *Species Plantarum* appear to be as true as Linnaeus imagined; as a natural consequence, except to the specialist, the genus *Rosa* is more or less of a tabooed subject.

Nor can this be wondered at when the novice beholds the bewildering array of forms, seemingly alike, masquerading under different names in the carefully labelled herbaria of the rhodologist, or even after he has attempted to name a casually collected rose by means of some flora. Both experiences are disheartening, but to the enquiring mind readily understandable. In the first place, so casually are rose specimens accumulated, and so effectually does the process of drying repress any but the most unreliable of characters, that forms, in reality most diverse, in the end look precisely alike; for example, it is quite an easy matter to produce a form of *Rosa coriifolia* so similar as a herbarium specimen to a member of the *tomentosa* group that even to the trained eye they are almost indistinguishable. If then the original descriptions of species be based on such material, as they often enough were, how little can we expect such accounts to square with the roses as they grow in nature, and how futile, therefore, our endeavours to determine a plant by their aid. Even with an ordinary genus a dried specimen may prove troublesome enough although the obstacles to a correct determination are not insurmountable, and so would it be with *Rosa* were it not that its members—call them species, little species, elementary species, microgenes or what you will—are so excessively variable that another difficulty arises. In some cases no two bushes are exactly alike; by that very fact they practically invite the attention of some individual blessed (?) with the "mihi"—or what Crepin used to call the "bush-mania"—who forthwith sees material for a possible new species. Obviously enough, the most hardened sinner would avoid the error of describing, as distinct, plants differing merely in some microscopic denticle on the back of the main leaf-serrations or in characters of similar value. Far from it, he selects his specimens from a bush as remote from the nearest book description as possible and upon those erects his "new" species. Now in all of its many inconstant characters, the variation in *Rosa* follows the ordinary frequency distribution of a Quetelet curve, as a very simple test will demonstrate. Collect, for example, a quantity of terminal leaflets from various bushes of the *R. lutetiana* group; measure their lengths, ignoring absolutely the fact that they are plucked from shrubs with large*, medium, or small leaves, and plot a

* These are the actual words used in certain dichotomous tables to separate alleged species !

graph. The result is a variability curve of the most ordinary type. And wherever the character lends itself to such treatment, be it in the degree of biserration of the leaves, the length of the styles, the number of setæ on the fruit, the number of glands per square millimetre on the underside of the leaves or in any other feature, the result would be the same.

This being the case, it is clear that if a value representing the condition of any given bush in respect to the sum of its characters could be assigned to it, and such statistics be collected for a host of closely allied forms, then these figures, too, if plotted as a graph, would produce a normal curve of variation. The natural outcome of the failure to recognise this elementary fact in the description of new species on the plan outlined above is that, for the most part, rose species simply exist on paper and at best only apply to bushes lying at the limits of the variation curve proper to their group and at irregular points more or less remote from these; such descriptions, therefore, are worthless.

To meet the circumstances of the case, the scientifically correct procedure ought to be, firstly, the collection and study of innumerable forms, then the selection for description of those falling at or near the crest of the Quetelet curve for their variability, followed, to do full justice, by a careful statement of the range and trend of variation as determined by careful study in the field, completed by details concerning the rose as it grows. Had this method been adopted, independently of one's attitude toward the status of such forms, the number of so called species would have been enormously reduced.

This brings us up sharply against the value to be attached to such forms; are they species or are they not? If not, what are they?

Anyone studying the roses as living organisms, paying due attention to habit as well as structure, cannot fail to be impressed by the numbers of apparently distinct forms separated by characters stable enough in themselves but nevertheless of relatively minor importance, each form being represented in any given station by crowds of individuals. Furthermore, even in stations vastly different in geological formation, there exist precisely the same types differing in the same way. For example, in two lanes in Mid-Durham on the Coal Measures a certain variety of what I call *Rosa omissa* occurs in hundreds. This is exceedingly closely allied to *R. mollis* which grows alongside it. Twenty-five miles away on the Magnesian Limestone of the coast denes identical forms of both *R. omissa* and *R. mollis* abound, and the same holds good of the Millstone Grit in Northumberland, thirty miles in the opposite direction. In addition to this locality-constancy both breed true to their special characteristics when due allowance is made for variation, in response to environment, within the limits of their particular range of fluctuating variation. So true to type and its own range of variation is each of these that knowing them only from these stations one could only regard them as genuine Linnaean species. If, however, one assembles with them numbers of similar forms from many stations, near as well as far, one is driven to confess that they merge* imperceptibly into each other as well as into many types of similar level, in this fashion forming a linked-up series of groups with the individual members of the same group substantially alike but each group separable from its neighbours by its own special character or characters.

Having thus equipped ourselves, and having submitted the material to detailed examination, we realise at once that, whilst we possess chains of groups continuous within the limits of the chain, on the other hand each chain is definitely divided from the next in respect to characters with which the comparison which linked up the original groups into

* It is well to emphasise here that, although, treated as above, all such forms would yield a Quetelet curve, they do not pass into one another at the minima of their respective curves; they cannot by any possibility be represented as a connected series of such curves. They are liable to merge at any point and *via* any or all of their characters.

parallel chains is no longer possible. Here at length we are up against something so close to a species in the Linnaean sense of the word that the unprejudiced observer can only regard them as such, despite the fact that few rhodologists would look upon the chain as of lower value than a section or subsection, comprising many species.

Admitting the validity of *our* conclusion, we find that our chain of collected forms assumes the familiar guise of the collective species, whereas the members of that chain sink to their natural level of the Jordanian species or microgene as I prefer to call it. That the microgenes glide into one another depends in all probability, for the most part, on hybridity, as I shall demonstrate later.

To avoid confusion I propose to call these chains section-species, and on that basis the number I am prepared to admit amongst the forms I have studied in a wild or half-wild condition in the north amounts to eight. These are *R. canina*, *R. Afzeliana**, *R. rubiginosa*, *R. agrestis*, *R. mollis*, *R. tomentosa*, *R. pimpinellifolia*, and *R. cinnamomea*, each of which includes a fairly large number of microgenes, which, as they exist in nature, are far from coinciding with the multitude of alleged species set out with such lavish detail in the various rose floras. Further, for ease in reference and to harmonise my nomenclature as far as possible with that current amongst botanists, I shall designate these section-species by the sectional names *Eucaninæ*, *Afzelianæ*, *Rubiginosæ*, *Agrestes*, *Villosæ*†, *Tomentosæ*, *Pimpinellifoliæ*, and *Cinnamomeæ* respectively.

* The name *Rosa Afzeliana* (a reinstatement due to Almquist) is used to cover the two old collective species *R. glauca* and *R. coriifolia*, the separation of which was ridiculous in view of the feebleness of the characters employed to differentiate them. The old *coriifolia* forms massed around var. *Lintoni* are transferred to their natural allies the *Rubiginosæ*. Similarly *R. tomentella* and its satellites are removed to the *Agrestes*. In the same way, and for similar reasons, I have united the old collective groups *R. canina* and *R. dumetorum* under *R. canina*.

† In the *Villosæ* I include all the related *mollis* and *omissa* forms.

Again, within these eight sections six, the *Eucaninæ*, the *Afzelianæ*, the *Rubiginosæ*, the *Agrestes*, the *Villosæ*, and the *Tomentosæ* are so much nearer to each other than to the others that they will always be referred to, when all are intended, under the comprehensive supersectional name *Caninæ*.

II.—ORTHOGENESIS IN ROSA.

So confused are the usual conceptions of geneticists and palaeontologists (and indeed of all who are interested in the matter) concerning the subject of orthogenesis, that it is with considerable hesitation one approaches it at all. Under these circumstances, therefore, before proceeding to discuss it in connection with the genus *Rosa*, it seems advisable to set forth the prevalent views on the subject as briefly as possible.

The word itself simply implies evolution or development in a definite direction and was adopted by Eimer himself from Haacke's "Gestaltung and Vererbung" to replace his own somewhat cumbersome phrase "bestimmt gerichtete Entwicklung" (= definitely directed evolution). Its more extensive use in genetics and allied subjects proceeds from this action of Eimer's.

Unfortunately, during the past twenty years, instead of remaining fixed, the meaning attached to the term has diverged along two distinct lines and so produced considerable uncertainty as to the exact import of the word. In its simplest interpretation, and that nearest the root meaning, it conveys to one's mind nothing more and nothing less than that certain observations have been made and that these are in harmony with the law of orthogenesis. In other words, the trend of evolution in certain groups of organisms is along definite lines. This appears to me to represent very nearly the value Eimer himself intended to assign to the term, and is the sense in which all palaeontologists and many zoologists (like Towers in discussing colour and pattern variation in Leptinotarsa, Whitman in describing his pigeons, and myself in treating the Lepidoptera) have understood it.

As may be readily perceived, in this original and restricted sense no explanation was or is advanced as to the cause of the phenomenon, although, of course, speculations as to what were the agents responsible for its existence were absolutely inevitable. From such theorising arose the transferred meaning of the word, in which it is employed, not as just explained to include only observed facts, but to cover the theory or theories evolved to account for those facts. The latter usage of the word is followed by Lull in his book on "Organic Evolution" in which he asserts that "Orthogenesis is a theory that variations, and hence evolutionary changes, occur along definite lines impelled by laws of which we know not the origin." Evidently, too, it is in this sense that Morgan looks on the word; otherwise he would not have described orthogenesis as being little more than a "mystic sentiment."

Such, then, are the differences in interpretation existing in the works of present-day writers, but they are in nowise attributable to Eimer. He very carefully distinguished between his actual illustrations drawn from a wide field in the Lepidoptera to explain the principle, and the original causes thereof. Briefly, without appealing to the inner driving force or principle of Morgan, or the "urge", *vis-a-tergo*, "kick" or "vital force" quoted by the same author as synonyms of orthogenisis, Eimer announced that "Die Ursachen der bestimmt gerichteten Entwicklung liegen nach meiner Auffassung in der Wirkung äusserer Einflüsse—Klima, Nährung—auf die gegebene Konstitution des Organismus."* By this dictum Eimer, without equivocation, commits himself to a belief in the inheritance of acquired characters. Although I made no definite pronouncement it will easily be deduced from my work on the Geometrid genus *Oporabia* that I was driven to similar views to account for various facts concerning lepidopterous larvæ.

* "The causes of orthogenesis, according to my notion, lie in the action of external influences, such as climate and food, on the given constitution of the organism."

In the present paper, with but the barest indications of possible causes, I intend to demonstrate as fully as possible that the development of section-species, microgenes and varieties in the genus *Rosa*, and more especially in the supersection *Caninæ*, proceeds on orthogenetic lines even if of a rather peculiar type; in doing so I believe that I shall be giving the first illustration of the law derived from the phanerogams. However, despite the emphasis on the *Caninæ*, it must not be supposed that the action of the principle is confined to them; on the contrary the *Pimpinellifoliæ* and *Cinnamomeæ* exhibit the same phenomenon. Thus, as far as possible these latter groups must be dealt with, but owing to the circumstance that they are at best stranded and possibly more primitive groups, badly represented in the North of England and greatly diminished in species throughout the range of *Rosa*, very little material remains for study; whatever has survived the vicissitudes of the past falls exactly in line with the *Caninæ*.

My attention was first drawn to the subject some years ago by the occurrence of a green-leafed form of *Rosa coriifolia** on the railway banksides near Billingham, South Durham, which ran down to the microgene *frutetorum*. In spite of its proving on examination to possess all of the characters proper to the aggregate *R. coriifolia*, as I then termed the hairy-leafed members of the *Afzelianæ*, I could not help being struck by its extraordinary resemblance to that segregate of the *Tomentosæ* which I take to be *R. tomentosa*, Smith. In consequence, influenced by its ambiguous appearance which had caused me at first sight to look upon it without question merely as *R. tomentosa*, I refrained from including it in my "Wild Roses of Durham" but laid it aside for future study. The same season I made a direct comparison between it and

* It must not be forgotten that I regard the glabrous *R. glauca* + the hairy *R. coriifolia* as forming the section species *R. Afzeliana*. However, in naming microgenes, to remove misunderstandings in the minds of English readers, the nomenclature of Wolley-Dod's list is employed throughout this paper.

fresh specimens of undoubted *R. tomentosa* gathered at Lamesley, North Durham, when I was amazed to discover that practically in every character, leaf shape, serration and colour, flower colour, size and shape of fruit, colour of bark, and finally, habit of growth the two coincided ; whatever differences were perceptible lay in the technical characters employed to differentiate the section-species *Afzelianæ* (= *coriifolia* + *glauca*) from the *Tomentosæ*. Subsequent investigations revealed that this microgene of the *Afzelianæ* abounded throughout the coast denes of Durham, in the hedges along the bridle path between Greatham and Cowpen, and in North Yorks., and further that its latitude of variation was much less than is common to most rose microgenes. The next development occurred in late August of the same year when a very similar clump of bushes was examined close to Greatham village; these bore fruit just changing colour and were therefore determined without consideration as *Rosa frutetorum*. Imagine my dismay when, on making detailed examination at home, I had to confess that the plant appertained to *R. glauca*. The tale did not end here. In the following year, working in Hawthorn Dene (another of the beautiful Durham coast ravines), I found a fourth rose, once more referable to *R. glauca*, but in this case distinguished from the form just described and the similar *R. frutetorum* and *R. tomentosa* by its very conspicuous blue green, pruinose leaves. Later, in the same expedition, I collected a *R. coriifolia* variety of precisely the same type with leaves covered with a waxy bloom, as well as a *Rosa mollis* very close indeed to it. Next day I brought all these alongside *R. frutetorum* and *R. tomentosa* from Lamesley. In the features referred to as linking *R. frutetorum* and *R. tomentosa* together, save in the one point of leaf colour (and of course in their special section characters), the agreement was complete.

To get parallel Eucanine forms proved far from difficult, for of the bushes growing along a disused waggon-way at Harraton, North Durham, more than 50 per cent. of the total, and at least 90 per cent. of the *Eucaninæ*, belonged to a microgene *R. flexibilis* simulating the green *R. glauca* discussed previously, whilst a much smaller number were of the related blue-green glabrous and blue-green hairy types. Thus, to all intents and purposes, I had traced the passage of microgenes of like type to the *frutetorum* through all the section-species except the *Rubiginosæ* and *Agrestes*. With the former section I have never made the link, simply because it is only a denizen in our counties, whilst with the latter the connection came later when I recognised that the microgenes regarded as glandular *Eucaninæ* were actually *Agrestes*. *Rosa vinacea* then fell into its natural place as an *Agrestes* representative of the *frutetorum—tomentosa—flexibilis* alliance to which I apply the name "species-type."*

By similar stages other linked species-types were discerned, although not every one was recognised in all the sections. For instance, whilst the *lutetiana—dumetorum* fraternity had yielded all four possible combinations in the *Eucaninæ* and *Afzelianæ*, only certain *Tomentosæ* provisionally named by me *R. pseudo-cuspidata* went with them—and so with others.

In all I determined seventeen definite species-types occurring in three or more groups, with a less number represented in two only, all of the section-species being involved except the *Rubiginosæ*. The members of that section, for reasons already stated, could not with certainty be attached to any forms occurring locally. Recently, however, I have received a number of Norwegian roses from Traaen which included a *glauca* form determined by him as *Rosa Traaeni* Almquist. To this the *Rubiginosa* form *R. Lintoni*†, which is common hereabouts, and the Eucanine *R. sylvularum* present

* A species-type may be defined as the model of a group of microgenes of similar facies, with representatives, in each section, possessing the characters proper to that section added to those peculiar to the species-type.

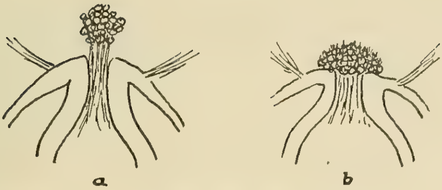
† This is, of course, the glandular *R. coriifolia* var. *Lintoni* of British authors.

a close resemblance. Even then I was sceptical as to the *Rubiginosæ* showing to the full the capabilities of the other sections, so much was I influenced by the uniformity of the full green *R. rubiginosa* growing sporadically in a sub-spontaneous way in our hedges. I simply couldn't imagine its yielding glaucous leaved varieties. This last stumbling block was likewise removed by Traaen. Thanks to him, I now have a splendid series both of the glabrous and of the hairy pruinose *Rosa glauci-rubiginosa* and *R. supra-rubiginosa*, whence we see that *R. rubiginosa* can also produce all four minor forms described below.

In this fashion the facts which were destined to give rise to, and then impress, the idea that species formation in the *Rosæ* was on an orthogenetic foundation were accumulated.* We are now in a position to expand and systematise the notion.

Whatever the common ancestor of the *Caninæ* was, it appears, if one judges from its geographical distribution, to have separated early into three divisions, each of which in turn gave rise to two allied sections, the pairs being *Afzelianæ-Eucaninæ*, *Rubiginosæ-Agrestes*, *Villosæ-Tomentosæ*. And the remarkable thing about these pairs is that, in every instance, the second members of the pairs bear the same relation to the first, the *Eucaninæ* differing from the *Afzelianæ* as the *Rubiginosæ* differ from the *Agrestes* and the *Villosæ* from the *Tomentosæ*. In each case the first section of any particular pair possesses a broad, flattish, hemispherical woolly head of stigmas almost sessile on and obliterating the disk (text fig. 1, b), whilst the second displays less hairy and, often enough, glabrous styles, more or less protruding from the disk, thus leaving it clear and distinct (text fig. 1, a); similarly in the first section-species the sepals are more or less erect and subpersistent (figs. 1, 5, pl. xvi; figs. 7, 8, pl. xvii; fig. 10, pl. xviii; fig. 33, pl. xx; and pl. viii B.), whilst in the

* Prior to any serious study of the material I had often been at a loss as to how to treat the blue-green *lutetiana* and *dumetorum* forms running down to the same name as their green relatives.



Text-fig. 1. a. *R. flexibilis (Eucaninæ).*
b. *R. Reuteri (Afzelianæ).*
To show difference in stigma heads.

second they are reflexed (rarely spreading) and deciduous (figs. 9, 12, 13, pl. xviii; figs. 14, 15, 16, 17, pl. xix; fig. 20, pl. xx; figs. 26, 27, pl. xxi), falling before the fruit ripens. Finally, the first section of any given pair ripens its fruit markedly in advance of the second. It will thus be apparent that one section-species of each pair of the *Caninæ* is fitted for self pollination and northern* latitudes, and the second for insect pollination and more southern climes, thereby indicating that the parallel evolution of the allied pairs from the primitive *Caninæ* ancestor was possibly a response to environmental factors. In this parallel movement we discern the first hint of the workings of the unfolding principle of Eimer's.

But progress did not end here; in these groups (as in others not studied by me) in Asia, America and Europe, a gradual advance has occurred with the evolution of a multitude of species-types, each species-type marking a definite halting point in the onward march. Once again, as these stages reveal themselves, we are bound to admit that throughout the sections there is complete agreement, for each species-type is common to all; a further unfolding of the latent powers of the sections has manifested itself. Again the evolutionary principle followed is strictly orthogenetic in its action.

Next, in each section-species, every species-type breaks into two microgenes, in one of which the foliage is of a full green

* And in more southern stations for mountainous habitats, as Gelmi so clearly explains in the case of *Rosa glauca* in the Trentino.

colour, and in the other of a glaucous hue due to its secretion of a waxy bloom. Finally, each of these two forms in its turn yields two varieties, one with the leaves glabrous and the other with them more or less hairy. Only one explanation of all these marvellous coincidences appears at all feasible, and that is, that in the derivation of the sections from their hypothetical common ancestor, in the segregation of the section-species into species-types, in the break of the species-type into microgenes, and in the splitting of the microgenes into varieties, we have a wonderful exposition of evolution on definite lines or, in other words, of orthogenesis.

As is obvious, no attempt has been made to trace the phylogenetical connection of the various species-types, although that would entail no great labour. One could commence with the neutral type of leaflet exemplified by *R. Traaeni* and from it trace by degrees in direct lines every form of leaflet from narrow to broad, from uniserrate to multiserrate, from forms with connivent teeth to those with divergent, and so on with every possible combination, just as Eimer followed up the wing patterns in the Lepidoptera. To do so, in the absence of exact evidence as to the true arrangement or even the correct starting point, would be unprofitable, for it would simply produce a scheme a fit target for gibes of the same nature as assail the palæontologist when he arranges his fossil reptilia and amphibia in orthogenetic series. He is always accused of making his arrangement to suit himself, irrespective of the time of appearance on the earth's surface of the creatures with which he deals. My omission cannot affect in the slightest the genuine orthogenetic course of evolution visible in *Rosa*, any more than a failure to indicate the order of the figures in the "cat's cradle" would prove that they had not been evolved in a definite order.

Independently of my researches, Almquist, another worker in the same field, travelling by the reverse route to mine, arrived at precisely the same conclusions, but as far as classification is concerned, far outdistanced me. Commencing by observing the break of the glaucous and the green microgenes of certain *Afzelianæ* into their smooth and hairy forms, he followed its occurrence throughout that group, and in the end proved its universality in the rose sections. With the huge mass of material at his command, and attacking the matter purely from the standpoint of the systematist, he proved that there were 31 species-types and fully characterised them, utilising, in addition to the features employed by me, the forms and relationships of the leaflets on the flowering sprigs as the basis of his scheme. On this foundation he constructed a tabular synopsis of the sections, species-types, microgenes and varieties; but in this many blank spaces exist.

All of this he carried out without the slightest inkling of its genetic import; nevertheless his table can be used as a kind of Mendeléeff's Periodic Classification to predict the existence of roses as yet undiscovered. Prior to this, however, on the evidence of my own work, I had outlined and lectured on a similar scheme evolved, after prolonged study, from my seventeen or more species-types. Moreover, I had employed my own arrangement with conspicuous success to predict the occurrence of a great number of forms (chiefly *Agrestes*) allied to *Rosa blondaeana* and *R. sclerophylla* which I afterwards discovered in South Durham and North Yorks where that group abounds.

The similarity of the tables developed by both Almquist and myself to that drawn up by Mendeléeff to illustrate the Periodic Law in classifying the chemical elements cannot be too strongly emphasised. Almost to the most minute detail they agree; we have the vertical groups of the chemist agreeing with my section-species, the horizontal series or periods with our species-types. Furthermore, if we allow for the division of the six members of the *Caninæ* into three pairs of more nearly related section-species, we have an immediate parallel to the divergence of the groups in Mendeléeff's table into two subgroups. For instance, the relationship between the *Eucaninæ* and *Afzelianæ* is much the same as that between the Lithium-Sodium-Potassium subgroup and the Copper-Silver-Gold subgroup. Again, the Semivillosan *R. faroensis* and *R. orientalis*, with *R. pimpinellifolia*, suggest in a striking way the transitional elements in the chemist's group eight. Lastly, it would not be a surprising thing should it turn out in the end that the parallel nature of the two tables is founded on chemical differences of the same type.

Thus Almquist working as a systematist, and I as a geneticist, arrived at essentially the same conclusions and announced them at practically the same period.

To fit the *Cinnamomeæ* into the general arrangement was not difficult, for the only two forms of that section known to me form by far the most beautiful and clearest illustration of the differences between the clear green and glaucous microgenes I have examined. *Rosa pimpinellifolia* (figs. 18, 19, pl. xix) on the other hand, completely defeated my efforts. After cytological examination, which determined that the *Caninæ* were endowed with a chromosome complement of 28 (haploid numbers) and the *Pimpinellifoliæ* with 14, I regarded these discrepancies as the cause of the unconformability. However, the acumen of Almquist in devising his table had not been lacking here. He points out that the leaflets on its flowering shoots have in no case advanced beyond the stage of the lower leaves of *R. Traaeni.* Any comparison of its leaf characters with those of other roses can only be with those of such lower leaves. If we recognise this, then it agrees with the non-committal and primitive *Traaeni* leaflet referred to previously as a possible point of derivation of all leaf forms.

Further, he adds the interesting remark that its stem with its closely set prickles stops short at the second year's stage of other roses. In both of these points, leaflets and armature, *R. pimpinellifolia* reveals itself as a juvenile species such as is seen elsewhere in the genus *Clematis*. Another very important fact also emerges; although *R. pimpinellifolia* is the only rose known from Iceland, and although the Icelandic form is indistinguishable from our Durham and Northern Scottish forms as I have satisfied myself by direct comparison, in the Faroe Islands* it is replaced by a very curious variety approaching the *Villosæ*. This plant Almquist terms a half-Villosan and regards as a mutant of *R. pimpinellifolia* in that direction. Very likely in that view he is correct. In my mind, however, we are encountering a further step from the "juvenile" species *R. pimpinellifolia* to the adult *R. mollis*. Nevertheless, let me hasten to explain, this does not exclude the possibility of mutation in any way.

In the ontogeny of *R. mollis* it cannot be denied that the species evolves from its seedling stage to its final condition in a determinate direction. *R. pimpinellifolia* and *R. faroensis* (as well as *R. orientalis*), as has been pointed out, represent halts in this ontogeny, so that their phylogeny recapitulates the ontogeny of the *Caninæ*. Hence, along vastly different lines, these microgenes conform to the usual orthogenetic development of the species within the genus.

Only one point remains and this portion of my work is finished; it must not be overlooked that in the species-types common to the sections, we may be dealing with similar segregates rendered possible by crosses made ages ago between forms carrying the same sets of coupled unit characters.

III.—POLLEN CONDITIONS IN THE ROSÆ WITH SOME CONSIDERATION OF OTHER FEATURES IN THEIR REPRODUCTION.

Pollen Abortion in the Roses.

As I have just observed in the previous portion of this paper, the persistence of species-types common to all the sections may arise through segregation from previous crosses—a contingency demanding, amongst other considerations, special investigations as to possible hybridity. The first of these to

* Rostrup in his Flora of the Faroes was completely baffled by this form; instead of naming it he simply says "perhaps *canina*"!

be set in motion were those attacking the matter from a cytological standpoint followed by an examination of the pollen conditions in the genus. Only the latter research will be discussed here in view of the enormous amount of material which has accumulated as a result of the earlier enquiry.

Very early indeed in the study of plant hybrids was their sterility observed, and determined in general to depend on their badly developed pollen. With the recognition of this fact, naturally enough, imperfect pollen was soon regarded as an adequate test of hybridity, as Dutrochet insisted in 1832. Moreover, Gaertner elaborated the point a little later, and stated it in terms differing but slightly from those current to-day. To test the reasonableness of these opinions is far from difficult. If one takes pollen from known natural hybrids like those between *Linaria repens* and *L. vulgaris* (=*L. sepium*), between *Rubus idaeus* and *R. caesius*, between *Rosa mollis* and *R. pimpinellifolia*, between *Primula officinalis* and *P. acaulis*, and examines it microscopically, a huge proportion, if not the whole of the grains, is found to be malformed or shrivelled, and thus shows a conspicuous lack of cytoplasmic contents. Not five minutes ago I plucked a wild hybrid between the two Primulas and was astounded to find that quite 90 per cent. of its pollen was in this state – an extraordinary fact when one realises the usual conception of the relationship between the parents and one's easy assumption that, if any hybrid is completely fertile, this one is.

With these facts as a basis the contents of the pollen sacs of certain rose microgenes were critically examined, when they, too, showed in most cases the same type of pollen abortion, although the proportion of sound grains varied with the form. One of the worst offenders in this respect appears to be *Rosa mollis* var. *caerulea* (text fig. 2, c); a little better behaviour is displayed by *Rosa flexibilis* (text fig. 2, b) and so on until we reach *Rosa rugosa* (text fig. 2, a) when practically every grain is perfect.

Text-fig. 2. a. Pollen of *Rosa rugosa* × 300.
b. Pollen of *R. flexibilis* × 250.
c. Pollen of *R. mollis* var. *caerulea* × 250.

These, and other observations, by the close analogy they bear to the circumstances ascertained to hold with recognised hybrids, urge one strongly to the view that similarity in pollen condition is correlated with similarity in genetical constitution. In other words, the conclusion becomes irresistible that the bulk of so-called rose species are hybrids likewise. The sole difference lies in the fact that in the known hybrids their condition is patent and betrayed by every point in their structure, whereas in most of the roses, owing to the closeness of the parent forms, the hybridity is latent. Thus it can only be manifested during that delicately balanced test of parental equality gametogenesis, when the lack of homology in the parental chromosomes ends in the result just described, *i.e.*, pollen abortion.

Although only a few rose microgenes were submitted to cytological examination, in a much greater number the pollen was critically examined and the proportion of good grains determined; what were the results the appended table discloses.

TABLE I.

Section-Species.	0% — 10% good pollen.	10% — 30% good.	30% — 50% good.	50% — 75% good.	75% — 90% good.	90% — 100% good.
AFZELIANÆ	subcristata (all bad) Reuteri subcanina fugax (all bad)	frutetorum coriifolia (type of Fries) venosa				
EUCANINÆ	inconspicua biserrata lutetiana × Lintoni	lutetiana hemitricha aciculata	flexibilis	fallens	senticosa	
RUBIGINOSÆ	Hybrid Lucy Ashton echinocarpa	Hybrid Anne of Geierstein comosa [Lintoni*]	[bakeri*]			
AGRESTES	[Borreri*]					
VILLOSÆ	cærulea (all bad)		submollis	omissa	mollis	cleistogamous omissa
TOMENTOSÆ	tomentosa (type of Smith)	sylvestris pseudo-cuspidata fœtida (all near 30%)				
PIMPINELLIFOLIÆ	Hybrid mollis × pimpinellifolia					pimpinellifolia var. rosea pimpinellifolia
CINNAMOMEÆ	cinnamomea plena				cinnamomea	[rugosa*]
SYSTYLÆ			arvensis			
TOTALS	14	12	4	2	3	4

* The microgenes placed in square brackets are placed by many other authors in different sections; the nomenclature, however, agrees otherwise with that of British authors.

From this table the astounding position emerges that, of 36 of our wild and subspontaneous roses and two garden hybrids produced from them, only four possess perfect pollen, three approach these, whilst no less than 75 per cent. have more than half of their microspores imperfect, and still more significantly, some 40 per cent. of the whole can only display at best less than 10 per cent. of well-formed pollen capable of bringing about fertilisation. Lastly, seven forms, two certainly hybrids, produced practically no good pollen. And matters are much worse than the table suggests, for whilst only a comparatively small number of the microgenes showing aborted pollen were examined quantitatively, and therefore tabulated, *all* of those with above 50 per cent. good grains are included.

Whence, if pollen conditions may be invoked as a criterion of hybridity, it appears certain that almost all of our wild roses are latent hybrids, *Rosa pimpinellifolia*, *R. mollis*, *R. omissa* and *R. senticosa* being more or less honourable exceptions amongst the genuine natives, and *R. cinnamomea* and *R. rugosa* amongst the introduced and half-wild forms.

At the lower end of the scale the most noteworthy feature lies in the preponderance of the *Afzelianæ* in the worst class, in the massing of the *Rubiginosæ* in their neighbourhood, and the presence of the *Villosa* form *caerulea* in the same category. In all of these cases the matter is complicated by the occurrence of facultative apomixis. Despite this, as with all other microgenes, it appears almost certain that the pollen sterility is the outcome of latent hybridity, and the apomixis, therefore, a secondary effect of the same. Any discussion on this point will be reserved until the latter phenomenon comes up for treatment.

But if so many of our roses are thus contaminated, and *Rosa pimpinellifolia*, *R. mollis*, *R. omissa*, *R. senticosa*, of the real natives, and *R. rugosa* and *R. cinnamomea* of the others, have to a very great extent escaped, there must be some reason for their favoured position. Let us carefully consider each of these and its habits, to extract, if possible, any clue to their comparative immunity. Amongst them four sections are represented, *R. pimpinellifolia* belonging to the *Pimpinellifoliæ*, *R. mollis* and *R. omissa* to the *Villosæ*, *R. senticosa* to the *Eucaninæ*, and *R. rugosa* and *R. cinnamomea* to the *Cinnamomeæ*.

Rosa pimpinellifolia is the sole representative of its group within our islands; whatever variability it displays is slight, and no forms attaining the rank of a microgene exist. Again, its flowering period is manifestly earlier than its congeners'; furthermore, it prefers stations abhorred by its relatives, wind-swept moors, mountain scars, coast ravines, cliffs and sandhills being its chosen habitats. Hence, geographically, and in habit, *R. pimpinellifolia* is powerfully secluded from extra-specific influences, so that almost inevitably its purity is ensured to a very considerable extent. However, its seclusion is not perfect; in many northern localities it encounters *R. mollis* and *R. omissa*, not only geographically, but also in season; more rarely it meets with the *Eucaninæ* and *Afzelianæ*. Hybridity with all of these is not excluded, but so remote are its affinities from them that almost uniformly its hybrids are patent and non-fertile; they cannot perpetuate their kind, and do not form a significant factor in our rose flora. Their rarity is even more pronounced in Central Europe where *R. pimpinellifolia* rarely collides with possible partners.

R. mollis and *R. omissa* are similarly isolated. Northern in range, and early in flower, their purity is, in general, maintained but is far from being absolute. They can intercross to some extent, but only slightly, with the *Eucaninæ* and other groups, so that the *Villosæ*, in the main, produce perfect pollen. Still, forms like *R. caerulea*, undeniably a member of the *Villosæ*, do crop up and hint by outward characters, as well as in their pollen, at their development from previous crossing.

Rosa senticosa, however, proves more difficult of solution. A typical Eucanine, it grows in the same districts and flowers with its relatives; it may, therefore, cross freely with them. Nevertheless, one feature shuts it off from them. Its curiously lower habit of growth renders it an unfit subject for the hedges and thickets in which its nearest relatives revel; it delights in forming a low scrub of compact little bushes in deserted localities. Pollination, then, if the microgene is at all prone to allogamy, will most likely take place through the agency of low-flying insects which, only in rare instances, will have visited other *Eucaninæ*, *Afzelianæ* and the like; therefore contamination, although not prevented, is at a minimum.

Rosa cinnamomea and *R. rugosa* need not detain us long. Both are forms isolated geographically and otherwise, *R. cinnamomea* being Arctic and Alpine and possessing no closely allied relatives, and *R. rugosa* being a native of Japan. Seclusion even more powerful than with *R. pimpinellifolia* is at work to prevent their crossing with other forms, and thus their condition harmonises with that of that species.

If our explanation of the superior genetic purity of these forms, as deduced from the state of their pollen, is warranted, a necessary corollary immediately arises. Monotypical genera and species completely secluded by any circumstance whatever from outside influence should invariably produce perfectly formed pollen grains. To test this I have prepared and examined pollen of wild *Narcissus pseudo-narcissus* (from an isolated colony growing on the heather in Farndale, North Yorks, far away from any cultivated form), *Pyrus Aucuparia* (likewise from the moors) *Primula farinosa*, *Trientalis europaea*, *Ulex europaeus* and *Parnassia palustris*, all far removed from the disturbing influences of allied species. In every case the microspores were absolutely perfect.

The circumstances attending *Pyrus Aucuparia* are particularly interesting. In Europe it is an isolated species, but in Canada it has several related representatives like *Pyrus americana* and *P. sambucifolia*, and in these the pollen is far from normal.

In addition, if this holds good, the converse ought to be true: wherever any genus is represented in a given locality by many related species their pollen, by its variable size and cytoplasmic content, should suggest hybridity. Such is indeed the case as has been demonstrated by Jeffery for the *Onagraceæ*, Hoar for the *Rubi*, Standish for the *Crataegi* and Cole for certain cultivated *Rosæ* in America. Of these I have made an independent examination of *Epilobium* (a notorious hybridiser in the *Onagraceæ*) and of the Durham *Rubi*, and my results agree exactly with the accounts given by these workers.

Thirdly, a totally distinct consideration of the genus *Rosa* tends to confirm the same view. If roses of such remote affinities as *Rosa pimpinellifolia* and *R. lutetiana*, *Rosa rugosa* (from Japan) and *R. foliolosa* (from Texas) can be successfully crossed; if such complexes as the Gottfried Keller briar composed of { H. P. (Pierre Notting × Tea Madame Berard) × Persian Yellow } × (Madame Berard × Persian Yellow) can be built up; if this latter can then be crossed with satisfactory results with the H. P. Charles Lefebre, what possible obstacle can there be to intersectional crossing between the *Afzelianæ*, *Eucaninæ*, *Tomentosæ*, *Villosæ*, etc., or intermicrogenic crossings between the various members of any one of these sections? The failure to hybridise is unthinkable. Its occurrence is simply masked by the close relationship of the parents and the fertility of the offspring. Only rarely would it be detected otherwise than by the state of the pollen. However, I have performed this feat once myself in the case of a cross described later between *R. lutetiana* and *R. Lintoni* where the hybrid, *which ran down in the books to the dumetorum form aciculata*, grew sandwiched between what careful study in the field proved to be its parents.

Another hybrid, *R. mollis* × *R. canina forma*, involving the *Eucaninæ* and *Villosæ*, was brought to my notice by Traaen; this he collected under circumstances much the same at Brevik in Norway.

Finally, to prove experimentally that crossing between various members of the supersection *Caninæ* was possible, I transplanted several microgenes to the garden where they flourished and blossomed freely. After castrating several of their flowers, I cross-pollinated them and enclosed them in strong paper bags. Fertile seeds were obtained in nearly all cases, and their numbers and possible parentages are set out in the table on the next page.

The seeds thus recorded have been planted and appear to be germinating normally; the resulting plants, if hybrid in nature, will not be available for study for a long time.

A glance at the table will prove conclusively that hybridity, in spite of its ostensible absence, is at least feasible within the limits of the *Caninæ*, and serves to confirm the idea deduced from the pollen condition and the irregular course of its development, backed up by other weighty facts, that within the *Rosæ* we are dealing with multitudes of latent hybrids. Thus the production of new forms is rendered possible whenever cross-pollination brings together gametes of different potentialities. This would account for much of the variability of the genus and would, at first sight, offer some explanation of the segregation and passage of the common species-types throughout the groups. We have only to imagine in the production of various inter-Canine crosses the interaction of a series of linked* genes, involving the characters proper to any given species-type, and the whole matter is elucidated. A moment's thought, however, recalls the fact that any special species-type passes through species the purity of which is

* Although to my mind this does not explain the species-type, it may nevertheless be the correct view. Independently of these possible linked genes others do exist in *Rosa*. That a detailed analysis of their genetical behaviour has not been made depends on the slow growth of the plants; at any rate the attempt is being made. The following characters appear to be linked; glandular leaves are always biserrate; forms with deep red flowers have hairy foliage; erect and suberect, persistent and subpersistent sepals always accompany woolly flat heads of stigmas and early ripening fruit, whilst dilated and broad bracts are correlated with short peduncles.

TABLE II.—*Showing numbers of good seed per fruit in certain pure species and crosses.*

POLLEN PARENTS	SEED PARENTS.					
	MOLLIS TYPE.	MOLLIS VAR. CÆRULEA.	OMISSA.	RUBIGINOSA VAR. COMOSA.	VAR. LINTONI.	HYBRID OMISSA ×PIMPINELLIFOLIA.
MOLLIS TYPE	33 (Average of 12)	—	0 (All fruit fell)	—	—	—
MOLLIS VAR. CÆRULEA	—	22 (Average of 15)	—	—	—	—
OMISSA	0 (All fruit fell)	—	23 (Average of 9)	—	17	—
TOMENTOSA TYPE	—	—	31	Fruit full no count made	18	—
LUTETIANA	7	16	16	Fruit full no count made	15	—
GLAUCA VAR. REUTERI	—	—	13 (and many chaffy scales)	—	—	—
VAR. LINTONI	—	—	35	—	18	—
PIMPINELLIFOLIA	33	—	36	—	Fruit full no count	—
PIMPINELLIFOLIA YELLOW SCOTCH ROSE	—	0 Fruit fell	33	—	15	—
RUGOSA	—	—	—	Fruit full no count	—	—
Pollen parent unknown—Self-pollinated or apogamous?	—	—	—	—	—	27 and 7 chaffy scales (Average of 12)
APOGAMOUS	—	8	—	Fruit full no count	—	—

unassailable, and occurs in regions so far asunder as to place the original crossing, explanatory of the present segregation of the type, far back in Miocene and Pliocene times. Thus the hybridity, the existence of which we have almost certainly proved, whilst capable of explaining some of the peculiarities of the persistent species-type, cannot account for all. The species-type idea is absolutely independent of hybridity, although that phenomenon may tend to its perpetuation.

Hidden hybrids as the roses would seem, some at least are to be reckoned within the ranks of those classified under normal conditions as true-breeding. Excluding proved apomictical forms, *Rosa omissa*, *R. mollis*, *R. vinacea*, *R. flexibilis*, *R. Lintoni*, *R. frutetorum*, *R. pimpinellifolia* and *R. rugosa* have all been shown to reproduce their kind with reasonable fidelity within the permissible limits of fluctuating variation known for the group—an observation which, regarded in the light of the behaviour of Burbank's many "compounds," cannot exclude their basal hybridity.

Granting then that hybridity such as postulated here is rampant throughout the *Rosæ*, they seem to me to afford exceedingly unsafe material upon which to erect any fundamental theory in genetics; so, therefore, would the *Epilobia* which are in exactly the same critical state, as a very casual examination of a specimen of *Epilobium hirsutum* will show. An extension of the argument to the related *Oenothera*, which produces a similar wealth of allied species in America, and likewise displays bad pollen to a considerable degree, becomes then quite natural. Inevitably, we are bound to take up the position that, in all probability, the phenomena studied with such detail in *Oenothera Lamarckiana*, instead of being those of mutation, are rather those of hybridity, and the elaborate structure erected on them falls to the ground—a conclusion likewise drawn from other considerations during experimental work in Lepidoptera.

Pollination in the Rosæ.

Investigating as I was the possible effect of cross-pollination in the roses, I was compelled to study the matter in the field, when some very interesting and illuminating evidence was secured. Very early indeed I discovered that, to say the least, pollination in *Rosa* was conducted under peculiar circumstances. Every morning at 7 a.m. practically every young flower, no matter what its species, provided that its stigmas were mature enough to receive pollen, was already pollinated, and this maturity, since the roses are homogamous, was almost always shown at that hour. Thus it appeared almost certain that, if pollination was effected by insects, it could only be through the action of Noctuidæ flying at dusk and dawn, or through Diptera and Hymenoptera busying themselves at daybreak. To determine which was responsible I paid special attention an hour or so after sunset to the blossoms of the day, and to those just ready to burst. At that time, as if by magic, every flower young and old was folded up for the night. Unless then brought about by casual day-fliers like the Noctuids of the genus *Miana* the agency of moths must be ruled out. There remained then the operations of Diptera and Hymenoptera to be considered. I therefore got up earlier, at 4 a.m. (G.M.T.), before any insects were at work, when I found that even then every newly expanded *R. pimpinellifolia* had its stigmas powdered with pollen from its own overarching stamens. At the same time those of *R. mollis*, *R. omissa* and *R. Lintoni* were quite untouched. A little later even their anthers dehisced, after which, unless insect guests performed the necessary operation, on the maturing of the innermost stamen whorls they curved over and deposited their precious dust. In many cases indeed even this curving motion as a mode of self-pollination proved superfluous, for almost without exception, as the flowers mature, several stamens are locked between the stigma heads so that their pollen, as it is shed, of necessity falls on the adjacent stigmas. By one method or another, therefore, in default of outside agencies, self-pollination is automatic.

Independent of this definite mechanism for utilising their own pollen, the same effect is frequently brought about in diverse ways by insect visitors. Firstly, every flower bears its own colony of the widely distributed *Taeniothrips primulæ* —an insect, contrary to the indications of its name, very impartial in its predilections. This Thrips rarely leaves its own particular flower, but spends its time in wandering indiscriminately amidst stigmas and anthers, and thus unavoidably carries pollen from the latter to the former. Secondly, insects from elsewhere, whilst in some measure rendering cross-pollination possible, since they are always pollen eaters and not nectar* gatherers, crawl at random from anther to anther, touching the stigmas as they pass, and deposit strange as well as adjacent pollen with the same result as before. Thus, to a very unexpected degree, the roses prove autogamous; that cross-pollination can occur, and in a manner likely to secure hybridity, the following journeys of the bees *Bombus pratorum* and *Andrena trimmerana* will give adequate proof.

(1) Journey of a worker *Bombus pratorum*:—*Rosa mollis* var. *caerulea*, *R. pimpinellifolia*, *R. omissa*.

(2) Journey of a second worker *B. pratorum*:—*R. mollis* type, *R. mollis* var. *caerulea*.

(3) Journey of a female *Andrena trimmerana*:—*R. pimpinellifolia*, *R. mollis* var. *caerulea*, *R. mollis* type, *Saxifraga lingulata*, *Rubus idæus*, *Aquilegia canadensis*.

How generously the roses are patronised by insects, and therefore some degree of cross-pollination possible, can be determined from the table on pages 272 and 273.

With such a crowd of guests as this, and guests of such cosmopolitan tastes, could one be surprised, even where autogamy and apomixis to a greater or less extent prevail, if hybridity became exceedingly frequent?

Cleistogamy.

In such a genus as *Rosa* one would scarcely anticipate the occurrence of cleistogamous flowers, so little need does there

* Unless the shining secretion on the exposed disk of the *Eucaninæ*, *Agrestes* and *Tomentosæ* is nectar the *Rosæ* do not secrete that substance.

TABLE III.

Rose Microgene.	Insect Order or Group.					
	Thysanoptera.	Diptera.	Hymenoptera.	Lepidoptera.	Hemiptera-Heteroptera.	Panorpidæ (Neuroptera Sens. Lat.)
Rosa pimpinellifolia	Tæniothrips primulæ	Eristalis tenax Syritta pipiens Platychirus albimanus	Bombus pratorum Andrena albicans Andrena trimmerana	Pieris rapæ ♂	—	—
Rosa glauca var. subcristata	Tæniothrips primulæ	Helophilus pendulus Syritta pipiens	—	—	—	—
Rosa var. Lintoni	Tæniothrips primulæ	Syritta pipiens Polietes lardaria Bibio laniger Platychirus albimanus	Odynerus parietinus Odynerus sp. Bombus pratorum Bombus terrestris	—	—	—
Rosa lutetiana	Tæniothrips primulæ	Rhyngia rostrata Syrphus ribesii Volucella bombylans Syrphus pyrastri Syritta pipiens Platychirus albimanus Degeeria sp.	Lasius niger Formica fusca Megachile circumcincta Cœlioxys elongata Apis mellifica Bombus hortorum B. pratorum Halictus cylindricus	Miana fasciuncula	—	—
Rosa dumalis	Tæniothrips primulæ	Helophilus pendulus Platychirus peltatus P. albimanus Syrphus inanis Eristalis tenax	Bombus terrestris	Simæthis fabriciana	Psallus variabilis	Panorpis germanica

Rosa dumetorum	Tæniothrips primulæ	Syrphus pyrastri S. inanis Helophilus pendulus Eristalis tenax Rhyngia rostrata	Andrena trimmerana Apis mellifica Bombus hortorum Megachile circumcincta Halictus cylindricus	—	—	—
Rosa rubiginosa var. comosa	—	Sericomyia borealis	Bombus var. lucorum B. pratorum Andrena trimmerana Apis mellifica	—	—	—
Rosa mollis	Tæniothrips primulæ	Syritta pipiens Polietes lardaria Bibio laniger Platychirus albimanus Syrphus ribesii Helophilus pendulus	Vespa norvegica Apis mellifica Andrena albicans A wilkella A. trimmerana Bombus pratorum B. var. lucorum B. sylvarum Halictus cylindricus	Pieris rapæ Macroglossa stellatarum	—	—
Rosa mollis var. cærulea	—	Helophilus pendulus Degeeria sp.! Syritta pipiens	Bombus pratorum	—	—	—
Rosa omissa	Tæniothrips primulæ	Helophilus pendulus Lucilia cæsar Platychirus peltatus Pyrellia lasiophthalmia Syrphus spp.	Bombus terrestris B. hortorum B sylvarum	—	—	—

appear for their existence. Their development in *Viola* spp., *Oxalis acetosella*, *Lamium amplexicaule* and, to a less extent, *Drosera rotundifolia* and *D. anglica* is quite understandable. With the rapid growth of the surrounding vegetation in spring these species run grave risks of being overwhelmed and thus prevented from receiving the necessary insects. To avoid this contingency this very specialised method of self-fertilisation has been evolved. No such fate seems to threaten *Rosa omissa*, so that the discovery of a considerable number of cleistogamous flowers in that microgene occasioned great surprise. In general structure these were quite comparable with similar flowers of *Viola hirta*.

Their ovate lanceolate sepals were perfectly normal, but the involute petals, of the usual shape when straightened out, were reduced in dimensions to 8 mm. by 4 mm. In colour, they were greenish white. Otherwise, both the male and the female organs were quite ordinary. Most significantly, the amount of fully developed pollen attained the surprising figure of 100 per cent.—a contrast with the normal flowers of the same bush which yielded 70 per cent. good grains.

Apomixis.

The defective nature of the pollen in many rose microgenes seemed, at first sight, to constitute a very effective barrier to their reproducing their kind, and therefore stimulated enquiries as to how the affected forms did so. To this end bushes known to have produced very defective pollen were marked in July and visited in September. Without exception, these individuals then bore, if possible, a greater supply of hips than their companions. Further, in one instance, a *Rosa rubiginosa*, the plant grew five miles from another member of the genus. Only one explanation seemed to account satisfactorily for the observed facts, and that was that in *Rosa* some form of apomixis was prevalent.

To put this to the proof, in the following season certain blossoms on each of the shrubs transferred to the garden were deprived of their stamens (care being taken to remove those clasped between the styles) and enclosed in stout paper bags. The roses thus treated comprised representatives of *Rosa mollis*, *R. mollis* var. *caerulea*, *R. omissa*, *R. rubiginosa* var. *comosa*, *R. coriifolia* var. *Lintoni*, *R. pimpinellifolia*, *R. rubiginosa*, Penzance hybrid Lucy Ashton. In the same year, in June and July, a considerable number of forms were similarly castrated in an unfrequented lane running along an old waggon way abandoned a hundred years ago. Remote from the colliery village as this lane is, too many people use it as a short cut to admit of the possibility of leaving the twigs bearing the experimental flowers exposed in paper bags. I therefore very carefully cut the stigma heads off the mutilated flowers. The bushes so dealt with were *R. mollis*, *R. omissa*, *R. tomentosa* var. *sylvestris*, *R. lutetiana*, *R. dumetorum*, *R. coriifolia* var. *Lintoni* and *R. glauca* var. *subcristata*. In the garden all of the fruit fell save for those on the two *Rubiginosæ* and certain of *R.* var. *caerulea*. On the waggon way matters did not pursue the same course; by August 8th all of the *Villosa* forms had fallen, and by August 15th the *R. tomentosa* var. *sylvestris* and *R.* var. *Lintoni* had followed. Only hips of *R. dumetorum*, *R. lutetiana* and *R. glauca* var. *subcristata* thus remained.

A month later, of these, *R. lutetiana* and *R. dumetorum* alone persisted, accompanied by a solitary *R. glauca*. In October the surviving *glauca* hip had vanished; then, since they were now ripe, the two lots of Eucaninæ fruits were removed for dissection. When examined, not a single fruit contained anything save a few useless chaffy scales. In the *Rosa caerulea* from the garden the fruit contained eight seeds on the average against 20 in the case of those pollinated normally; the two *Rubiginosæ* supplied perfect seeds not differing widely in numbers from those flowers left exposed to chance pollination, self, insect, or otherwise.

The position of the *Rosa glauca* var. *subcristata* needs special attention. Unlike what occurred with the *Villosæ*, *Tomentosæ* and *Eucaninæ*, the beheaded fruits began to swell as usual and gave every promise of abundant seeds, as was disclosed when examples were opened for examination. The future wholesale failure was far from being suspected, and it was with considerable dismay I beheld the gradual dropping of the hips. The reason, however, was only too apparent after dissection ; on account of the sessile head of stigmas, to ensure their complete removal, I had cut too deeply into the fruit so that decay and insect enemies could work their will unhindered, thus causing its premature fall with its store of half-ripened seeds.

From these experiments we perceive that at least *Rosa mollis* var. *caerulea*, *R. rubiginosa* var. *comosa*, *R. rubiginosa*, hybrid Lucy Ashton and *R. glauca* var. *subcristata* are apomictical. All of the other microgenes tested would seem, at first sight, to depend for their successful seeding on pollination either by means of their own sound microspores or by foreign pollen conveyed by insects. However, experiments carried out during 1920 prove that all our local rose microgenes examined, save *Rosa arvensis* and *R. pimpinellifolia*, are to some extent facultatively apomictical.

Although not submitted to experiment, *Rosa Borreri* seems likewise to be apomictical. A certain shrub, whose pollen proved wholly defective when put under the microscope in June, was nevertheless decked with a brave array of crimson globes in October. One of these carried at its apex the unopened flower bud. This seems proof positive that in this particular blossom some type of apomixis had taken place, and suggested that the other fruits originated in the same manner.

Of course in this, as in all the other instances, the apomixis may be of the facultative order.

The proof of apomixis existing in *Rosa* does not rest solely on my work, for Dingler has proved it to occur in an unnamed *Rubiginosa* form, whilst Lundström demonstrated its existence in varieties of *R. glauca* and *R. coriifolia*.

A careful comparison of the degree of apomixis with the position of the affected forms in Table I., giving statistics for pollen abortion, tends to emphasise the very close connection between the two phenomena; almost without the faintest possibility of error they are the coupled effects of a common agency.

Now arguing from the analogy of known or patent plant hybrids, either produced artificially or detected in the field, we have urged that pollen abnormalities in *Rosa* and genera similarly affected depend on hybridity in a latent condition, or at least in a state not readily determined as such. This view was strengthened by the discovery that a *dumetorum* form, classed as *R.* var. *aciculata*, was in reality a cross between *R.* var. *Lintoni* and *R. lutetiana*, and that its pollen was exceptionally bad. Carrying the argument to its legitimate conclusion, we are compelled to take up the view that in the *Rosæ* apogamy, or whatever form of apomixis they present, is a phenomenon originating in hybridity—an opinion advanced from other data by Ernst.

Quite recently Gates has attempted to show that apogamy was intimately bound up with tetraploidy and octoploidy, whilst earlier Strassburger and Rosenberg, formulating the same idea in a cruder form, tried to trace a connection between apogamy and a high chromosome number both in species of the present genus and in those of related genera. In particular, Rosenburg insisted that the *Rosa* species with a haploid number of eight chromosomes—*R. livida*, *R. cinnamomea*, and certain *R. canina* forms—were "sexual," whilst those with 16—*R. canina* var. *persalicifolia* and *R. glauca*—were apogamous. In the first place, Rosenberg's figures are absolutely fallacious. Every* rose I have examined appertaining to the *Tomentosæ*, *Afzelianæ*, *Eucaninæ* and *Rubiginosæ* has been endowed with a diploid number of thirty-five, and is, therefore, pentaploid, whilst the *Villosæ* and *Pimpinellifoliæ* possess twenty-eight, and are thus tetraploid, as Rosenberg would have discovered had he pursued their cytology further.

* Except a dubious example possibly referable to the *Rosa stylosa*.

These facts support, to some extent, Rosenberg's conception of the linking of apogamy and high chromosome number but nullify the attempt to correlate apogamy and tetraploidy *quâ* tetraploidy—at any rate in this genus; for within its limits we have on the one hand the tetraploid* *Pimpinellifoliæ* microgenes pollinated normally, and on the other the tetraploid *Villosæ* apomictical. Except by analogy, since none of the British *Rosæ* are octoploid species, their evidence neither confirms nor confutes the possible relation which Gates, on the basis of Strassburger's work, draws between octoploidy and apogamy in *Eualchemilla*.

Returning now to the dependence of apomixis on hybridity, let us attempt to discover how the latter can induce the former. Since the supersection *Caninæ* and the allied *Synstylæ* include both sexual and apomictical microgenes, and further since the former is the more primitive and normal state in the *Rosaceæ*, it is a reasonable assumption to make that the apomictical roses are derived from the sexual types. Moreover, it seems a fair deduction from the foregoing work to regard many rose microgenes as latent hybrids. If they are hybrids they can be between forms whose physiological divergence is slight or between forms where it is great. Suppose a cross of the second type to take place. Arguing from the analogy of the *Linaria* hybrids, or, appealing to the animal world, of the two *Oporabia dilutata-autumnata* hybrids in which in the reduction division few or no chromosomes find partners, we may anticipate similar happenings in the F1 generation of our wide rose cross. Hence, in the pollen formed, in place of the reduced number of chromosomes we have the full somatic number. This pollen, again, if the power of the *Linaria* pollen or of the *autumnata-dilutata* spermatozoa is any criterion, will be defective and therefore impotent—deficiencies leading to its collapse. In the same way, in megaspore formation we have a similar failure of reduction, so that when the egg nucleus appears finally, even prior to fertilisation, it

* *i.e.* if we regard the haploid chromosome number of seven encountered in *R. arvensis* and *R. rugosa* as the base.

may carry the full unreduced chromosome complement. What is more natural than to assume that, spurred on by the stimulus of heterozygosis, this cell is capable of development just as if it had been normally fertilised? Even were the pollen functionally active the position here is unaltered; the only difference would be that apomixis would be facultative.

Thus an apomictical race would come into being capable of little variation and therefore faithfully reproducing its kind, like the apomictical *Rosa rubiginosa* mentioned previously, the seeds of which have been planted and from them young shrubs grown.

If, however, the cross was between roses of less remote relationship, then in the maturation division of their F1 hybrids dislocation more or less serious of the ordinary mechanism may occur, some chromosomes finding mates, others vanishing and so on exactly as described above. Hence, whilst many microspores will collapse, others will possess nuclei carrying normal or nearly normal chromosome numbers. These latter will be perfectly active, and like the similar sperm of the *autumnata-filigrammaria* hybrids differing but little in power from those of a pure species. If events in the female apparatus follow a parallel course the mature embryo sac will, in many cases, contain the egg-cell and egg-apparatus complete and prepared for the advent of the male nucleus. Fertilisation is thus possible, and apomixis unnecessary. If, however, the chromosomes are the heredity bearers, and their distribution in the micro- and mega-spore development anomalous, then the potentialities of the fertilised egg-cells will vary greatly, and thus account for the huge range of variation seen more especially in the fertilised roses.

Should this be the correct explanation of the genesis and continuance of apomixis in the roses, then it offers an adequate explanation of constant hybrids in the plant kingdom, and also of the multiplication of "species" in such critical genera as *Hieracium*, *Rubus*, *Mentha* and *Salix*.

With dominance in the apomictical forms, and dominance followed by segregation in the sexual microgenes, it is clear that the notion of the species-type remains unaffected.

Polyembryony.

Linked up in some way with apomixis, and depending like it on the presence of unreduced chromosome numbers in the cells of the egg-apparatus, in many roses these cells, as well as the egg-cell proper, develop into embryos. Thus *Rosa* produces for our benefit a further complication, that of polyembryony. Concerning this I cannot say more at this juncture, for work in this direction is not complete.

IV.—PHENHYBRIDS OF ROSA.

So homogeneous in their traits are the various members of the supersection *Caninæ*, and so delicately graded are the relations between the sections, that only in exceptional cases could intersectional hybrids be detected as such. If that is true of such wide crosses as those between sections, then the extreme difficulty of distinguishing hybrids of the various microgenes within the same section by ordinary macroscopic features will be plain. Further, if hybridity between parents so related does exist (and from what has been said previously we know that it does), only pollen conditions under ordinary circumstances will betray it. Nevertheless, even that criterion will fail to give the faintest indication concerning the microgenes which gave rise to any given plant. Clearly then, this chapter, which will deal with wild plants patently hybrid, cannot in general include inter-Canine crosses; still, as we shall discover, two* such are brought forward, although their recognition was due to exceptionally favourable conditions. Moreover, since the work described here was carried out in northern counties, where the only other section occurring in quantity sufficient to give a reasonable prospect of hybridity is the *Pimpinellifoliæ*, we have to consider, in the main, crosses

* Since this above was written Jebe of Christiana has indicated several other similar hybrids.

between it on the one hand, and the *Afzelianæ*, *Eucaninæ*, *Rubiginosæ*, *Agrestes*, *Villosæ* and *Tomentosæ* on the other. To determine hybrids of such origin would, at first sight, seem to present little, if any, difficulty, so sharp is the break between the latter six sections and the *Pimpinellifoliæ*. In spite of this, so used were rhodologists to the gentle way in which their multitudinous species appeared to merge into one another, that even in such cases they followed, without hesitation, their usual proclivities for the erection of new species. Any hybrid on its discovery thus passed with its real nature unrecognised into the wordy chaos which overwhelmed all rose forms—species, microgene, variety and hybrid alike. This being so, before referring to our local forms, we shall endeavour to trace the steps by which the real genetical character of these forms was ultimately established.

History of recognised Rose Hybrids.

Their history may be stated to have commenced with the finding of *Rosa hibernica* in County Down. This rose, although collected by Templeton in 1795, remained undescribed until 1803 when he published a short diagnosis in the Transactions of the Dublin Society; independently, Smith followed this by another and only slightly more comprehensive one in English Botany, tab. 2196 in 1810. Borrer's detailed description in British Flora III. p. 231 (1833) supplements both but, significantly enough of his attitude towards it, he ends his remark with the following phrase:—"A satisfactorily distinct species intermediate in habit and in size of leaves between *Rosa spinosissima* (*pimpinellifolia*) and *R. collina* *β*. Woods, but in its fruit and in the presence of setæ nearer to the former." As Woods applied the name "*collina*" to a Eucanine form this was an excellent representation of its relationship in the light of the knowledge of the "thirties" of the nineteenth century. Baker in his Monograph (1867) could add little to these descriptions but, nevertheless, brought forward new localities in England, as well as in Ireland, and had, moreover, already published an account of his new variety *glabra* in his earlier "Review." Yet one remark in the "Monograph" seems, when viewed in connection with later developments, to be very illuminating. He says: "In general habit, when in flower, the ordinary glabrous English form has just the same sort of resemblance to typical *canina* that *Doniana* [*Sabini*]* has to *mollissima* [*mollis*]."

Six years later, in 1875, Dr. Christ, the Swiss botanist, once again raised the subject in the Journal of Botany, and deliberately propounded the question "What is *Rosa hibernica* Smith?" To this he supplied the answer, "Ce rosier est un hybride entre le *R. canina*, L., et le *R. pimpinellifolia*, L.," adding as his reasons its mixed characters (armature of *spinosissima*, fruit of *canina*, etc.) and, most important of all, its manifest sterility—the then recognised criterion of the interspecific hybrid. Furthermore, he pointed out that Fries had determined the glabrous form of *Rosa hibernica* (= var. *glabra*, Baker) to be *Rosa spinosissima* × *R. canina*.

At the time these views were not adopted universally, and those contrary to them were never absolutely confuted; nevertheless, no one to-day disputes their validity.

Events moved on similar lines with the parallel hybrid to this in which *R. spinosissima* [*pimpinellifolia*] and *R. tomentosa* (*sens. latiss.*) took part, for in 1809 Smith brought forward in *Flora Britannica*, as a new species, a Scotch rose which he termed *Rosa involuta*. This was speedily followed by the description of those alleged species by Woods in 1816, *Rosa Sabini*, *R. Doniana* and *R. gracilis*, to wit. In this case, the critical eye of Lindley perceived glimmerings of the truth very early, for, in his "Monograph" (1821), we find him asserting his doubts as to whether, after all, this is not a product of *R. tomentosa* var. *mollis* [*R. mollis*]—a remark repeated by Hooker in *Flora Scotica*. Still more allied forms turned up, *Rosa Wilsoni* erected by Borrer in 1835, *R. coronata* collected by Crepin in Belgium in 1858, *R.* var. *Robertsoni* described by

* Words in square brackets added by me.

Baker in his "Review" in 1864, and *R. gracilescens*, *R. Smithii*, *R. laevigata* and *R. occidentalis* by the same worker in the Monograph in 1869.

In none of these cases, save *R. Wilsoni*, was hybridity suspected. That curious form, however, aroused suspicions in the mind of Borrer, for in speaking of it he asks "Can it be a hybrid product?" and follows this with the remark, "Mr. Wilson finds several bushes of it, which discourages such an idea."

Thus a fact that, after due examination by a competent geneticist, would have strengthened his earlier suspicions served to lull them with Borrer. Had the phenomenon of heterosis been recognised then, the remarkable speed with which these hybrid roses spread vegetatively, and in doing so give rise to clumps independent of the parent bush, would inevitably have directed attention to the fact that all the *Wilsoni* bushes occurred along the Menai Strait, and radiated from one centre.

Once again Christ supplied the key to the derivation of *Rosa involuta* and its satellites. By careful analyses of its characters, coupled with other pertinent facts, he proved beyond cavil that it had sprung from a crossing of *Rosa spinosissima* and *R. tomentosa* (*sens. latiss.*)

If we remember that in making these decisions the widest view has been taken of *Rosa canina* regarding it as equivalent to the *Afzelianæ* + *Eucaninæ*, and of *R. tomentosa* by looking on it as including the *Villosæ* and *Tomentosæ*, on the same basis one more combination is possible, and that is *Rosa pimpinellifolia* × *R. rubiginosa*. Precisely as in the other two instances, roses of this parentage had actually been encountered, *Rosa biturigensis* described by Boreau in 1857, and *R. involuta* var. *Moorei* by Baker in 1869. Moreover, the relationship of the former plant had already been determined in a fairly accurate sort of way, since Boreau terminates his description with these words, "Looks like *R. pimpinellifolia* but nearest *rubiginosa* in its characters, differing therefrom in its prickles, earlier white flowers, and smooth peduncles, etc. This form occupied a great area, and if it were a hybrid as Schultz asserts, one would scarcely anticipate its being more abundant than its parents."

Once again we learn that the stimulus imparted by heterozygosis had sufficed to emphasise an origin correctly determined from other considerations to be hybrid, but that lack of knowledge of such an impulse had caused its indications to support the opposite view.

Baker in the same way recognised the true affinities of his plant for he says, "I cannot tell whether this is more like *Sabini* or *rubiginosa*. . . . . It comes very near to the French *Rosa biturigensis*." Recollecting that *Sabini* is a *pimpinellifolia-tomentosa* hybrid, we are bound to confess that this closely approximates the truth, although the resemblance to *Sabini* caused its description as an "*involuta*" form.

In spite of all these shrewd surmises, it was left to Crepin to point out 25 years ago the exact value to be attached to these plants, and his opinion was confirmed by Marshall's discovery of a *biturigensis* form in Kent, which could only arise from a crossing between the *Rubiginosæ* and *Pimpinellifoliæ*. A little later, in 1897, Barclay gathered the same hybrid in Perthshire, and further repeated his good luck at Port Seaton, in Haddington, in 1910. In addition, Prof. Traill detected the same plant at Turriff in Aberdeenshire, as did Miss Hayward at Melrose.

Here again the powerful stimulus of heterozygosis had played its part, and, to such an excellent observer as Barclay, the fact caused much thought. I cannot do better than quote his exact words in discussing his find. "I had the good fortune to fall in with a rich colony of the hybrid, consisting of twenty or thirty great clumps spread over nearly a mile of the coast. . . . It has often been remarked that hybrid plants frequently excel their parents in size and vigour. This was strikingly exemplified at Port Seaton. The hybrid there forms magnificent bushes, growing to a height of ten to twelve feet, twice the usual height of the sweet briar (*Rosa rubiginosa*), which again is usually a taller plant than the Scotch rose (*R. pimpinellifolia).* Like the other hybrids which I have mentioned it forms clumps rather than bushes. In this point we see clearly the influence of *R. pimpinellifolia.* This sends out numerous suckers from the roots, which themselves produce roots, and soon produce a thick cluster of daughter plants around the parent stock. All its hybrids partake of the same character, and I have seen a clump of *R. involuta* extending for a distance of 20 yards, the whole evidently having arisen from one single original plant."

Modern Conceptions regarding them.

Since Christ made his original determinations the study of roses has been revolutionised, and, in spite of the silly erection of multitudes of "sawdust" species, microgenes which actually exist, and therefore can be recognised in the field, have been described. Further, their systematic positions have been accurately made out. As a result we have the separation of the *Afzelianæ* from the original *Eucaninæ*, the *Agrestes* from the *Rubiginosæ*, and the *Tomentosæ* from the *Villosæ.* No longer does it suffice to say that *Rosa hibernica*= *R. pimpinellifolia* × *R. canina*. *R. canina*, when that diagnosis was first made by Fries, was a very comprehensive aggregate. To British authors not obsessed with the splitting mania, it now breaks into four* collective species, *R coriifolia*, *R. glauca*, *R. canina* and *R. dumetorum.* Each of these possesses numerous microgenes, each of which may be involved in a cross with *R. pimpinellifolia.* Still, let us note, the opportunities for crossing are not very great; differences in habitat and time of flowering interpose very effective barriers, so that even to this day hybrids of this type remain very rare. They do, however, occur both in the north and in the south of our island. If they appear in the south, since *R. glauca* (agg.)

*I only admit two, for I regard the first pair and the second pair as each forming an aggregate species.

and *R. coriifolia* (agg.) are boreal groups, the second parent is bound to be either a *canina* or a *dumetorum* form. Should the leaflets be hairy beneath, then *dumetorum* is the second parent; if glabrous, then *canina*; which microgene of either is not determinable except under specially favourable conditions in the field, or when very striking features characterising any special microgene reappear in the hybrid.

Matters in Scotland, Ireland and in the North of England generally are on a different footing. In these localities all four aggregates flourish, so that hairy leaflets simply assert that the plant is either *dumetorum* × *pimpinellifolia*, or *coriifolia* × *pimpinellifolia*; glabrous leaflets, or the contrary, imply *glauca* or *canina* × *pimpinellifolia*. Fortunately enough, seclusion of special forms in mountainous districts, or in coast ravines, occasionally assists in a diagnosis; so, too, does the almost universal impotency of *glauca* pollen. Therefore, whilst the occurrence* of a *glauca* × *pimpinellifolia* cannot be referred to as impossible, any glabrous *hibernica*, no matter where gathered, is almost certainly the product of a crossing between *R. pimpinellifolia* and some *canina* microgene.

Again, but rarely indeed in my experience does any *coriifolia* form come into contact with *pimpinellifolia*, so that the matter is narrowed down to circumstances not differing widely from those in the south. Nevertheless, in one or two ravines on the Magnesian Limestone in Durham, the rose flora comprises only *Rosa mollis*, *R. coriifolia* var. *frutetorum*, and *R. pimpinellifolia* var. *spinosissima*. Any so-called *hibernica* there must be generated from the setose-peduncled form of *R. pimpinellifolia* and *R.* var. *frutetorum*, as in the case of the specimen figured in Plate XII.

With *Rosa involuta* and its allies matters are complicated in much the same way. Christ, as we mentioned, looked upon

* On May 29th, 1920, I discovered an undoubted *glauca* × *pimpinellifolia* on a ledge just under a raven's nest on Falcon Clints, Co. Durham. The only *Rosa* at that elevation (1,600 feet) were *R. pimpinellifolia* and *R. glauca* (*forma* ?).

it as a *tomentosa* × *pimpinellifolia* hybrid—a designation now wholly insufficient. The *R. tomentosa* of those days, although shorn of the *R. mollis*, was yet wide enough to cover many microgenes now transferred to the *Villosæ*. Even allowing for this far-flung *R. tomentosa* it is as certain as anything can be that the names *involuta*, *Sabini*, *Doniana* and *occidentalis*, if not others, were applied to plants of *mollis* × *pimpinellifolia* parentage as well as to *tomentosa* (agg.) × *pimpinellifolia*. Of course, southward of a line from Yorkshire to Wales, the latter origin was certain; northward of this nothing was sure; *mollis*, *omissa*, *tomentosa* in the guise of any of their segregates might very well enter, although in descending order of frequency; firstly, because the period of flowering in *R. mollis* more nearly synchronises with that of *R. pimpinellifolia*; secondly, because those two species, as in the coast denes of Durham, occupy common habitats, and lastly, because *tomentosa vera* and its microgenes thin out with extreme rapidity northward.

In Durham and Northumberland, *R. rubiginosa* is certainly not a genuine native, and never, as far as I know, comes into contact with *R. pimpinellifolia*; these counties, therefore, cannot produce *R. biturigensis* or any of its varieties. For the specimen figured (Plate VIII. A) I have to thank Mr. Barclay, and judging from its general appearance, I have very little doubt but that in this case, and in the vast majority of others, the hybrid had for its parents *R. pimpinellifolia* and the *R. rubiginosa* form *comosa*. In the species-section *Agrestes* no hybrids have been reported.

The only other wild rose phen-hybrids known to me are inter-Canine, and they include the *lutetiana* X *coriifolia* referred to above and the *mollis* X *canina* from Norway. At this juncture I have no intention of going into minute details of these or of the numerous other hybrids I have seen growing naturally, nor indeed do I intend, in general, to give full descriptions at all; whatever remarks I have to offer will be reserved for the concluding portion of the paper, when, for the first time, many of these crosses are figured.

Their uneven Geographical Distribution.

One very striking feature of the rose hybrids we have considered thrusts itself upon us, and that is the manifest inequality of their geographical distribution. For every single hybrid shrub discovered in the South of England, dozens have been detected in the North and in Scotland and Ireland. As I have explained, this proceeds from the nearness of *mollis* and *pimpinellifolia* in their flowering season, and secondly from the lateness of spring in these latter areas tending to mass, as it were, the periods for blossoming of all the forms very close together. Great as this disparity is with us, it is still further accentuated on the Continent. There, rose hybrids of the patent type are extremely unfrequent, and this, I think, depends on an exaggeration of the facts governing their occurrence with us, involving a much more sharply marked period of flowering in the earlier *pimpinellifolia*, aided by the restricted area inhabited by the northern *Rosa mollis*. With a renewal of northern climatic conditions, as in Norway, hybrids in the genus attain the same frequency as in the northern portions of our island. Nothing could surpass the magnificent set of *mollis* X *pimpinellifolia* hybrids I have obtained from various stations in the west of Norway.

Their Powers of producing Good Seed.

Probably one of the causes leading to the tardy admission of the hybrid nature of the forms discussed above was the erroneous ideas which were current as to their fertility. This fertility was so contrary to the preconceived notions of hybrid sterility which held sway that it served to mask the real state of affairs. To a very great degree the vogue of the idea, and the failure of books to disclose the almost uniform barrenness of recognised rose hybrids, arise from the fact that, as just shown, such hybrids are infinitely more prevalent in the north; in consequence, they are usually collected by visiting botanists shortly after the fall of the sepals. Then, owing to the effects of heterosis and the exceptional display of flowers provided by the bushes, everything seems normal. Visit the same bushes a very short while later, and note the changed scene. Gone is the plentiful promise of fruit, and all that remains for our inspection is a shrub abundantly endowed with leaves and a site strewn with countless shrivelled, immature fruits—at least this has been Barclay's experience as well as mine. Figs. 28–31, Plate XXII., will illustrate the stage at which the shrubs most accessible to me cast their hips.

Personally, I have only encountered two fertile wild hybrids, one the *lutetiana* X *coriifolia* var. *Lintoni* already mentioned, and a *mollis* X *pimpinellifolia* from Corbridge, Northumberland. Fruits of the former are to be seen in Fig. 25, plate xxi., and of the latter in Fig. 30, plate xxii., whilst those of their putative parents appear in Figs. 8, pl. xvii.; 16, 17, 19, pl. xix.

Mr. Barclay's experience of fertile hybrids is even more limited than my own. Whilst, favoured by his more northerly home, he has inspected many more hybrid bushes than I, he has only fallen in with one fertile specimen, the parentage of which he was able to ascertain with absolute precision to be *R. omissia* X *R. pimpinellifolia*. The shrub in question, classed as an *involuta* form, grows near Auchterarder railway station, Perthshire, and a fruiting twig plucked from it is shown on Plate X., and fresh 1919 hips on Figs. 21 and 22, whilst Fig 23 (plate xx.) depicts last season's fruit from the actual parent *omissa*. With his Haddington *pimpinellifolia* X *rubiginosa* matters are apparently the same, and the plant yields an enormous supply of perfectly ripened fruits. However, if one opens them another tale is told; only in a few cases do they contain more than a mass of chaffy scales. Barclay, nevertheless, gives the facts concerning a *pimpinellifolia* X *rubiginosa* reared artificially by Wilson, of St. Andrews. This undoubtedly fruited satisfactorily, and, moreover, its seeds germinated so freely that an F2 generation has been grown. One plant of this lot leant unmistakably towards *R. pimpinellifolia*. Many other garden hybrids of *R. rubiginosa*, like Lucy Ashton, Anne of Geierstein, etc., which

I have examined, likewise yielded fertile seeds. The connection between these observations and those of Barclay, in view of the phenomenon of apomixis displayed by *R. rubiginosa*, seems significant.

Lastly, in the lengthy series of examples of *mollis* X *pimpinellifolia* and of *mollis* X *canina (forma ?)*, received by me from the Norwegian rose student Traaen, practically every hip dissected had its quota of neatly shaped, well filled seeds; very scarce indeed were the chaffy scales so numerous in the majority of hybrid fruits. Considered alongside my fertile *mollis* X *pimpinellifolia* cross, these Norwegian specimens from Mostero, etc., by their fertility, throw some light on the relationship between the two component forms, and suggest that *R. mollis* and *R. pimpinellifolia* are much more closely allied than one naturally expects. If we couple this suspicion with the fact that *R. pimpinellifolia* can throw a semi-Villosan form in the Faroe Islands, the near genetical dependence of the one on the other seems reasonably well established.

Ripened fruits and fertile seeds, therefore, in the widest rose crosses, are the exception rather than the rule, and we must dismiss as inaccurate the optimistic views of Smith, Hooker, Baker, Dumortier, Woolly-Dod and others.

Observations on the Hybrid Forms.

(1) *R. pimpinellifolia* X *R. lutetiana.*

I found a plant, unfortunately badly damaged by fire, referable to the above cross in a dene near Horden, Durham. It was growing at a wood edge where the tiny sandhill form of *R. pimpinellifolia* (var. *spinosissima*) came into contact with a mass of a rose with very dark glaucous leaves, running down to the variety *glaucescens* of *R. lutetiana*. To the latter the hybrid approached very nearly in the colour and serration of its glabrous leaves, although its armature was midway between that of *glaucescens* and *spinosissima*. This is the *R. hibernica* var. *glabra* of Baker. Almost certainly the rose recorded by me from Cowpen Bewley as *pimpinellifolia* X *glauca* in the same plant.

(2) *R. pimpinellifolia* X *R. dumetorum.* Plate XI.

This also occurred on the Magnesian Limestone in Durham and at different points. None of the bushes bore fruit on August 14th except that figured, and even in this case 95 per cent. had fallen. A careful study of this bush, and comparison with its neighbours carried out in the field, incline me to consider it as a cross between *pimpinellifolia* and *R. dumetorum* (*sens. str.*) None of the bushes attained the height of a normal *R dumetorum*, but one very low one straggled over a tremendous area in the manner characteristic of rose hybrids; in connection with the former observation, the flattening influence of the prevailing north-east winds from the sea must not be lost sight of. Even oaks and ashes yield to it.

(3) *R. pimpinellifolia* X *R. coriifolia* var. *frutetorum.* Plate XII.

One of the coast ravines adjoining the Black Hall Rocks protects enormous thickets of *R. mollis*, *R. coriifolia* var. *frutetorum*, *Ligustrum vulgare*, and on the sandy patches *R. pimpinellifolia* var. *spinosissima.* The *coriifolia* leaflets were densely clad with a tomentum both above and below, and whilst undeniably more decided in its biserration than usual, the plant could only be assigned to the variety named. Near by grew the present hybrid in the shape of a young bush; attaching due weight to the surrounding plants and to its leaf, prickle and other features, its parents are as given. This rose is *R. hibernica* var. *laevigata.* I have a plant substantially the same from maritime localities in Norway.

(4) *R. pimpinellifolia* x *R. rubiginosa* var. *comosa.* Plate VIII.

The plant in the sketch is from the East Lothian colony of Barclay and was collected in September. At this date its fruit was fully developed and perfectly ripe, as is apparent from the figure, although its good seeds are few. For Barclay's remarks on this hybrid see page 284.

(5) *R. pimpinellifolia* X *R. mollis.* Plate IX.

The example shown was obtained at Corbridge, Northumberland, on July 16th, 1919. Even at that early date its fruits were reddening and contained an adequate stock of perfect seeds. The early ripening is in itself enough to determine the *mollis* parent, because that species exhibits its array of cernuous crimson globes weeks before its allies of the *Tomentosa* and *Villosa* sections. Even were this not so, the neighbouring bushes were practically all macrophyllous *R. mollis* which the hybrid resembles strongly in fruit, foliage and prickles. The central plant was linked up by underground stems with other clumps covering nearly a score of yards of a steep bankside.

On paper, the bushes fall under *Rosa Sabini*, but since that name covers hosts of crosses between *R. pimpinellifolia* and the *Villosa* and *Tomentosa* allies, it is quite an unsatisfactory designation.

(6) *R. pimpinellifolia* X *R. mollis* (from Norway). Plate XV. B.

Compared with the bulk of the British examples resulting from the same crossing, the most peculiar point about these Norwegian specimens is the preponderatingly microphyllous character of which the photograph gives an excellent notion. Although I possess about 40 examples selected from as many bushes, the majority depart but slightly from the plant in the figure. Its most noteworthy characters are its fertile seeds, rounded leaflets, long setose peduncles, prickly fruit, the strongly bipinnate pair of sepals and the strong reddish coloration of stems, petals, bracts and sepals, the latter feature recalling certain varieties of *R. mollis*. Furthermore, attention must be directed to the enormous and fairly regular development of the prickles of the main stem, as well as to the half-opened flowers, which caused Smith to apply the name *involuta* to parallel forms. This trick of exhibiting half-expanded blossoms is not universal; most that I have studied behaved quite normally.

Two or three specimens, of which the inset on the left of Plate XV. B represents a leaf, are so abnormally microphyllous as to suggest as their possible origin a back cross between such a plant as I figure and *Rosa pimpinellifolia.*

(7) *R. pimpinellifolia* X *R. omissa.* Plate X.

Again I have had to rely on Mr. Barclay for the specimen placed before us in this plate. It was collected from his fertile Auchterarder bush; from its fruit, foliage, and glandular development, assisted by a reference to the bushes growing with it, Barclay satisfied himself that its parentage was that just stated. Its exaggeration of the prickle armature on fruit and peduncles is very noteworthy, and is typical of many *pimpinellifolia* hybrids. Since, in many instances, this surpasses in strength that of its parents, it caused much tribulation in the minds of early workers. No doubt the phenomenon is to be attributed to the action of heterosis.

(8) *R. pimpinellifolia* X *R. omissa.* Plate XIII.

Once more Northumberland provided the specimen illustrated. This was gathered near Slaley on the same day as the *pimpinellifolia* X *mollis* described previously. On that date, July 16th, 1919, the fruit shown was about the best left on the bush. Under the plant, on the clayey bankside, thousands of immature fruits lay rotting, and others were ready to follow them.

Relying on book descriptions, this plant would appear to be *R. Sabini*, and has been so called by such a competent observer as Baker. Comparison with Plate X. will reveal what a heterogeneous mass comes under that name. My determination of its origin depends on critical examination of the plant and its neighbours.

Baker and Tate refer in their "New Flora," 1868, to the very bush, and localise it so exactly that no mistake is possible; this means that this plant has persisted in its original station for 60 years at least.

(9) *R. pimpinellifolia* X *R. tomentosa* var. *sylvestris*. Plate XIV.

The present plant grows in a shady lane leading from Hawthorn Dene to the village of Hawthorn, Co. Durham, and was first observed on August 13th, 1919.

Unlike the previous specimens we have brought under examination, it was a drawn-up, feeble-looking plant, and differed most obviously from all the other hybrids of the group in my possession by its bright green, heavily glandular foliage. At the date in question, its unripe hips were just commencing to fall. This suffices, in itself, to indicate that its second parent was not the *R. mollis* or *R. omissa* of the Corbridge and Slaley plants. Independently of this the *Villosæ* and *Tomentosæ* were but weakly represented in microgenes in the vicinity, although, just as in other coast denes, *R. mollis* covered acre after acre, and excelled any other form in individuals. The only *Tomentosa* variety about was *R. tomentosa* var. *sylvestris*, and this coincided in colour and type of foliage, and in gland and prickle development with our plant. In a flora one would see it determined as *R. gracilis*, so that if all plants passing under that name are genotypically alike they are derived from a crossing between *R. pimpinellifolia* and *R.* var. *sylvestris*.

(10) *R. mollis* X *R. canina* (*forma*?) Plate XV. A.

Without very close inspection, in the form of its glabrous leaflets, the flexuose nature of its internodes, the more or less reflexed sepals, this plant has a strong *canina* look Examination of the setose fruit and peduncles, its woolly flattish head of stigmas, its copiously compound serrate leaflets, its dilated stipules, just as strongly insists on the influence of *R. mollis*, whilst the prickles are a very obvious compromise between prickles of the straightish, thin *mollis* type and the stout uncinate ones of the typical Eucanine. Altogether, the plant is a good intermediate between the plants named.

(11) *R. coriifolia* var. *Lintoni* X *R. lutetiana*. Fig. 25, Plate XXI.

This forms a stout luxuriant bush. In its flowers the colour of the corolla seems to be a delicate pink intermediate between the white of *lutetiana* and the clear rose of *Lintoni*; similarly, too, the shape of the petals strikes the mean, for they are neither so broad as those of *lutetiana* nor so narrow as in *Lintoni*. In the calyx, the sepals are more strongly glandular and pinnate than those of *lutetiana* and to a great extent approach *Lintoni*. The latter form has a broad woolly head of stigmas sessile on the disk; this has a much narrower head, slightly larger, subspherical, far from sessile, and weakly hispid; in *lutetiana*, as we know, the protruding stigma head is nearly glabrous. The lengths of the peduncles are intermediate. The bracts, stipules and prickles, in colour, shape and other minor characters, are not so far removed from *Lintoni*.

The leaves are dark green and keeled and remind one of *lutetiana*; still, the teeth, whilst not so marked, bear the three or four glandular denticles of *Lintoni*. Influenced by the same form they exhibit beneath a feeble hairiness on the primary veins, but only rarely do glands appear; when they do, they resemble the reddish ones of *Lintoni*.

On July 21st, 1919, the sepals of the hybrid were horizontal, those of the adjacent *Lintoni* half erect, and those of *lutetiana* reflexed. At that time *Lintoni* fruits were the largest by far, and, as a matter of fact, both the hybrid and *lutetiana* were still flowering.

To sum up, as a bush and broadly speaking, it is liker *lutetiana* and was at first regarded as a phase of that microgene; in its minuter details it follows *Lintoni*.

I call it *Rosa* hybrid *promissa*.

For all the figures, except those in the text, and Plate VIII., fig. B, and Plate XV., I am indebted to Miss Monica M. Hull.

Armstrong College,
March 25th, 1920.

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A

B

PLATE VIII.—A. *Rosa pimpinellifolia* x *R. rubiginosa*.

B. *R. eminens* (Durham).
A *Villosa* form showing sepals rising on ripening fruit.

PLATE IX.—*Rosa pimpinellifolia* x *R. mollis* (Northumberland).

PLATE X.—*Rosa pimpinellifolia* x *R. omissa* with fertile fruit, from Auchterarder, Perthshire.

PLATE XI.—*Rosa pimpinellifolia* x *R. dumetorum.*

PLATE XII.—*R. pimpinellifolia* x *R. coriifolia* var. *frutetorum*.

PLATE XIII.—*Rosa pimpinellifolia* x *R. omissa* (Northumberland); practically sterile.

PLATE XIV.—*R. pimpinellifolia* x *R. tomentosa* var. *sylvestris* (Durham).

A B

PLATE XV.—A. *Rosa mollis* x *R. canina*, from Norway. B. *R. pimpinellifolia* x *R. mollis*, from Norway.

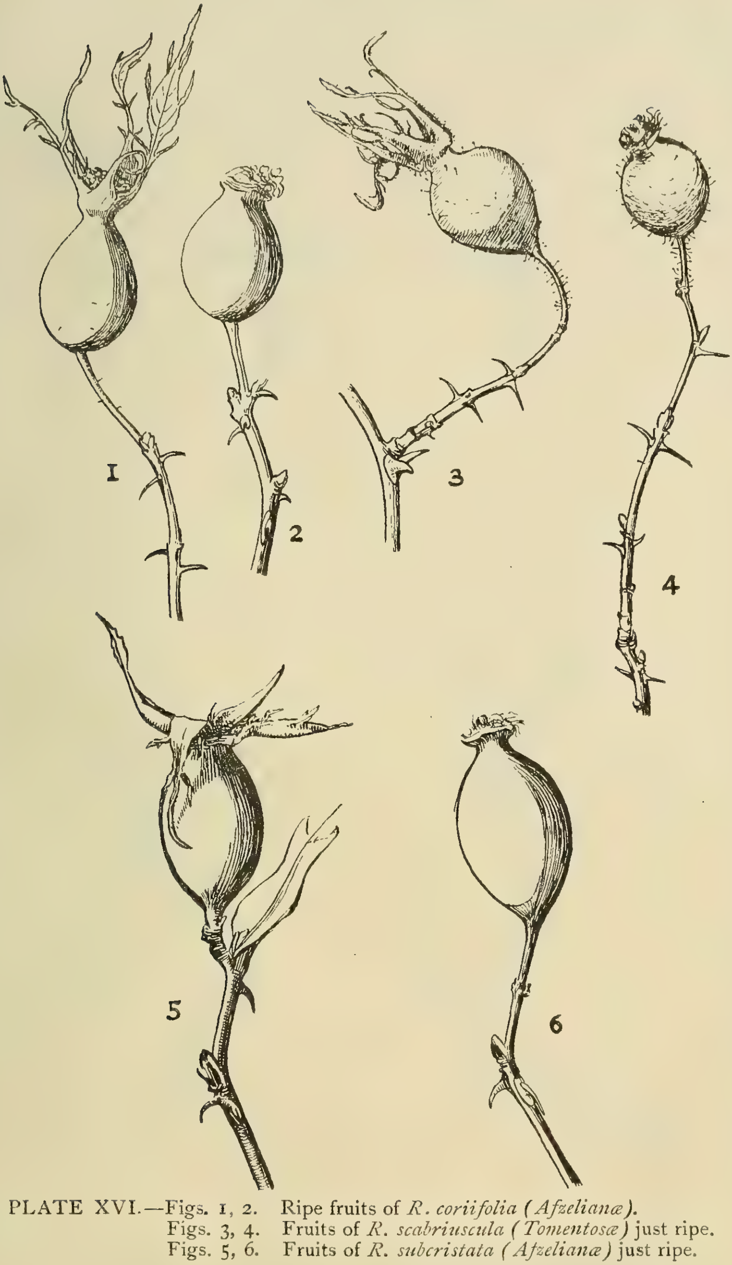

PLATE XVI.—Figs. 1, 2. Ripe fruits of *R. coriifolia (Afzelianæ).*
Figs. 3, 4. Fruits of *R. scabriuscula (Tomentosæ)* just ripe.
Figs. 5, 6. Fruits of *R. subcristata (Afzelianæ)* just ripe.

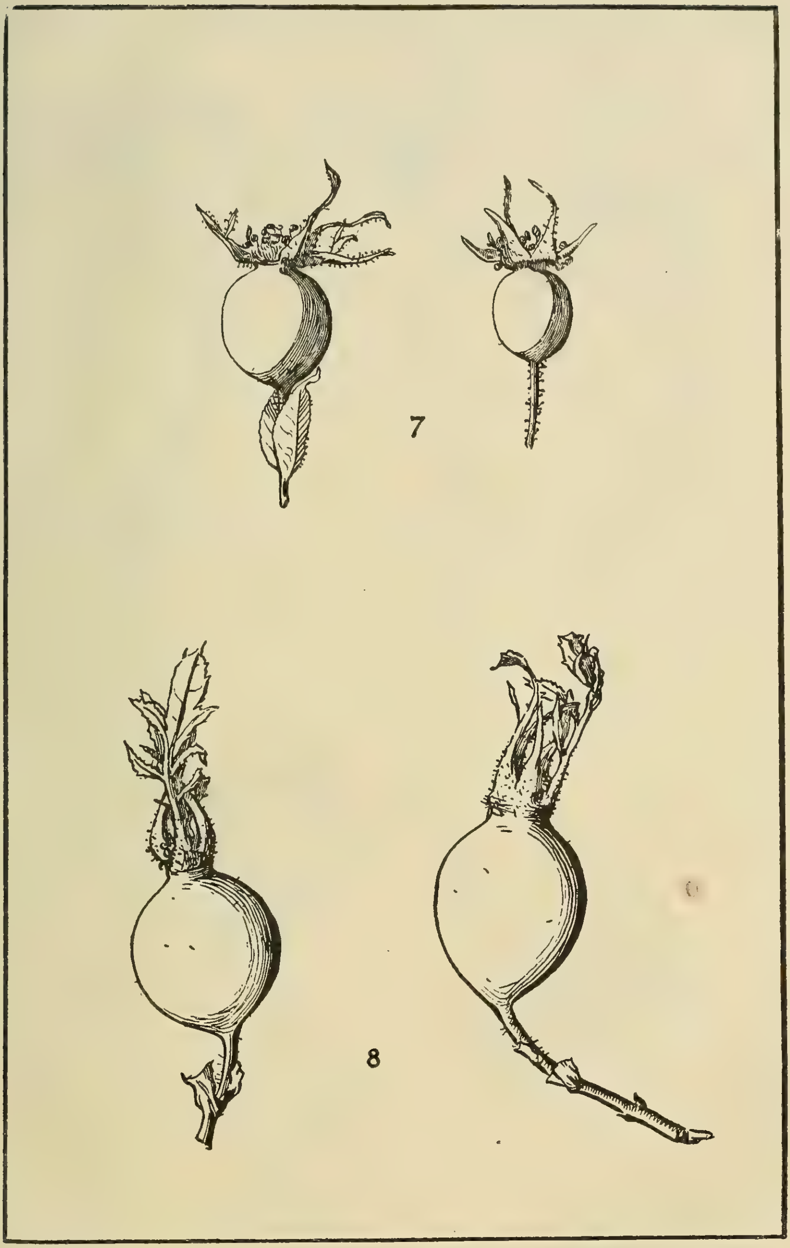

PLATE XVII.—Fig. 7. Ripe and ripening fruit of *R. rubiginosa (Rubiginosæ)*.
Fig. 8. Fruit of *R. mollis (Villosæ)* absolutely ripe.

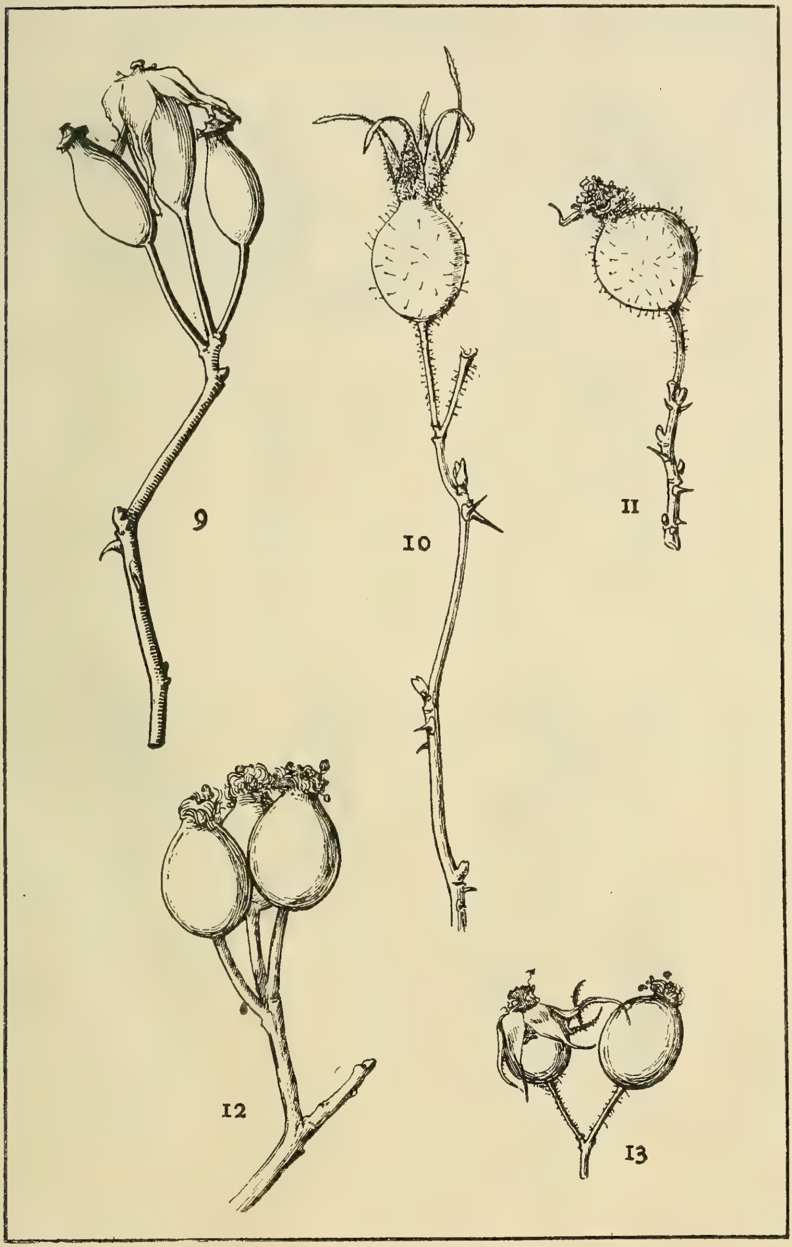

PLATE XVIII.—Fig. 9. Fruit of *Rosa dumetorum (Eucaninæ)*.
Fig. 10. Fruit of *R. omissa (Villosæ)* just ripe.
Fig. 11. Fruit of *R. omissa* in October.
Fig. 12. Fruit of *R. biserrata (Eucaninæ)* just ripe.
Fig. 13. Fruit of *R. micrantha (Agrestes)* just ripe.

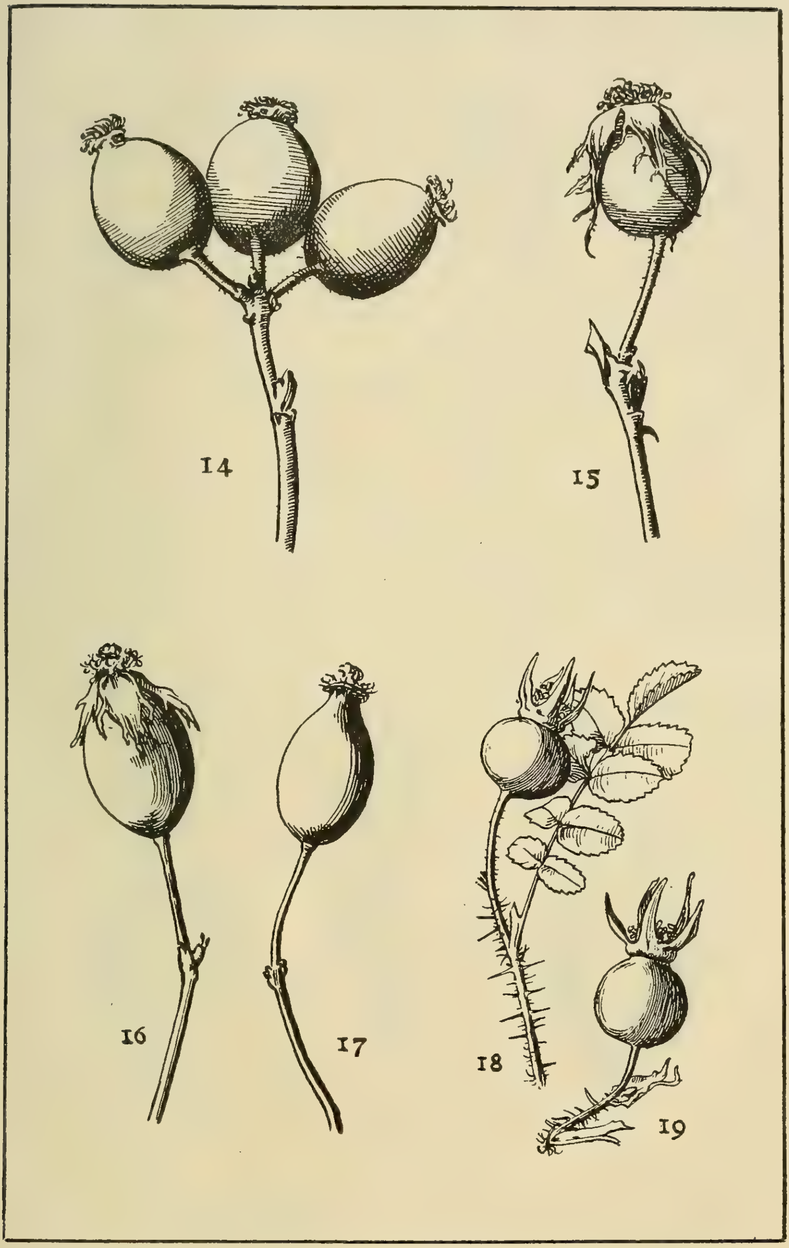

PLATE XIX.—Fig. 14. Ripe fruit of *Rosa Borreri (Agrestes).*
Fig. 15. Ripening fruit of *R. Borreri (Agrestes).*
Fig. 16 Ripening fruit of *R. lutetiana (Eucaninæ).*
Fig. 17. Ripe fruit of *R. lutetiana (Eucaninæ).*
Fig. 18. Fruit of *R. pimpinellifolia* var. *spinosissima.*
Fig. 19. Fruit of *R. pimpinellifolia (Pimpinellifoliæ).*

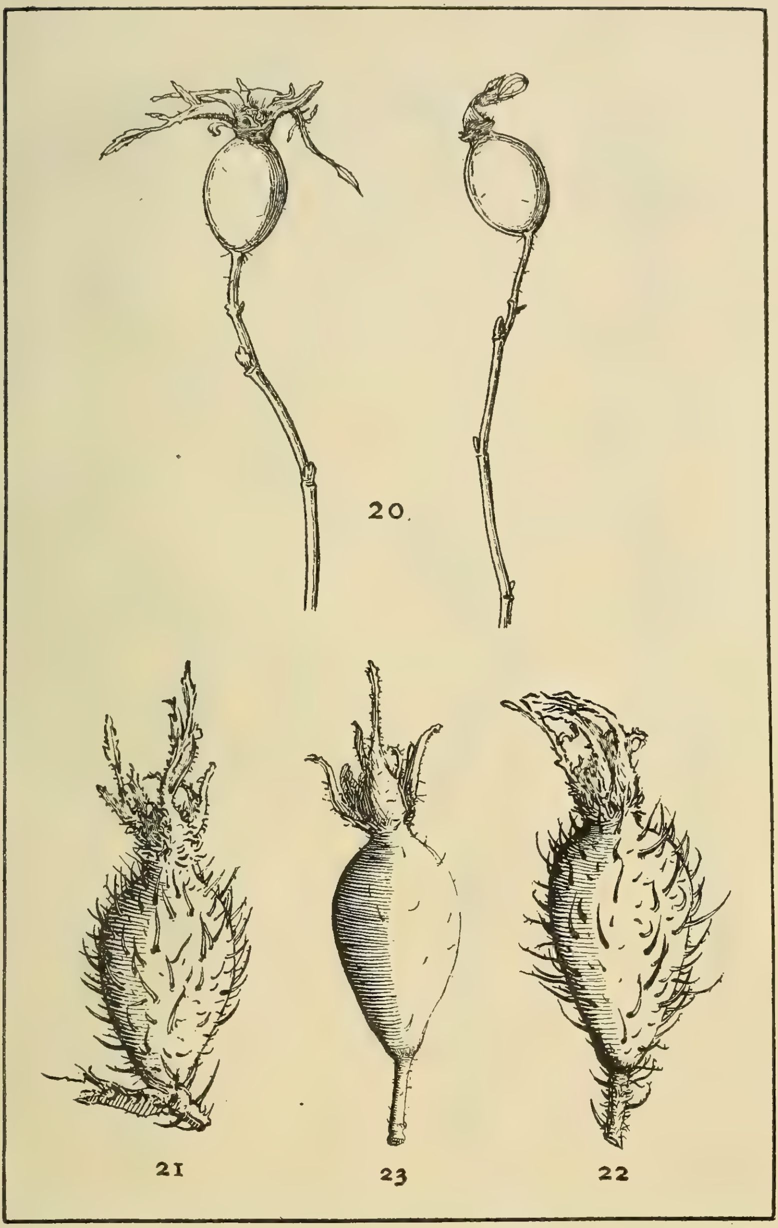

PLATE XX.—Fig. 20. Fruits of *R. tomentosa* var. *sylvestris* just ripe (*Tomentosæ*).

Figs 21, 22. Fruits of the fertile bush of the *R. pimpinellifolia* x *R. omissa* hybrids.

Fig. 23. Fruit of *R. omissa* bush parent to the above.

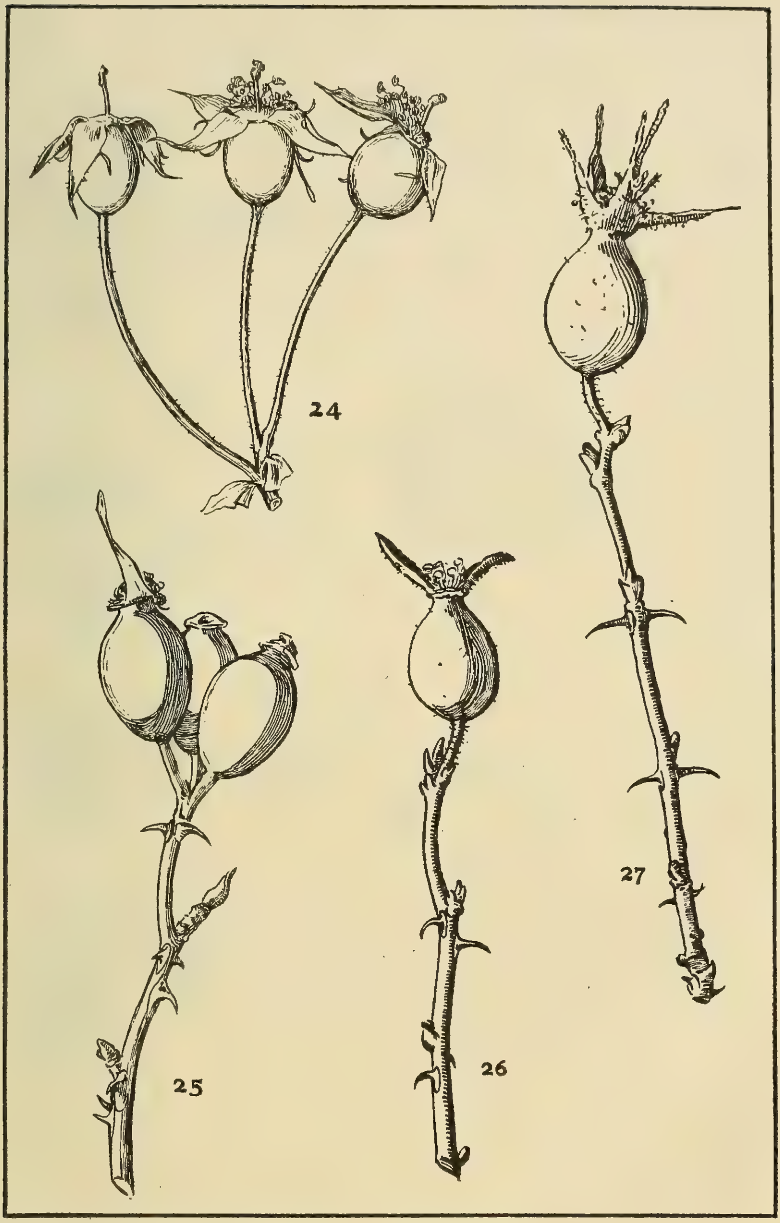

PLATE XXI.—Fig 24. Fruit of *Rosa arvensis (Synstylæ)*.
Fig. 25. Fruit of hybrid *R. coriifolia* var. *Lintoni* x *R. lutetiana* in November.
Figs. 26, 27. Fruit of *R. tomentosa* just ripe.

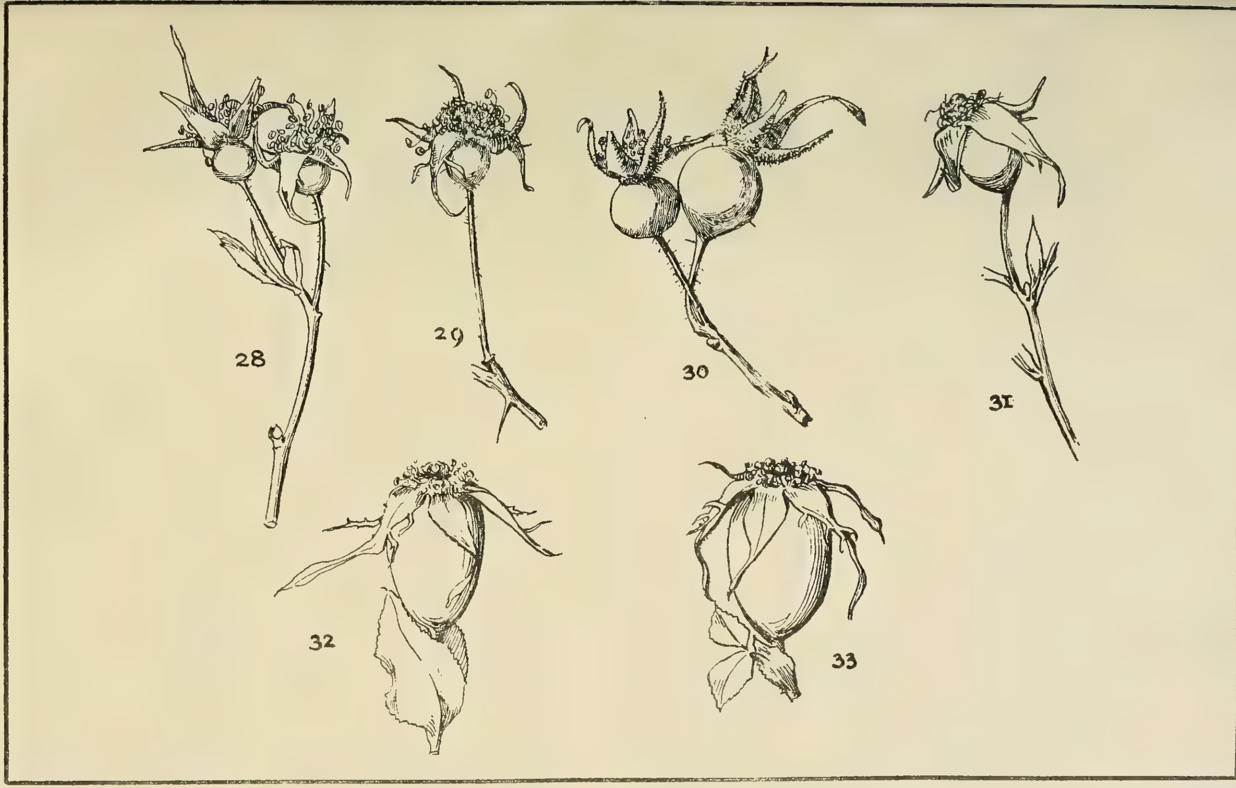

PLATE XXII.—Figs. 28 31. Fruits of various *R. pimpinellifolia* hybrids at the stage when they fall. Fig. 28.—*R. pimpinellifolia* x *R. tomentosa* var. *sylvestris*. Fig. 29 —*R. pimpinellifolia* x *R. omissa*. Fig. 30.—*R. pimpinellifolia* x *R. mollis*. Fig. 31.—*R. pimpinellifolia* x *R. dumetorum*.

Fig. 32. Ripening fruit of *R. subcollina*.

Fig 33. Ripe fruit of *R. subcollina*. *R. subcollina* is very probably a hybrid between some member of the *Eucaninæ* and one of the *Afzelianæ*.

MISCELLANEA, 1917 -1921.

High Mortality among Frogs.

The extreme fluctuations of temperature in the early months of 1917 seem to have been the cause of the death of an abnormal number of frogs, *Rana temporaria*, in a local pond. This tiny lakelet on the outskirts of Gateshead is of cement, only two yards by three, about one and a half feet deep, and supplied with town's water controlled by a tap. It contains several plants in baskets or pots, and has mud at the bottom. The ordinary number of frogs to be seen in the pond during summer has been 15 to 20. Two gold-fish that have been in the pond about three years survived the winter safely.

When the severe frost gave towards the end of February, and the ice melted, several dead frogs were seen, and at intervals 54 dead were taken out of the pond. In ordinary years not more than three or four perish. Many of the dead frogs had each a living male on its back tightly clasping it in the usual conjugal embrace.

The best opinion that can be arrived at is, that the mild spell in January caused many of the frogs to become active and to leave their safe hibernating quarters in the mud at the bottom. They were observed to be on the move, elsewhere, in that month. Then came the severe frost and they fell victims to the treachery of the spring. After the thaw at the end of February, the sexual activities of the living males were stirred, and as they crawled along in search of females they found the dead ones, and these sufficed.

Among the dead were three tiny ones, about one to one-and-a-half inches long, probably cases of arrested development, the cause of which is obscure. Such cases are better known in newts and in natterjack toads.

Considering that frogs of this species are found as far north as 70° latitude, and at as high an elevation as 8,000-ft. in the Alps, in both of which positions the winter temperature must be extremely low, it is thought worth now putting on record that such a high death rate has occurred here in Tyneside.

There must have been an uncommonly large congregation of frogs in this little pond in the winter 1916-1917, for after taking out the 54 dead there were still the usual score of living, and the spawn appeared in abundance in the fourth week of March. *Nicholas Temperley.*

Ancient Mulberry Trees in Tyneside.

Disappearance of the last one.

(Note written in 1917 by Mr. Nicholas Temperley).

In 1872 the late Mr. G. C. Atkinson recorded in the Transactions of the Natural History Society, vol. V., the existence of many important trees in the two counties of Northumberland and Durham. Among these were four ancient mulberry trees, with details as follows, the girth being measured at 4 to 5-ft. from the ground :—

(1) At *Axwell Park*, girth about 8-ft., spread of branches trifling, height 15-ft. ; generally bears fruit which is used in tarts, but in fine seasons it ripens and is eaten at dessert. Bole about 3-ft., then divides into three spreading limbs.

(2) At *Bywell Hall*, girth 7-ft. 7-ins., a ruin, bears a few berries occasionally.

(3) At *Felling Hall*, east of the old residence of the Brandlings, now a public-house, called the "Mulberry Inn"; girth 5-ft., spread of branches trifling, height 12-ft. ; suffocated by smoke and chemicals ; has one branch to the north vigorous. Has not fruited for many years. The maid of the inn, when asked, said she could not tell its age, but they once hanged a monk on it.

(4) At *Saltwellside*, near Gateshead, girth 6-ft. 4-ins., spread of branches 8 yards, height 15-ft., a fine, fairly healthy tree.

From Loudon's *Aboretum*, vol. iii, p. 1314, we learn that James I. in 1605 recommended the cultivation of silk-worms, and offered packets of seeds of the mulberry to all who would sow them. No doubt this rendered the tree fashionable, as there is scarcely an old-fashioned garden without one. *Morus nigra*, the black-fruited mulberry, was introduced into England in 1548. In Britain it assumes a dwarf or stunted character, spreading into thick arms or branches near the ground, and forming an extremely large head. It is a tree of very great durability: the specimens at Syon House, on the Thames, are said to be over 300 years old, and some at Oxford are of nearly equal antiquity. In warmer countries silk-worms are fed on the leaves. In the south of England it ripens its fruit, but here in the north only rarely, and that in very warm summers.

We have every reason to be confident that the four aged mulberry trees referred to in this note represent those distributed by King James I., for local tradition has it that these came as saplings.

Let us see how these four trees have fared in the interval between 1872 and 1917.

(1) At *Axwell Park* the tree has entirely vanished, possibly in some alterations in the grounds.

(2) I learn from my friend Mr. Thomas Sisterton, who recently held a celebration with four score candles on his birthday cake, and who has been parish clerk at *Bywell* for sixty-six years, that in his early days he had eaten the ripe fruit of the mulberry tree that stood in the Park there. It lived carefully propped up for many years, and at last was blown over about twenty years ago, and has disappeared entirely.

(3) The *Felling* tree has likewise gone. Its name alone survives in the rebuilt "Mulberry Inn."

(4) The ancient tree at *Saltwell* has outlived its contemporaries, but the fierce tempest this autumn has been fatal to it. After the Saltwell estate was acquired by the Gateshead Corporation for cemetery purposes, the aged tree lying almost horizontal was carefully propped up and surrounded by an

iron railing to protect it. It continued to bring forth its leaf in due season, and it bore fruit up to present year, 1917, but succumbed, alas, to "chill October's stormy blast!" Not one of the four ancient trees remains.

Convolvulus Hawk Moth (Sphinx convolvuli).

Of interest to entomologists was the sporadic appearance of this fine, bold moth during the summer of 1917. Two or three specimens were brought by strangers to the Hancock Museum during August for identification, but it was soon established that these were not solitary finds, for shortly afterwards several were recorded, chiefly from the coast or not far inland. Records of such were made at Whitley Bay and Ovingham by Prof. Meek; East Holywell, Stannington and Cullercoats by Mr. J. W. Thompson; Embleton by Mr. J. Meek; Prestwick Car by Dr. Martin; Belford by Mr. J. Purvis; Newcastle-on-Tyne by Mr. J. N. Tate; Gateshead by Mr. J. Thompson; Winlaton by Mr. J. Atkin; Stocksfield (male and female) by Mr. W. L. Turner. One of our members, stationed near the coast in Kent, found the moth flying in large numbers and took five specimens.

In response to a letter which the editor of *Nature* was good enough to insert on September 20th, it was found that the moth had been taken to the west and north over a wide area. Col. Fawcett of Leicester kindly reported that a male and two females had been taken there and a male at Kirkby Mallory, nine miles west. Another on a tobacco plant at Bath by Mr. H. H. Winwood; one at Blandford in Dorset; at Winsford, Cheshire, by Mr. Ledward; at Kendal by Mr. Geo. Nicholson; at St. Andrews in the Castle ground by Dr. Walter S. Collinge.

The record is by no means complete; it is, however, sufficient to suggest an immigration from the near Continent and to lead one to enquire why it is not a yearly occurrence. *Sphinx convolvuli* is described as being rare throughout Britain by Mr. J. E. Robson in his Catalogue of local Lepidoptera, Natural History Transactions, vol. XII., pp. 39

and 304; especially rare in the north of England. Never taken in the larval state until 1901, when Mr. Proudlock found about 50 in a hedge overgrown with *Convolvulus Sepium* near Seaton Sluice, which were identified by Mr. Robson. As the plant which forms its food is plentiful in this country, one wonders why the moth should not breed here.

C. E. Robson.

Camberwell Beauty at Rothbury.

(Extract from letter from Lord Armstrong to
Prof. M. C. Potter).

I am writing to you, as I feel it will be of interest to you and your brother entomologists to hear that on or about May 14th, 1918, I was working in our woods with my 'lady foresters' when I saw a fine specimen of the Camberwell Beauty (*Vanessa antiopa*). It was quite tame and kept flying about near us in the sunshine during a great part of the afternoon. I could easily have caught it if I had had a net. I see specimens were noted in 1896 in Berwickshire and the Isle of Skye.

Rooks and Sparrows.

For a number of years there has been sad havoc among the oak trees with caterpillars. This year (1918) has been even worse than usual. In many instances there were scarcely any leaves left. If it had not been for the rooks, helped by jack-daws and starlings, the oaks would have had a bad chance of thriving. I take Chopwell Woods which cover well nigh a thousand acres. The rooks know somehow or other when the caterpillars are at their height; they do not, however, go here or there or any way, but organise themselves, and they seem to work according to plan. When the time arrives for them to start destroying caterpillars, starting early in the morning they take one section of the wood and go thoroughly through it: this lasts for one day; the next day they take another section and so on till all the wood is searched. This lasts about three weeks. Of course it is impossible to get every caterpillar; there are always some that get through. But for the rook I believe the oaks would disappear, while as it is the oak is greatly impeded in its growth.

The sparrow, too, does a large amount of good which very few people ever notice. It loves moths, and is never tired of hunting and catching them on the wing or in hiding. It is amusing to watch a sparrow chasing a moth on the wing. It is a bit clumsy, but it generally gets it. They hunt under potato tops and cabbages, in crevices, behind fences and in all sorts of places. The sparrow also takes the crane-fly by the hundred. A few years ago I spent an amusing twenty minutes watching a pair of sparrows trying to catch a dragon-fly. Of course they failed. After trying all they could to catch it they were exhausted and dropped to the ground for a rest, during which the great insect disappeared. The chaffinch and jackdaw are the greatest enemies of the allotment holder.

P. Charlton, July, 1918.

Blackcap wintering in Northumberland.

One of the most interesting of recent additions to the Hancock Collection of British birds is a Blackcap (*Sylvia atricapilla*, L.) which was wintering in Northumberland. The bird, a male, was brought to the Museum by Dr. Hamilton Drummond on January 11th, 1921. It had been seen all through the late autumn and until early January about the garden at Twizell House, near Belford, where it had come with other birds to a bird-table and had fed on bread crumbs. It was found dead on January 9th. When I skinned it I found no trace of injury and the body was not wasted, but the flesh was noticeably soft and watery. Blackcaps have long been known to remain in the British Isles in exceptional cases for the winter, but usually in the southern counties. Only about four previous instances are on record for Northumberland and Durham (see Mr. George Bolam's *Birds of Northumberland and the Eastern Borders*, p.47). The present specimen was presented by Mrs. Maling, of Twizell House.

E. Leonard Gill.

CONTENTS.

The volumes of the present and preceding series of Transactions may be obtained through the publishers, or direct from the Hon. Secretaries, Hancock Museum, Barras Bridge, Newcastle-on-Tyne.

Where brevity is desired in directing exchanges, etc., the following is a sufficient address :

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NEWCASTLE-ON-TYNE,
ENGLAND.

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NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE.

REPORT OF THE COUNCIL

FOR 1913–1914.

The outstanding event of the year in the history of the Society is the attempt which has been made to raise an Endowment Fund for the maintenance of the Museum. The need of an endowment has long been apparent; it has been felt, in fact, since the Hancock Museum was first built. As is pointed out in the recently issued appeal (reprinted later in this report), the generosity of local people of the last generation enabled a particularly fine Museum to be built and equipped, a Museum worthy of the noted collections it was to house and of the distinguished men by whom those collections had been made. But from the beginning it was plain that the resources of the Natural History Society were by no means adequate to maintain the Museum on lines commensurate with the excellence of the building, and this has been the chief problem before the Society for the last thirty years. By great efforts the membership has been considerably increased, but a limit in this direction appears to have been reached, and it is now none too easy to secure enough new members year by year to keep up the numbers. Many other institutions of similar kind have from time to time benefited by legacies. Such has rarely been the good fortune of the Natural History Society; its invested funds derived from this and other sources were very small until a few years ago it received the generous bequest of the late Mr. George E. Crawhall. An endowment fund built up from legacies or direct contributions was so obviously the best solution of the Society's difficulties that it was thought of, and an attempt made to realise it, in the early years of the Museum's history. The present effort is due to the initiative and energy of Mr. N. H. Martin. Its object is to secure an endowment sufficient to provide for the general upkeep of the Museum, and to leave the members' subscriptions free for the publication of scientific papers and for meeting the numerous demands for special expenditure which arise every year. It is calculated that a capital sum of £25,000 would yield the necessary income, and that is accordingly the amount asked for.

The appeal was signed by the President, Lord Joicey, who headed the subscription list with £1,000. Other donations brought up the total to £3,224 4s. 6d. on June 30th, and rather more than £500 has been added subsequently. There was apparently little prospect that the fund would quickly reach the figure originally aimed at, and the outbreak of war has naturally destroyed all expectation of making further progress with it at present. It may be hoped that with the return of more settled conditions it will be possible to revive the effort and bring up the fund to a level more nearly adequate to the needs of the institution. Meanwhile the best thanks of the Council are accorded to the members and others who have already contributed to the fund. A list of the subscriptions will be found on a later page.

The President's subscription to the fund has been referred to. The Society is indebted to him for financial help in another direction: as the Treasurer's report shows, Lord Joicey very kindly paid off the deficit under which the year opened. The Council have been much gratified also during the year by the readiness with which a number of members have come forward to enable certain special expenditures to be met. In this way it has been possible to complete the dark-room and photographic outfit of the Museum, and to secure an extremely desirable acquisition in the shape of Dr. Eltringham's collection of butterflies. Further details of these will be found in the Curator's report on museum work, and lists of the subscriptions are printed later in the report. In connexion with the fund raised for the photographic outfit (started last year by Mr. W. E. Beck with a gift of £10), special mention must be made of Mr. J. G. Bell's two subcriptions, namely, £4 16s. 2d. to clear off the balance on the cost of the apparatus and £3 18s. for the equipment of the dark-room.

Beyond a little work on the roof, where defects were revealed by the extraordinary rainfall of September 16th, 1913, the building has not required much repair during the year. A heavy charge has, however, fallen upon the Building Repair Fund in consequence of some very necessary work on the drains. The main drain at the back of the Museum showed evidences of defective flow, and under the direction of Mr. J. J. Hill and Mr. W. E. Beck it was opened up and examined. The defect proved to be of long standing, and of so serious a nature as to necessitate the entire reconstruction of that section of the drainage. The new drains were laid on a system planned by Mr. Hill, which makes it easy to locate and remedy any trouble that may occur in future. While the workmen were at the Museum the opportunity was taken to have some minor defects in other drains and other parts of the building attended to. Mr. Hill gave his efficient professional services free of all cost to the Society, and Mr. Beck also kindly co-operated with him in planning and supervising the work. Another service has been rendered by Mr. Wilfred Hall: at his own expense he has had the oak doors in the front of the Museum cleaned and put into good order. There is still work waiting to be done on the building, particularly in repointing masonry. The House Committee have recommended that a considerable amount of this work should be carried out during the coming year. The good progress made by Mr. Walther with the examination and re-arrangement of the mineral collection has necessitated the purchase of five supplementary cases, and already more are required.

The membership of the Society on June 30th stood at 412, which represents a gain of two in the year. Sixteen new members have joined the Society, whilst six have been lost by death and eight by resignation. The year's total of ordinary visitors to the Museum is 16,148; an additional number of 3,907 has been registered for the visits of classes from the municipal Council Schools. The attendance at the lectures given at the winter evening meetings averaged 45, a much lower figure than usual; but the average of 115 at the Christmas holiday lectures for young people, and that of 76 for the Curator's "museum talks," were quite satisfactory. The thanks of the Council are due to the lecturers, who by their willing help enabled a full course to be given during the winter. The evening meetings of those interested in field work were continued, and it is hoped that these will be made good use of in future sessions. The programme of field meetings planned for the summer months was carried out; the number taking part in them was about equal to the average of recent years.

The visits of classes from the Council Schools have unfortunately become more irregular even than last year; it is understood that they are not now organised at all, but that it is left to the individual teachers to bring their classes when they can. No doubt the difficulties are considerable, but in view of the extensive use which the schools in some other towns make of their local museums, the apparent failure of the experiment here is disappointing. It is counterbalanced to a certain extent by the fact that the authorities of the Royal Grammar School have arranged for their masters to bring boys to the Museum, and to give them lessons there on any subject which can be illustrated by the collections. As part of this arrangement the Curator, during the winter terms, has given lessons on the British birds to classes of the Grammar School boys.

One part of the Transactions, vol. iv., new series, part 1, has been issued during the year. It contains about 250 pages. In addition to a number of valuable technical papers, the contents include two which are of more general interest, namely those of Mr. C. T. Trechmann on Neolithic remains on the local moors and coast-line, and of Dr. J. A. Smythe on the traces left by the Ice Age in Northumberland. Some papers are now in hand for the next issue. There is also a prospect of an addition to the series of museum catalogues. There has long been a need for a catalogue of the original drawings and woodcuts by Thomas Bewick shown on the gallery of the zoology room. Mr. E. Bewick Ward has now offered to have such a catalogue printed at his own expense, and Mr. W. H. Gibson, of the Newcastle Public Libraries staff, is kindly preparing the text in his spare time.

The Hancock Prize Competition for 1913-14 had a special interest owing to the President's offer of three extra prizes—a second prize of the value of £2 in the main competition, and prizes of the value of 25s. and 15s. for competitors under sixteen years of age. The first prize in the senior competition was won by Mr. P. Charlton of Chopwell, the second by Mr. J. Buckle of Darlington. In the junior section the first and second prizes were won respectively by Miss Mamie B. Richardson (aged 9) and Miss Jessie M. Thomson (aged 11). The duties of judging the essays were kindly and very efficiently discharged by the Rev. J. E. Hull and Mr. George Bolam.

Among the members of the Natural History Society lost during the year by death were two whose active interest in its work dated from considerably before the building of the Hancock Museum. Mr. E. J. J. Browell was for many years a member of the committee and a trustee, and later as senior vice-president he usually occupied the chair at the Council meetings. His scientific interests lay chiefly in the direction of mineralogy and petrology. Mr. James S. Forster was an old and admiring friend of Mr. Hancock; even when he had become completely an invalid one of his greatest pleasures was to be wheeled round the bird room. Death has also deprived the Society of the very competent services of Miss Emily Welford, who for eight years had been on the Museum staff as lady secretary and typist. She had adapted herself with such success to her position, and had become so established in it, that her loss was very seriously felt. During her illness her duties were kindly taken over by her sister, Miss Edith Welford, whose help was very welcome in this emergency. Miss Gladys M. Scott has been appointed to fill the vacancy, and has been at work long enough to show that she will be a thoroughly useful member of the staff. Lastly, the Council, in touch with the work that is being quietly and steadily done day by day at the Museum, take the opportunity of acknowledging the thoroughness and efficiency with which Mr. Gill, the Curator, and his assistants fulfil their various duties.

NEW MEMBERS ELECTED

FROM JULY, 1913, TO JUNE, 1914.

Edward C. Chaston, 36, St. George's Terrace, Newcastle-upon-Tyne.

J. Cowper, 7, Framlington Place, Newcastle-upon-Tyne.

Arthur J. Haggie, J.P., The Manor House, Longbenton.

Jas. Heslop, South Close, Riding Mill-on-Tyne.

A. H. Higginbottom, Simmondley, Adderstone Crescent, Newcastle-upon-Tyne.

Cuthbert A. Lambton, 2, Kensington Terrace, Newcastle-upon-Tyne.

T. W. Lovibond, West Jesmond House, Osborne Road, Newcastle-upon-Tyne.

Wm. P. Mail, Roecliffe Cottage, Corbridge-on-Tyne.

Dr. William Martin, West Villa, Akenside Terrace, Newcastle-upon-Tyne.

F. C. Pybus, F.R.C.S., Windsor House, Jesmond Road, Newcastle-upon-Tyne.

Thos. Sanderson, 3, Westfield Avenue, Gosforth.

Mrs. A. S. Swan, Daneswood, North Avenue, Gosforth.

C. E. Thelwall, 36, Percy Gardens, Tynemouth.

R. J. Thompson, 38, Eldon Street, Newcastle-upon-Tyne.

Frederick Wise, Heddon Hall.

ASSOCIATE MEMBER.

William Richardson, 91, Whitefield Terrace, Heaton.

CURATOR'S REPORT ON MUSEUM WORK

1913–1914.

The reports which I present each year will give some idea of the work actually accomplished in the Museum, but it may be worth while for once to include something more, namely a brief summary of the various pieces of work we have *not* accomplished, but which are more or less in hand or in temporary abeyance. It is these which constitute the real worry of trying to carry on the work of a large museum with a small staff. Definite progress can only be made by concentrating upon one line of work at a time. But meanwhile small miscellaneous jobs accumulate; and further, it nearly always happens that before we have properly finished the work we have concentrated upon, something else has become so urgent that we have to divert our energies to it and leave one more piece of work on the "temporarily in abeyance" list. Our position at the present time in regard to the most necessary museum work is shown in the following table:—

Actually in hand:

Butterflies, Eltringham collection, practically finished.
Minerals—work in Mr. Walther's hands.
Skeleton of lion.
British butterflies and moths.

In temporary abeyance:

Exotic moths.
British beetles, reference collection.
Fish casts, painting and finishing.
Skeleton of whale.

In longer-standing abeyance:

Marine invertebrates (much done several years ago, but much still to do in arranging and labelling).
Small skeletons.
Geological introductory cases.
White whale model—alterations.
Printing of labels (much waiting to be done in all parts of museum).

Much-needed but not taken up in recent years:

Bird-room gallery—large numbers of bird skins to be mounted.
Insects—exhibition sets of orders of insects other than butterflies and beetles.
Reptile collection—general overhauling.
Fossils—enormous quantity to be identified, labelled and arranged.
Rock collection—overhauling and bringing into useful order.
Geological sections—large-scale coloured sections for geological room.
Store-specimens and duplicates—much overhauling required.

The work shown here as "actually in hand" was none of it in hand at the beginning of the year under review. Then and for some time afterwards we were chiefly occupied with *(a)* the casts of fishes, *(b)* the beetles, and *(c)* to some extent with the whale's skeleton. Later, with the prospect of having Dr. Eltringham's butterflies to deal with, we had to leave the fishes in order to get the exhibition series of beetles finished. For the same reason we had to postpone putting together the whale's skeleton, especially as we had to take in hand *(d)* a fresh skeleton, that of a lion. For the last four months of the year we were engaged for the most part upon *(e)* Dr. Eltringham's butterflies. Work in one other department, *(f)* that of the minerals, has been pursued with continued vigour by Mr. P. Walther. Notes on these various lines of work follow.

(a) Casts of fishes. Among the more striking casts made and painted were those of a large angler, a cod, a dogfish and a large ballan wrasse. One of the most annoying instances of work having to be temporarily shelved is this of the fish collection. We cannot fix the casts in the cases until all, or nearly all of them are finished, and consequently we are having to leave the show cases of the fish collection in a very unfinished condition.

(b) Beetles. The general series from all parts of the world has been finished and put on view. With the British reference collection good progress was made in the earlier half of the year; a large part of the work was done for us by Mr. Geo. B.

Walsh, of Jarrow, who very kindly devoted much of his spare time to it during the winter. This reference collection, which is being formed by combining three private collections—those of the late T. J. Bold, and of Mr. John Gardner and Mr. R. S. Bagnall—will be one of the best in existence when it is completed.

(c) Whale's skeleton. We obtained the tools and the iron-work necessary for mounting this large skeleton, and had begun drilling the bones, but, as already stated, we then had to defer the mounting to some later time.

(d) Skeleton of lion. In April the body of a fine male lion was sent to the Museum by the proprietors of Bostock and Wombwell's menagerie. To our own disappointment and that of the donors, we found that the skin was useless for mounting: the disease of which the animal had died had apparently loosened the hair. We are therefore preparing the skeleton, and this will be a valuable addition to our limited osteological series.

(e) Dr. Eltringham's butterflies. These constitute undoubtedly the most important acquisition made to the Museum in recent years. The collection includes about 6,000 specimens, practically all in fine condition, and contained in four cabinets, of which two are very large and of the best make. The butterflies of all tropical and sub-tropical parts of the world are well represented; many rarities are also included, and as Dr. Eltringham has made a special study of mimicry (he is the author of an exhaustive monograph, recently published, on "Mimicry in African Butterflies") his collection is particularly rich in examples of this remarkable phenomenon. Dr. Eltringham is now working on the vast collections in the Hope Department of the Oxford University Museum. He consequently has little use for a collection of his own, and he generously offered it to the Natural History Society at a price which scarcely represented the value of the cabinets. After it had become the property of the Museum we were indebted to Dr. Eltringham for a further great kindness. He planned out

for us a series of eighteen cases illustrating all the groups of the world's butterflies, and five cases illustrating mimicry in different regions. For these cases he selected the specimens, and finally drew up an excellent series of descriptive labels. In this way, with his thorough knowledge of the subject and of the collection, he saved us an immense amount of work, and the subsequent installation of the cases, though quite a long job, was a straightforward one. The descriptive labels—typed, and with hand-printed headings—we have framed behind thin glass and placed on the inside of the shutters which protect the cases from light. When the shutters are opened the labels thus confront the visitor, but do not take up any of the exhibition space in the cases. We have since been making up a few cases on a geographical basis, to illustrate the butterfly fauna of particular parts of the world. Though there is still a large collection left in the original cabinets, the series of butterflies put on public view forms a splendid and most attractive addition to our show-collections; while the illustrations of mimicry in all its phases are certainly among the best things of the sort exhibited to the public anywhere.

In addition to the cases supplied from Dr. Eltringham's collection, we have made up four exhibition cases of British butterflies and moths. The final portion of the work on the Lepidoptera will consist in preparing a representative series of the moths of the world. For this we have already looked out a considerable amount of material from our store-cupboards, but many of the specimens require re-setting and many additional specimens are needed. By way of meeting this deficiency, we propose to use the small balance of the Lepidoptera Fund for making occasional purchases of exotic moths from the London sales.

(f) Minerals. Mr. P. Walther continues his splendid work on the mineral collection. During the last two or three years he has analysed great numbers of doubtful minerals, examined large quantities of store specimens, and thoroughly over-

hauled and re-arranged the exhibited collection. He has now been setting out the minerals in standard cardboard trays, which in itself quite transforms the general appearance of the collection. A further great improvement has been brought about by having upright centre cases fitted above five of the desk cases, and using them for the exhibition of specially fine specimens. Such centre cases should undoubtedly be fitted to all the desk cases in the mineral galleries, and I hope we shall in time be able to provide them. A second batch of five at the present time would greatly facilitate Mr. Walther's work. He is now engaged in preparing a complete tabulated catalogue of the collection, and from this catalogue the labels will afterwards be printed. His brother, Mr. W. Walther, has kindly defrayed the cost of a small printing outfit for this purpose.

A few other matters may also be referred to briefly :

Wild flowers. Fresh wild flowers have again been shown on the counter in the entrance hall, and, as was the case last year, we have been indebted for supplies chiefly to Mr. Randal B. Cooke, of Corbridge, and Mr. Carins of Ovington. Miss Scott has taken readily and successfully to the duty of identifying and tending the flowers.

Taxidermy. Not much has been done this year. I have mounted a nestling raven and a hamster (a Continental rodent). A Welsh example of the polecat, presented in the flesh by Mr. George Bolam, has been mounted by a professional.

Parties conducted. At various times during the year I have met parties by arrangement and conducted them round the Museum. In December we had a visit of an unusual kind: at the suggestion and at the expense of Mrs. Pease, a large party of children from the Royal Victoria School for the Blind were brought to the Museum. We set out a number of things for them to feel and examine—mammals, large birds, and ethnological objects—and they seemed to get much interest and enjoyment out of the experience.

"*Museum talks.*" Attendances at my "museum talks" had fallen in the preceding year to the low average of 44. Last winter I tried the experiment of making four of the talks into a series, dealing with the bird life of different situations and types of country. The result (as far as numbers were concerned) was an average attendance of 76 for the winter, and of 92 for these four talks. This, though gratifying, can hardly be taken as conclusive as to the success of giving the talks in series: birds are always a more popular subject than anything else.

Photographic outfit. We are now very well equipped in this way, and have been glad of it on many occasions during the year. Our outfit consists of a half-plate Sanderson camera with Zeiss lens and accessories, an enlarging and reducing lantern, and a very convenient dark-room. The excellence of the lens and the great range of movements provided in the camera make the outfit extremely useful for the varied applications of photography which arise in museum work.

Donations. A list of these will be found on a later page, but a few call for special mention. Dr. Eltringham's butterflies, as already stated, were in reality largely a gift. A number of good fishes for casting were sent us by Mr. W. E. Forster, of Paignton, Devon, who was most kind in exerting himself to obtain fishes which we particularly wanted. From Mr. W. A. C. Henderson we received a large and well preserved collection of reptiles and other natural history specimens collected by him in the neighbourhood of Singapore, and from Mr. Max Holzapfel another batch of reptiles, etc., from East Africa. Mr. Harold Cookson has presented to the Museum a considerable collection of British birds and a number of interesting ethnological objects which he had brought home from Africa, New Zealand and the South Seas. The most important acquisition connected with local ornithology is a clutch of quail's eggs presented by Mr. Thomas Thompson, of Ryton; they were taken from a nest at Ryton about twenty years ago. A consignment of miscellaneous minerals from South America, presented by Mrs. Knothe, was found by Mr. Walther to include a number of rare and valuable ores.

Outside help. A number of people outside the staff have given us help which it is a pleasure to acknowledge and record. Mr. Walther's work on the minerals, continued now for several years, is one of the finest pieces of work done for any museum by an honorary curator that has come to my knowledge. Two other honorary curators, Dr. H. Eltringham and Mr. Geo. B. Walsh, have given us very valuable help which has already been referred to. Mr. A. Blayney Percival, who has been home on furlough from British East Africa, has laid out as a temporary loan exhibition in the Museum an extremely interesting set of skins of birds and small mammals collected by him in that country. Mr. B. Storrow, of the Dove Marine Laboratory, and Mr. George Bolam have thoroughly revised a card catalogue of local fishes which Mr. Fletcher and I had drafted. Four scientific men who have visited the Museum during the year have given valuable help in the way of identifying specimens and revising labels: Dr. R. Hartmeyer, of Berlin, who corrected the naming of our tunicates; Mr. Balfour Browne, who revised the water-beetles in our reference collection; Dr. Morley Davies, of the Imperial College of Science, South Kensington, who gave me the most modern names for a number of fossils; and Dr. A. C. Haddon, of Cambridge, a leading ethnologist, who looked over our ethnological collections and gave me much useful information. Dr. Hartmeyer is the chief living authority on the tunicates (sea squirts), and his object in coming here was primarily to examine the classical collection of Joshua Alder and Albany Hancock. He has written a full and most valuable report upon it, which he offers for publication in the Transactions.

I should like to record my personal sense of obligation to the excellent staff by whom I am assisted at the Museum. I must also say how deeply I and the other members of the staff regretted the death of Miss Welford. With a disposition which earned her everyone's liking and respect she combined such efficiency and conscientiousness that we could leave to her with absolute confidence the work that she was called upon to do.

E. LEONARD GILL.

MUSEUM STAFF

CURATOR	E. LEONARD GILL, M.Sc.
ASSISTANT	HERBERT FLETCHER.
LADY ASSISTANT AND SECRETARY	MISS GLADYS M. SCOTT.
ATTENDANT	WILLIAM VOUTT.
GARDENER	ALBERT SPENCER.

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.
R. S. Bagnall, F.E.S., F.L.S.
Rev. W. McLean Brown.
Harry Eltringham, M.A., D.Sc.
Samuel Graham.
Prof. G. A. Lebour, M.A., D.Sc.
Prof. Alex. Meek, M.Sc.
Prof. M. C. Potter, M.A., Sc.D.
Geo. B. Walsh, B.Sc.
P. Walther.

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 20th, 1913.

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey.

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Ridley.
Lord Barnard.
Lord Ravensworth.
The Bishop of Durham.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Andrew Noble, Bart., F.R.S.
Sir G. H. Philipson, M.D., D.C.L.
Sir John Swinburne, Bart.
Sir Lindsay Wood, Bart.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
E. J. J. Browell.
R. Coltman Clephan, F.S.A.
Clive Cookson.
Samuel Graham.
Principal W. H. Hadow, M.A., Mus. Doc.
N. H. Martin, F.R.S.E., F.L.S., F.C.S.
H. N. Middleton.
Col. C. W. Napier-Clavering.
Prof. M. C. Potter, M.A., Sc.D.

COUNCIL

Hugh P. Angus.
W. E. Beck.
Rev. W. McLean Brown.
Reginald Bryant.
J. L. Gracie.
Wilfred Hall.
T. E. Hodgkin, M.A.
Hon. J. Arthur Joicey.
Prof. A. Meek, M.Sc.
Ernest Scott.
George Sisson.
J. D. Walker, J.P.

HON. SECRETARIES

C. E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

EVENING MEETINGS HELD DURING THE WINTER SESSION, 1913–1914.

Oct. 22.—Mr. W. H. Young, F.Z.S., F.L.S.: "Micro-Organisms of the North Sea"; chair taken by Mr. H. Benson.

Nov. 12.—Rev. J. E. Hull, M.A.: "The Colours of Flowers"; chair taken by Mr. Richard Adamson.

Dec. 10.—Rev. W. McLean Brown: "The Pollination of Flowers"; chair taken by Mr. Hugh P. Angus.

Jan. 14.—Dr. J. T. Dunn, F.I.C.: "Crystals"; chair taken by Mr. Wilfred Hall.

Feb. 11.—Mr. F. C. Pybus, F.R.C.S.: "The Natural History of Disease"; chair taken by Mr. John Talbot, M.A.

Mar. 11.—Mr. T. Bentham, B.Sc.: "Some Parasites of Man"; chair taken by Mr. C. E. Robson.

Mar. 18.—Private Evening Meeting of the Society: Report on Field Meetings of 1913, by Mr. Edwin Burnup. Reading of extracts from the Hancock Prize Essays.

AFTERNOON LECTURES TO YOUNG PEOPLE.

Dec. 29.—Mr. George Hurrell, B.A.: "Shore Life"; chair taken by Mr. N. H. Martin, J.P., F.R.S.E., F.L.S.

Jan. 5.—Mr. H. S. Wallace, F.E.S.: "A Thimbleful of Pond Water"; chair taken by Prof. M. C. Potter, M.A., Sc.D.

CURATOR'S "MUSEUM TALKS."

Oct. 29.—Garden Birds.

Nov. 26.—Woodland Birds.

Dec. 17.—Moor and Mountain Birds.

Jan. 28.—Birds of Inland Waters.

Feb. 25.—Beetles.

Mar. 25.—The Plumage Bill.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1914.

DR. GEO. ABBOTT (Tunbridge Wells).—Forms of concretionary magnesian limestone from Fulwell Quarry, Sunderland, to add to a set previously presented.

COL. C. H. E. ADAMSON, C.I.E.—Two entomological store boxes, and some duplicate Burmese butterflies.

HUGH P. ANGUS.—A living leech found in garden soil. Three goliath beetles from Africa.

GEO. A. ATKINSON.—Natural history specimens from Japan: a further batch of butterfles and six bird skins (Japanese pheasants, etc.).

RICHARD S. BAGNALL, F.E.S., F.L.S.—Reprints of papers by the donor: two on Symphyla, six on British and foreign Thysanoptera, one on a new British centipede (*Lithobius duboscqui*), and a "Review of Field Work in 1911."

T. LINDSAY BAINBRIDGE.—A living peregrine falcon (now being kept at the Museum).

HARRY BENSON.—Some locusts brought by the donor from Teneriffe

GEORGE BOLAM.—Copy of the donor's book "Birds of Northumberland and the Eastern Borders." A polecat in the flesh, and shells of kites' eggs sucked by crows, from Wales. Noctule bats and a lesser shrew, from East Yorkshire.

R. BOLAM.—A living male of the longicorn beetle *Astynomus aedilis.*

E. H. BOSTOCK (Bostock and Wombwell's Menagerie).—The bodies of a young leopard and a fine adult lion.

GEO. STEWARDSON BRADY, M.D., F.R.S.—Reprint of paper by the donor "On Freshwater Entomostraca from various parts of South Afric.a"

BRITISH MUSEUM (NATURAL HISTORY), the Trustees.—A set of copies of the labels used for the series of British nesting birds.

MRS M. G. CAMPBELL (Falstone).—A Northumbrian bread basket, made about 1790, which "belonged to the Robsons of Emmethaugh, North Tyne."

H. G. Carr-Ellison.—On loan : skins of some birds collected about fifty years ago in China and elsewhere.

Abel Chapman.—A salmon parr from the North Tyne (used as model for painting a cast).

Hugh V. Charlton.—Large water-colour painting, framed, of an eagle owl in the Hancock collection.

P. Charlton (Chopwell).—Fossil plant-remains from Chopwell, including examples of *Mariopteris muricata*, and of unidentified spores, seeds or eggs on a slab of fine *Asterophyllites* foliage. Also a large plant of broomrape, *Orobanche major*.

Isaac Clark.—Two nestling ravens.

Mrs. Alfred Cochrane.—A pair of living golden pheasants for the aviary.

Cochrane and Co.—Sample of barytes, with alstonite and witherite, from New Brancepeth Colliery.

Harold Cookson.—A collection of skins (73) of British birds, including black redstart from Northumberland, dotterels from the Highlands, and varieties of grouse and chaffinch. Other natural history specimens : a large colony of the coral *Merulina*, part of the skeleton of a trigger-fish (West Indies), two "vegetable caterpillars" from New Zealand. A number of ethnological objects collected by the donor, including a native drum, tobacco pipes, carved figures, and a gazelle trap, from Africa ; kava root and bowl, combs, tappa, etc., from the South Sea Islands ; flax dresses, etc., from New Zealand.

Thos. Dunn (Whitley Bay).—Skeleton of opah or king-fish from near St. Kilda ; a rabbit-fish (*Chimaera*) and a sponge, also from northern waters.

Thos. Elliott (Ford, per Newby S. Green).—A very large pike, netted in the Till (cast made for Museum).

Dr. Harry Eltringham.—Reprint of paper by the donor "On the Urticating Properties of *Porthesia similis*, Fuess." Also a number of entomological store-boxes.

Wm. Eltringham (West Ryton).—An unusually fine example of the enigmatic fossil *Palæoxyris* (egg-case of a large fish ?) in a clay-ironstone nodule from Crawcrook.

W. E. Forster (Paignton, Devon).—A number of fishes for casting, including ballan wrasses, pilchards, a pollack, and a shadow-fish or maigre ; also an eared grebe in winter plumage.

H. W. GARBUTT (Bulawayo).—Photographs of the remarkable prehistoric ruins in Rhodesia and of Rhodesian scenery; a Kaffir sweat-scraper; some small agate pebbles of puzzling origin. Also, per P. Walther, two Kaffir throwing spears and a hippo-hide whip.

JNO. GARDNER, F.E.S.—A further instalment of the donor's collection of British beetles, for incorporation in the Museum reference collection.

NEWBEY S. GREEN.—Some fishes (pike, roach, etc.) for casting and painting.

P. O. HARE.—A living water rail (subsequently kept for some weeks in the aviary) which ran into the donor's house in Manor House Road, Newcastle, on October 1.

W. A. C. HENDERSON —Natural history specimens, carefully preserved, brought by the doner from Singapore: snakes (19), scorpions (5), centipedes (3), a turtle (*Chelone imbricata*), a large python's skin; fishes, barnacles.

MAX HOLZAPFEL.—Natural history specimens, well preserved in spirit, from East Africa; including a legless lizard, *Chamaesaura anguinea*, Agama lizards, chamaeleons, frogs, shrews, a leaf-nosed bat (*Megaderma sp.*), locusts, crickets, giant earthworms (*?Microchaeta sp.*), etc.

J. HORSLEY.—Very large claw of a lobster, from Beadnell.

INDIA OFFICE (Secretary of State for India in Council.)—A further volume of "The Fauna of British India": Orthoptera (Acridiidae), by W. F. Kirby.

REV. W. JOHNSON.—A collection of plants made by the late Rev. J. W. Allison; mostly collected in Northumberland.

DR. E. B. KITCHING.—A collection of plants made by the late Miss Eliza Wigham, a well-known Edinburgh lady.

MRS. R. KNOTHE.—Two boxes of minerals from Chile, including good specimens of many ores (some very rare) of gold, silver, cobalt, antimony, etc.

A. E. MACDONALD.—A box of large beetles and other insects from Assam.

J. MACKENZIE (per Wm. Voutt). — A young hamster, *Cricetus frumentarius*, in the flesh.

MISS MARGARET MCALISTER.—A box of large Oriental insects (leaf-insects, longicorn beetles, etc.).

HENRY T. MENNELL.—Current publications of the Linnean Society, in continuation ot the long series presented previously.

FRED. MILBURN.—Skins of antelopes (for mounting) shot by the donor in East Africa.

EDWARD NEWTON (Thirston Hall).—Two waxwings shot in February at Felton.

PROF. FREDERICK PAGE.—Egg of a wading bird *(? Ochthodromus sp.)* from Australia.

J. PROUDLOCK (Seaton Delaval).—Fine piece of *Sigillaria* from Main Coal-seam, and mussels *(Carbonicola)* from Low Main. A young heron.

W. MARK PYBUS.—Skins of a pair of Sardinian warblers, *Sylvia melanocephala*, from Andalusia. A series of the "Annals of Scottish Natural History," quarterly, 1892 to 1911; followed by the "Scottish Naturalist," monthly, 1912 to date, and subsequent parts as issued.

H. T. RICHARDSON (Gosforth).—Good samples of timbers bored by *Pholas*.

MRS. CHAS. SANDERSON (Filey).—Six large moths collected by the donor's husband on the Upper Amazon.

ERNEST SCOTT.—Some glow-worms (females) from Riding Mill. A section of elm timber showing the healing of the cut end of a branch. Also, on loan: two large cases of birds collected in Egypt.

R. R. SHARP.—A set of enlargements of photographs of big game taken by the donor in Central Africa.

J. W. SHOEBOTHAM.—Reprint of paper by the donor, "Notes on Collembola," part 2.

COL. GEO. R. B. SPAIN.—Male and female of a large and rare species of house spider, *Tegenaria atrica*, caught in Newcastle. Samples of Northumbrian jasper from the Ramshope Burn and the Rede.

B. STORROW.—Tubes of the marine worm *Pectinaria auricoma*.

THERMAL SYNDICATE (Wallsend).—Examples of the fused silica ware manufactured by the donors, together with sample of the raw material.

THOMAS THOMPSON (Ryton).—A clutch of quail's eggs taken by the donor at Ryton about 1894.

JAMES THOMSON, M.A.—A living goat moth caterpillar.

H. S. WALLACE.—Three birds' nests found in bunches of bananas from Jamaica, one containing the dried body of a young bird.

GEO. B. WALSH.—Some rare British beetles to add to the reference collection.

MISS JOYCE WATSON.—A number of sea-shore shells—*Solen*, *Pecten*, *Cypraea*, etc.

PROF. F. E. WEISS (Vice-Chancellor, Manchester University).—Reprint of paper by the donor, "Species, Varieties and Hybrids."

MRS. WINGATE.—On loan : a model of Mount Sinai, constructed by the late Rev. W. J. Wingate from rocks brought by him from the actual locality.

JOS. WRIGHT.—A glazed tile from the White Friars' Monastery, Newcastle. Copies of a number of books on natural history, including Landsborough's "British Zoophytes," White's "British Crustacea," Henslow's "How to study Wild Flowers," Dawson's "Dawn of Life," Carpenter's and Hogg's works on the microscope.

The publications received by exchange with British and foreign scientific institutions are acknowledged in a separate list which is published later in the Transactions as an appendix to the report.

DONATIONS TO THE ENDOWMENT FUND.

	£	s.	d.
Lord Joicey	1,000	0	0
Sir Andrew Noble	500	0	0
Major George Noble (in five years)	500	0	0
Sir Hugh Bell (in five years)	250	0	0
Lord Ridley (first subscription £100)	200	0	0
Lord Ravensworth	100	0	0
F. S. Newall	100	0	0
J. H. B. Noble	100	0	0
N. H. Martin	52	10	0
Clive Cookson	50	0	0
T. E. Hodgkin	50	0	0
Mrs. Pease	50	0	0
Jos. H. Straker	50	0	0
The Misses Cruddas	25	0	0
C. V. Swan	25	0	0
Dr. Clement Stephenson	21	0	0
W. E. Beck	20	0	0
J. L. Gracie	20	0	0
J. B. Pease	20	0	0
Mrs. Alfred Cochrane	10	0	0

	£	s.	d.
G. B. Richardson	5	7	6
R. E. Bryant	5	5	0
M. Holzapfel	5	5	0
H. T. Mennell	5	5	0
Howard Pease	5	5	0
W. B. Reid	5	5	0
Thomas Simpson	5	5	0
Mrs. Spence Watson	5	5	0
Col. C. H. E. Adamson	5	0	0
T. Lindsay Bainbridge.	5	0	0
R. C. Clephan	5	0	0
Lawrence Richardson	5	0	0
E. W. Swan	5	0	0
F. E. Forster	3	3	0
J. Askew Dixon	2	2	0
Mrs. Marshall	2	2	0
D. Stephens	2	2	0
Miss C. T. Adamson	1	1	0
J. A. Irving	1	1	0
Richard Welford	1	1	0
Sir John Swinburne	1	0	0
Total June 30, 1914	£3,224	4	6

Received or Promised since June 30th, 1914.

	£	s.	d.
J. H. Burn	105	0	0
Sir Charles Milburn	100	0	0
William Gibson	52	10	0
Thomas Taylor	50	0	0
W. J. Benson	25	0	0
Col. R. H. Carr-Ellison	25	0	0
Frederic Straker	25	0	0
Mrs. Gurney	20	0	0
Charles H. Merz	20	0	0
Principal W. H. Hadow	10	10	0
Francis Priestman	10	0	0
Miss S. A. Richardson	10	0	0
Mrs. Mary Willson	10	0	0
W. S. Burton	5	5	0

	£	s.	d.
F. Carrick	5	5	0
W. W. Gibson	5	5	0
C. C. Leach	5	5	0
George Renwick	5	5	0
Mrs. Clay (in memory T. R. Clay)	5	0	0
John H. Holmes	3	0	0
George Jenkins	2	2	0
T. H. Leathart	2	2	0
Mrs. T. Pumphrey	2	2	0
Frederick Beavan	1	1	0
Dr. William Martin	1	1	0
	£505	13	0

Total to September, 1914, £3,729 17s. 6d.

DONATIONS TO THE LEPIDOPTERA FUND

(For the purchase of Dr. Harry Eltringham's collection of butterflies).

	£	s.	d.
Col. C. H. E. Adamson	20	0	0
Wilfred Hall	20	0	0
Major Edward Clayton	10	0	0
Charles O. Trechmann	10	0	0
Hon. J. Arthur Joicey	5	5	0
Cuthbert Bainbridge	5	0	0
Sir Hugh Bell	5	0	0
Lord Ravensworth	5	0	0
A. Munro Sutherland	5	0	0
Lord Barnard	2	2	0
W. E. Beck	2	2	0
H. I. Brackenbury	2	2	0
Clive Cookson	2	2	0
T. E. Hodgkin	2	2	0
N. H. Martin	2	2	0
Sir Charles Milburn	2	2	0
J. H. B. Noble	2	2	0
J. D. Walker	2	2	0
J. Ford Maling	2	0	0
Hugh P. Angus	1	1	0
Samuel Graham	1	1	0
F. Priestman	1	1	0
George Sisson	1	1	0
George Jenkins	1	0	0
	£111	7	0

DONATIONS TO THE CAMERA FUND.

	£	s.	d.
W. E. Beck	10	0	0
J. L. Gracie	3	0	0
N. H. Martin	2	2	0
Col. C. H. E. Adamson	1	1	0
J. A. Richardson	1	0	0
Total June 30th, 1913	£17	3	0

	£	s.	d.
J. G. Bell	8	14	2
J. D. Challoner	1	1	0
Mrs. Dinning	1	1	0
J. D. Walker	1	1	0
J. L. Gracie	1	0	0
R. C. Clephan	0	10	6
C. E. Robson	0	10	6
Total, 1914	£31	1	2

REPRINT OF CIRCULAR APPEALING FOR DONATIONS TO THE ENDOWMENT FUND.

Hancock Museum,
Newcastle-upon-Tyne,
May, 1914.

The citizens of Tyneside and the North and a very extensive circle in all parts of the world are proud of the Hancock Museum. Local people whose privilege it was to know them, either in person or through their work, are proud of the men who as pioneers in this district laid the foundation of an intelligent study of Nature—John Hancock himself, whose intuitive appreciation of the nature of birds was a revelation to many in his lifetime and is embodied in his magnificent collection for the instruction and delight of all later generations; his brother Albany Hancock and their friend Joshua Alder, whose patient and brilliant work on marine forms of life has made their joint names famous in the history of zoological science; the brothers George and Henry Bowman Brady, whose reputation caused them to be selected to report on two important classes of the collections brought home by the Challenger Expedition, the most momentous scientific undertaking of the last century; William Chapman Hewitson, in his time the leading authority on birds' eggs and on the butterflies of the world; Daniel Oliver, who, beginning as a local amateur, became a head official at Kew and one of the leading botanists of the world; William Hutton, the celebrated early geologist after whom one of the chief coal seams of this district is named, and whose collection of fossil plants is still constantly consulted by the greatest modern authorities; Thomas Atthey, whose stone floor kitchen at Gosforth was a veritable Mecca to scientists from all parts of the world, and whose exquisitely prepared fossils from the Low Main shale now form the most important source of information in the world regarding the higher forms of life of the coal period.

These are only a few names out of the thirty or more students whose collections had become so important in the early eighties that another group of men, of whom north country citizens may be equally proud, came forward and with rare and unselfish generosity gave the freehold land and subscribed the money (amounting in the first instance to nearly £50,000) to erect a building in which these treasures might be suitably housed and be made for all time accessible for reference and study to the serious student from any part of the world. This Museum with its important collections was handed over to the Natural History Society as being a body of men who, possessed of the knowledge and imbued with the scientific spirit of the pioneers, were best fitted to be the custodians of these highly prized specimens. The Society accepted this responsibility, and for nearly thirty years, by means of their subscriptions and the frequent generous assistance of friends, its members have not only maintained the Museum, but have taken over many other important private collections.

The suitable care of these collections has for many years rendered necessary the services of a highly trained scientific naturalist. The Society have been fortunate in having secured this for more than twelve years in the person of Mr. E. Leonard Gill, M.Sc., but at a remuneration far below his value, and in order to retain his services or to secure an efficient successor if at any time he should leave his present position, the Council of the Natural History Society are most anxious to be in a position not only to give more adequate remuneration to their Curator and to the Museum Staff, but also to possess an annual income which will enable them to carry on the other work of the Society in the spirit of its founders, and to maintain the high position in the scientific world which has been held by this Society in the past.

Under these circumstances the Council of the Natural History Society now confidently appeal to the successors of the men who in the eighties showed such appreciation of these collections, to show a like appreciation by subscribing £25,000 at least as an endowment fund, so that the collections themselves, their care and further study, may be placed beyond all possibility of neglect.

The originators of the great industries which have so enormously increased the productiveness and wealth of the Tyneside and adjacent districts were the friends and admirers and daily companions of the men who founded the Hancock Museum, and it is no flight of imagination to suggest that in some measure their success was due to the spirit of these men. The local wealth to-day is immeasurably greater than it was in the eighties, and it is surely not too much to ask the inheritors and possessors of the wealth at the present time to give at least one-half of what their ancestors did thirty years ago. The late John Hancock was under no illusion as to the necessity for the creation of such a fund, seeing that in 1888 he made an appeal for a "Maintenance Fund," but it was then probably too near to the great effort of building the Museum for it to meet with the response he desired. Had he lived longer, however, there is no doubt such a fund would have been created.

We confidently appeal to your generosity to give us such a donation that so far as you are concerned the Hancock Museum of the future shall be worthy of its past and of the great reputation of the naturalists, past and present, of Tyneside.

Yours very truly,

JOICEY, President.

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM 1ST JULY, 1913, TO 30TH JUNE, 1914

RECEIPTS				£	s.	d.
Members' Subscriptions				378	13	6
Museum Admission Fees	130	7	8			
Education Committee's Grant	10	0	0			
				140	7	8
Sale of Guide Books, etc.				5	2	10
Interest on Investments				375	4	7
Sundries	3	15	2			
Grant from Armstrong College	5	5	0			
Special donation from Lord Joicey to clear off deficit, June 30th, 1913	84	8	1			
				93	8	3
Refunded from Camera Account now closed				6	8	8
				£999	5	6

PAYMENTS				£	s.	d.
Deficit, 30th June, 1913				84	8	1
Salaries				600	7	8
Advertising				7	16	10
Fuel, Lighting, and Water				61	4	5
Insurance				29	13	8
Materials and Fittings				22	17	5
Postage and Carriage				14	12	2
Printing				9	8	0
Property Tax				10	11	1
Building Repair Fund				40	0	0
Stationery				1	16	6
Publication Account				84	19	1
Subscriptions: Museums Association	1	1	0			
Ray Society	1	1	0			
Hooker Memorial	1	1	0			
Sundries	26	18	6			
				30	1	6
Balance in hand				1	9	1
				£999	5	6

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

BUILDING REPAIR FUND

	£	s.	d.		£	s.	d.
Balance in hand, 30th June, 1913	30	6	2	Work on drains	48	9	7
Transfer from General Account	40	0	0	Sundry repairs	16	13	3
				Balance in hand, 30th June, 1914	5	3	4
	£70	6	2		£70	6	2

CRAWHALL LEGACY ACCOUNT.

	£	s.	d.		£	s.	d.
On deposit and in Bank, 30th June, 1913	652	4	1	On deposit with Crown Benefit Building Society	300	0	0
Interest on Deposits	24	0	0	,, Crown Permanent Benefit Building Society	300	0	0
Bank Interest on Account	1	13	8	Balance in Bank, 30th June, 1914	77	17	9
	£677	17	9		£677	17	9

PUBLICATION ACCOUNT

	£	s.	d.		£	s.	d.
Sale of Transactions	1	6	0	Carriage of Transactions	0	18	4
Transferred from General Account	84	19	1	Printing of Transactions (Vol 4, part 1)	85	6	9
	£86	5	1		£86	5	1

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

CAMERA ACCOUNT

	£	s.	d.		£	s.	d.
Donations, July, 1913, to June, 1914	13	18	2	Sundry fittings for dark room	7	9	6
				Balance refunded to General Account	6	8	8
	£13	18	2		£13	18	2

LEPIDOPTERA ACCOUNT

	£	s.	d.		£	s.	d.
Donations received	89	5	0	Dr. H. Eltringham	75	0	0
				Messrs. Currie and Co.—removing	2	7	6
				Fittings	1	18	4
				Balance in hand, 30th June, 1914	9	19	2
	£89	5	0		£89	5	0

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1914:—

Nominal			Investment		Taken at cost. £	s.	d.
£2,000	0	0	Newcastle Corporation 3½ per cent. Irredeemable Stock (Coppin Bequest)		2,000	0	0
500	0	0	River Wear Commission 4½ per cent. Funded Debt		500	0	0
2,946	18	1	Midland Railway Company's Consolidated 2½ per cent. Preference Stock	Crawhall Bequest.	6,000	0	0
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock				
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock				
400	0	0	Armstrong, Whitworth & Co., Ld., 4 per cent. Debenture Stock		*2,000	0	0
485	0	0	Newcastle and Gateshead Water Company's Ordinary Stock				
80	0	0	Weardale and Consett Water Company's 10 per cent. Maximum Ordinary Stock				
350	0	0	,, ,, 7 ,, ,, ,,				
					£10,500	0	0

* This was formerly invested in the Tyne Commissioners' Ccnsolidated Fund.

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors

A. H. DICKINSON, Hon. Treasurer.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE

REPORT OF THE COUNCIL

FOR 1914–1915.

THE year under review has been overshadowed by the Great European War, which broke out about the time when the last Annual Report was drawn up and which has made its effects felt throughout the world. With the thoughts of everyone dominated by this terrible struggle it was to be expected that there would be less interest in the work of Natural History. This has proved to be the case.

Immediately war began, Armstrong College was taken over by the Government as a Military Hospital. In consequence of this action other centres had to be found in which to carry on its educational work; and in this the Natural History Society has been able to co-operate by granting the use of certain portions of the Hancock Museum. The east and west corridors, both upper and lower, as well as the library, were placed at the disposal of the Council of the College, and in these the biological sections, Geology, Zoology, Botany and Mineralogy, and Art, including Arts and Crafts, have been housed. It has been a source of satisfaction and pleasure to your Council to have been able to assist in this important work. The use of the library during one week early in June for the purpose of holding the Cambridge Higher Local Examination has also been help of a similar nature.

Another effect of the war and the consequent great demand that it has made, and is making, upon the monetary resources of everyone, has been the suspension of contributions to the Endowment Fund. This has been a serious blow to the hopes of the Society. When peace is once more restored it is trusted that there may be a renewal of the generous flow of support which marked the early effort to establish this fund.

The membership roll shows that during the year there has been a loss owing to death and resignation of 17, while 9 new members have joined the Society, bringing the total number on June 30th to 404.

Turning to the attendance, the record of the turnstile shows that the admittances only totalled 12,821, including 1,877 children of the Newcastle Council Schools, as against 20,055 in the preceding year. Soldiers and sailors in uniform have been admitted to the Museum free; but while there is satisfaction in this, there is less in the fact that the attendance and support of the general public has fallen off to such a large extent. Our experience, however, is far from unique, and is amply accounted for by the general preoccupation caused by the war.

In last year's Report reference was made to certain repairs, chiefly to the repointing of the outside of the Museum, which appeared to call for attention. A careful inspection was again made by Mr. J. J. Hill, F.S.A., and Mr. W. E. Beck, who reported that in the face of financial difficulty these might be deferred for the present, but that it was absolutely necessary that the roof should be painted and all damaged glass renewed. This work has been carried out by Mr. G. G. Laidler. It was also found necessary to reset some of the lead sheeting on the roof of the east corridor. As regards the interior work of the Museum, there is much that your Council would like to see put in hand, but they feel that, in the present national difficulty, economy of expenditure must be strictly exercised. The cases containing the valuable collections of corals, sponges, sea-fans, etc. were, however, found to be in such condition that it was considered necessary to make them dust-proof. The cases in which the collection of fishes is being rearranged on a systematic basis need similar treatment; and also the accommodation for the exhibition of minerals needs considerable enlargement. These matters, important as they are, must be postponed for the moment.

During the year many interesting acquisitions have been received, a full list of which appears on another page. One most interesting addition to the collections is that of the trunk and roots of a fossil tree, secured through the generosity and kindness of Mr. Utrick A. Ritson. Some particulars of this fine object will be found in the Curator's Report.

The Hancock Prize Competition this year shows a falling-off in numbers. Only nine candidates sent in essays, the quality of these, however, showed a higher standard of work and observation. The prize was divided equally between Mr. W. Leonard Turner, of Low Fell, whose essay dealt chiefly, though not entirely, with the spiders of the district, and Mr. Edward Miller, of Warkworth Old Barns, who took the birds of his neighbourhood for his theme. The task of examining and reporting on the essays was again undertaken by the Rev. J. E. Hull, M.A., and Mr. George Bolam, who applied their usual patience and skill to the work. The Council highly appreciate their help.

An attractive programme of field meetings was planned at the beginning of the season; these were faithfully carried out with the exception of that on the coast in September, which it was feared might not be permitted at the time by the military authorities. The attendance at these meetings was only moderate.

A course of lectures was organised and delivered, details of which are given on another page. The Curator again carried on a series of instructive "museum talks." At the two lectures arranged for children during the Christmas and New Year weeks the attendance was 125 and 72 respectively. Excluding these lectures the average attendance did not exceed

44, whilst at the attractive "museum talks," given by the Curator, it fell slightly below 24. Informal meetings in the evenings were held monthly during the winter. The thanks of the Society are given to those lecturers who so generously gave their services to help in making the series a success.

The arrangement has been continued by means of which children attending the Newcastle Council Schools had the opportunity of visiting the Museum in classes. It is a matter of regret that there is a decrease in the number of those who take advantage of this scheme and that the systematic plan of work drawn up for their help is no longer followed. On the other hand it is satisfactory to report that boys of the Royal Grammar School come regularly to the Museum under the arrangement made with the Head Master, and follow, as far as time permits, a course of work which it is hoped and believed is tending to develop their power of observation and their taste for natural history.

The exhibit of wild flowers has been continued and proves each year more successful. Many visitors come regularly to inspect the plants and to seek help in the identification of specimens which they have met with in the field.

The Society has been unfortunate in losing several of its old and valued members by death; Lady Armstrong, wife of a former President, and the Hon. Drever Joicey, son of the present President; Sir John Swinburne, Bart., who joined in 1864; Mr. M. Havelock in 1862; Alderman Geo. Harkus in 1885, and others who loyally supported the Society for many years.

No transactions have been published during the year. There are now several papers in hand, which will appear in due course. Good progress is being made with some sections of the card catalogue of local natural history. The Rev. J. E. Hull in particular has prosecuted his share of this work with much energy, and has completed the sections dealing with spiders, harvestmen (*Opiliones*), beetle mites and several other groups.

Regarding the accounts and finances, the falling off in admissions has naturally affected the position, which but for the Endowment Fund (the full benefit of which is gradually being felt) would have been much less favourable. The General Account shows an adverse balance of £41 13s. 4d., but as there is £33 7s. 10d. left in the Building Repair Fund, the actual deficit at the end of the year's working is only £8 5s. 6d., which under the circumstances may be regarded as satisfactory.

Tickets, in packets of 25 for 5/- and 12 for 2/6, have been prepared for the use of those members who wish to invite their friends to visit the Museum, and it is hoped that many will take advantage of this means of interesting strangers in the work that is being done here.

It is again with pleasure and satisfaction that the Council acknowledge the unfailing interest and excellent work shown and carried out by the Curator, Mr. Gill, and his efficient assistants.

CURATOR'S REPORT ON MUSEUM WORK

1914–1915

In common with other institutions of every kind, the Hancock Museum has had its working disturbed to a certain extent by the war. In August there was some prospect of the building being taken over for conversion into a hospital. This danger did not materialize, but Armstrong College was less fortunate, and it has fallen to us to provide temporary accommodation for some of the College departments. We are housing the departments of zoology, botany and geology, as well as a large section of the art school. This has meant practically abandoning work for the time being in the east and west corridors on both floors and in the back corridor; some other parts of the building are also given up to the use of the students and staff, but happily, through general good-will and considerateness, there have been no further difficulties, and the main course of our work has hardly been interfered with. The only important case in which we have had to modify our plans is that of the whale's skeleton. This we had just started to put together in the back corridor, and we cannot proceed with it until the occupation of the corridor by the art school comes to an end.

For clearness, and in order to shorten a report written in rather difficult circumstances, I will adopt again the plan followed last year and make use of headings.

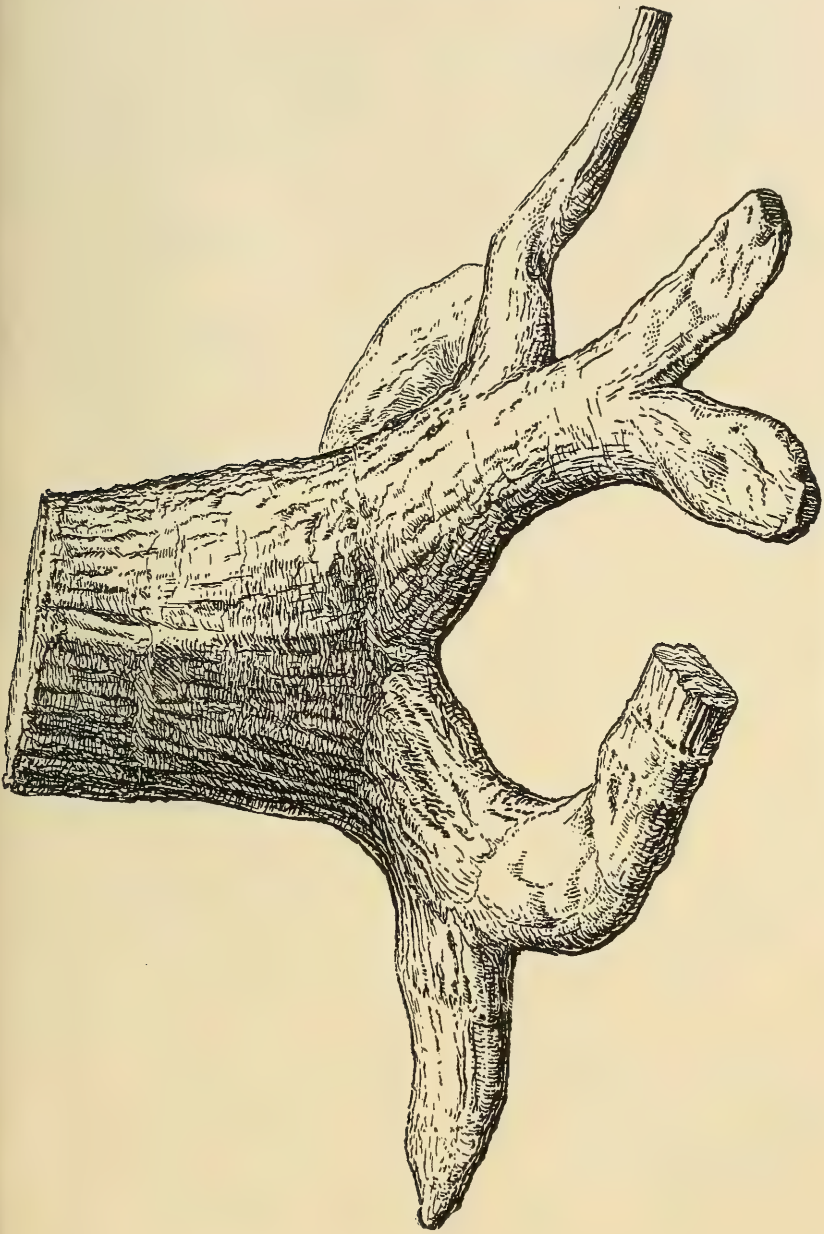
Butterflies and Moths. A full account of Dr. Eltringham's splendid collection was given in last year's report. During the past year we have dipped further into the collection to make up a few more cases of butterflies from special regions and to select some exotic moths for exhibition. We have subsequently re-arranged the large collection still remaining in the cabinets and have thus gained some space for other uses. Our set of British Lepidoptera for exhibition has been completed. We are showing a full series of the butterflies and a representative series of the moths; and owing to the kindness of Mr. Alexander Rosie we have been able to include a very good selection of the Microlepidoptera. The series of exotic moths is not yet ready for exhibition, but with the help of some which we have purchased with the small balance of the "Lepidoptera Fund" we hope soon to be able to make a creditable display.

Other Insects. A great deal of work has been done upon other orders of insects. Exhibition sets of Diptera (flies) and Hymenoptera (bees, wasps, ants, etc.) have been prepared and put on view. Descriptive and introductory labels have been drawn up to accompany these sets, and also for the cases of beetles from all parts of the world which we fitted up last year. Very good progress was made during the winter with the large reference collection of British beetles; the work involved was done almost entirely by Mr. G. B. Walsh, who, as in the previous two winters, spent many of his Saturdays upon it.

Casts of Fishes. This section of our work appeared in last year's report on the "temporarily in abeyance" list. We had always regretted having to leave it in that position, and it has been one of the pleasantest features of the year that we have been able to take it up again with vigour. The result is that we now have a nearly complete set of casts of the fishes we intend to show in this form. A large number of casts have been made or finished and painted during the year. The bulk of them are casts either of sea fishes of economic importance or different varieties of salmon and trout. The fishes of which we still have to obtain casts are chiefly coarse fresh-water fishes not found in this district. It may here be mentioned that the *Museums Journal* has published a full account, written and illustrated by Mr. Fletcher and myself, of our method of making casts.

Fossil Tree. The most striking acquisition made during the year is that of a large fossil tree. This was exposed, together with a number of others, in a quarry in the Millstone Grit on the summit of the watershed between the Derwent and the Wear, not far from Stanhope. Its special value lay in the fact that not only the lower part of the stem but also the thicker parts of the roots were preserved in the position of growth. But though it was so desirable as a museum specimen, the difficulties presented by its bulk and weight, by its rather awkward position, and by the distance over which it had to be transported were so great that we should have had to renounce it had not Mr. U. A. Ritson come to our aid. Mr. Ritson took a great interest in the discovery, and he most generously purchased the tree, arranged for its removal by motor lorry, and paid the whole cost of transport and of the subsequent erection in the museum. This last job, the re-erection of the tree, was an interesting and difficult undertaking. A large block of the stem, weighing considerably over a ton, formed the key to the whole, and had to be supported in position before the roots could be fitted on below it. But with the help of photographs and preliminary measurements we managed it quite successfully, and the tree as it now stands forms an imposing object. An excellent idea of its appearance may be gathered from the accompanying figure, which is reproduced from a drawing kindly made for us by Mr. A. Heslop, of the College School of Art. We have not yet been able to make the tree fully accessible to the public, as the corridor in which it stands is occupied by the College geological department.

Coral Cases. About eight years ago we cleaned, identified and completely re-installed the corals, sea fans and sponges in the Tankerville Collection at the south end of the zoology room. Since then the wall-cases containing the collection had become very dusty and dirty—more so than they ought to have done. We have now had to clean the cases and specimens again, and at the same time we had the cases examined to find out where they were defective. As a result we have had the doors taken off and fitted with fresh arrangements for trapping dust, and we hope the worst of the trouble is remedied. Nearly all the wall-cases in the room are in need of similar treatment, but it has not been possible, with the funds at our disposal, to deal with more of them at present.



Fossil Tree with Stigmarian Roots.

From the Millstone Grit, Crawleyside, near Stanhope-in-Weardale.

Presented by Mr. U. A. Ritson. Figure drawn by Mr. A. Heslop.

Minerals. The main work during the past year has been the making of a systematic reference catalogue of the collection, taken case by case; and much miscellaneous work has also been done, including the mounting of special specimens in such ways as to show them off to the best advantage.

Raine Collection of Birds' Eggs. Miss Scott has been working through this fine collection, replacing the cotton wool where necessary and dealing with any signs of mould.

Photography. We have made a good deal of use of the camera during the year. We prepared a number of lantern slides to illustrate lectures, took a series of photographs for the purpose of a paper in the Transactions, and used the camera and other parts of our outfit for a variety of other purposes.

Wild Flowers. We expected to find great difficulty in keeping up a good show of fresh wild flowers this summer, but after the first few weeks we were able to make at least as good a display as we had ever done before. This was very largely due to the kind efforts of Lord Ridley and Mr. Nicholas Temperley.

Lessons and "Talks." During the two winter terms I again gave weekly lessons in the museum to classes of boys from the Grammar School. There were three classes, and the lessons lasted twenty minutes for each. Among the subjects were birds (from the general and structural point of view), shore life, and British mammals and fishes. My "museum talks," for reasons connected with the war, were fewer in number than usual, and for the most part poorly attended.

Parties Conducted. Among the parties of visitors conducted round the museum were two of special interest. One was a party of children from St. Ann's Mission, who seemed to enjoy their visit amazingly; the other was a group of convalescent soldiers brought by Mrs. Pease from the hospital she has established in her house at Benwell.

Donations. The fossil tree presented by Mr. Ritson was certainly the most notable donation of the year, but a number of others were of importance. Among them were a selection of shells, fossils, etc., from the late Mr. J. D. Robinson's collections, presented by his niece, Mrs. Heppell; a fine wapiti head from Mrs. Norman Cookson; birds given for the aviary by Lady Noble, Mr. T. Bentham, Mr. H. P. Angus, and Mr. Geo. Weddell; and a copy of Haeckel's celebrated work, "Art Forms in Nature," from Mr. P. Walther. Valuable sets of insects have also figured conspicuously in the year's acquisitions; the Microlepidoptera from Mr. Alex. Rosie have been mentioned, and Mr. Walsh has given us a number of rare British beetles, Mr. John Gardner the remainder of his noted collection of beetles for incorporation in our reference collection, Mr. Bagnall a series of local Psyllids (froghoppers, etc.) collected by himself, and Dr. Geo. S. Brady his collection of British wingless insects (Collembola and Thysanura).

Before concluding my report I should like to point out that I have abstained from trying to assign credit for different portions of the work to the various members of the staff. It is therefore a duty, as well as a pleasure, to state that their work has been admirable both in spirit and in result.

E. LEONARD GILL.

MUSEUM STAFF

CURATOR	E. LEONARD GILL, M.SC.
ASSISTANT	HERBERT FLETCHER.
LADY ASSISTANT AND SECRETARY	MISS GLADYS M. SCOTT.
ATTENDANT	WILLIAM VOUTT.
GARDENER	ALBERT SPENCER.

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.
R. S. Bagnall, F.E.S., F.L.S.
Rev. W. McLean Brown.
Harry Eltringham, M.A., F.Z.S.
Samuel Graham.
Prof. G. A. Lebour, M.A., D.Sc.
Prof. Alex. Meek, M.Sc.
Prof. M. C. Potter, M.A., Sc.D.
Geo. B. Walsh, B.Sc.
P. Walther.

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 28th, 1914.

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey.

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Ridley.
Lord Barnard.
Lord Ravensworth.
The Bishop of Durham.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Andrew Noble, Bart., F.R.S.
Sir G. H. Philipson, M.D., D.C.L.
Sir Lindsay Wood, Bart.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
R. Coltman Clephan, F.S.A.
Clive Cookson.
J. L. Gracie.
Samuel Graham.
Principal W. H. Hadow, M.A., Mus. Doc.
N. H. Martin, F.R.S.E., F.L.S., F.C.S.
H. N. Middleton.
Col. C. W. Napier-Clavering.
Prof. M. C. Potter, M.A., Sc.D
J. D. Walker, J.P.

COUNCIL

G. A. Atkinson.
W. E. Beck.
H. I. Brackenbury.
Rev. W. McLean Brown.
Reginald Bryant.
John D. Chaloner.
Wilfred Hall.
Prof. H. J. Hutchens, M.A., M.R.C.S., D.S.O.
Hon. J. Arthur Joicey.
Prof. A. Meek, M.Sc.
Ernest Scott.
George Sisson.

HON. SECRETARIES

C. E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

EVENING MEETINGS HELD DURING THE WINTER SESSION, 1914–1915.

Oct. 14.—Mr. A. D. Peacock, M.Sc., F.E.S. : "An Entomologist in Southern Nigeria"; chair taken by Mr. Ernest Scott.

Nov. 17.—Mr. A. T. Gillanders, F.E.S. : "The Minute Structure of Forest Trees"; chair taken by Mr. John Losh.

Dec. 9.—Mr. B. Storrow : "Our Marine Food Fishes and their Distribution"; chair taken by Mr. Cuthbert B. Wilson.

Jan. 27.—Mr. Richard Adamson : "Rarer Flowers of Northumberland and Durham"; chair taken by Mr. N. Temperley.

Feb. 10.—Dr. F. A. Bainbridge, M.A., F.R.C.P. : "Heredity"; chair taken by Mr. Jos. G. Angus.

Mar. 10.—Mr. Wm. Percy Mail : "Poachers and the Poached"; chair taken by Mr. C. E. Robson.

Mar. 30.—Private Evening Meeting of the Society : Report on Field Meetings of 1914, by Mr. J. J. Hill. Reading of the Hancock Prize Essays.

AFTERNOON LECTURES TO YOUNG PEOPLE.

Dec. 28.—Dr. T. Coke Squance : "Primitive Man"; chair taken by Mr. N. H. Martin, J.P., F.R.S.E., F.L.S.

Jan. 4.—Mr. Hugh Richardson, M.A. : "Map Reading for Naturalists"; chair taken by Sir G. H. Philipson, J.P., M.D., D.C.L., F.R.C.P

CURATOR'S "MUSEUM TALKS."

Oct. 28.—Animal Frameworks, Part I.

Nov. 25.—Animal Frameworks, Part II.

Dec. 16.—Mimicry.

Feb. 24.—Bird Life in Spring.

Mar. 31.—Some Skins from East Africa.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1915.

HUGH P. ANGUS.—Nest of young hedge sparrows, living, one normal bird and two white; from the donor's garden at Low Fell. A piece of thick lead water-pipe gnawed through by rats.

GEO. A. ATKINSON.—Some Japanese butterflies, set, including a large *Hestia*.

RICHARD S. BAGNALL, F.E.S., F.L.S.—A collection of local Psyllids ("frog-hoppers," etc.), about 35 species. Reprints of four papers by the donor: *Euthrips tamicola*, a new species of Thysanoptera; *Stenurothrips succineus*, a fossil insect in amber; Brief descriptions of new Thysanoptera, iv.; The Woodlice of Northumberland and Durham.

D. M. BARRINGER.—Copy of paper by the author, "A Meteor Crater in Northern Central Arizona."

MISS SEYMOUR BELL.—A West Indian globe fish.

THOS. BENTHAM, B.SC.—A pair of living Californian quails *(Lophortyx californicus)*, and a bullfinch, for the aviary.

GEO. BOLAM.—A Daubenton's bat from Alston.

T. W. BRACKEN.—Butterflies (in papers) and other natural history objects collected by the donor on the Lagos Government Railway, Northern Nigeria.

DR. GEO. STEWARDSON BRADY, F.R.S.—A collection of apterous insects (Collembola and Thysanura) taken by the donor in various parts of the British Isles.

ABEL CHAPMAN.—A malformed trout from the North Tyne. An adult great grey shrike, picked up dead near Houxty, North Tyne, on 1st May.

HUGH V. CHARLTON.—A fieldfare shot out of a large flock in Cumberland on 3rd May. A trout, about 1½-lbs., from the Eden, for casting.

MRS. NORMAN COOKSON.—A fine wapiti head from Canada.

HERBERT COXON.—Five trout from Rothley Lake, for casting.

MRS. DINNING.—From the collections of the late Mr. William Dinning: a box of small tools for developing fossils; a book of newspaper cuttings referring to the work of local naturalists in the 'sixties and 'seventies.

W. E. Forster.—An example of the three-spotted wrasse (female of the striped wrasse, *Labrus mixtus*) from Paignton, Devon.

Jno. Gardner, F.E.S.—The remainder of the donor's collection of British beetles, for incorporation in the large reference collection. Reports of the International Congress of Entomology, Oxford, 1912: vol. i., Proceedings, and vol. ii., Transactions.

Newbey S. Green.—A grouse's egg curiously bleached by the action of moist peat.

T. A. Hancock.—As a bequest from the donor's brother, the late John Hancock (nephew of the ornithologist): a prize chalk drawing by the donor's brother, and a water-colour drawing by the late Miss Mary Hancock.

S. R. Haselhurst, M.Sc., F.G.S.—A fine piece of cone-in-cone from St. Mary's Island, and (deposited) a unique collection of cone-in-cone and related rock-structures from many localities, illustrating recently published work by the donor. Model and coast section explaining the Tynemouth landslip. Samples from glacial or post-glacial beds at the mouth of the Tyne, including pieces of birch wood and concretions formed round rootlets. Samples of Bovey Tracey lignite.

Mrs. Heppell.—Objects selected from the collections of the late Mr. J. D. Robinson, of Gateshead, uncle of the donor: a large number of marine shells; fossils from British and French Cretaceous beds, Lias, Coal Measures, etc.; economic products, *e.g.*, cocoa pods and beans; early forms of matches, tinder boxes etc.; and some ethnological objects.

Mrs. T. E. Hodgkin.—Two nests of weaver birds *(?Ploceus sp.)*, from India.

Rev. J. E. Hull, M.A.—A large "bird-catching" spider, *Avicularia versicolor*, Walck., female, from Trinidad, West Indies.

India Office (Secretary of State for India in Council).—A further volume of "The Fauna of British India": Mollusca, vol. ii., by G. K. Gude.

Dr. A. Randell Jackson.—Copies of papers by the donor: "A Preliminary List of the Myriapoda of the Chester District"; "On some Arachnids and Myriapods observed in 1914"; "A Second Contribution to the Spider Fauna of Scotland."

Prof. Henry Louis, M.A., D.Sc.—A well preserved twig of *Lepidodendron* from the Millstone Grit, Crawleyside.

Edward Lovett.—Copy of paper by the donor on "The Game of Knuckle Bones."

Mr. Macarthur.—A nest which there is good reason to think is that of a siskin, from near Kenton.

Hugh Main.—Two living ant-lions (larvæ of *Myrmeleon sp.*), from Switzerland; kept alive for some time at the Museum.

N. H. Martin, F.R.S.E., F.L.S.—Complete bound series of the Journal of the Royal Microscopical Society, 1874 to 1900.

Henry Tuke Mennell, F.L.S.—The Journal of the Linnean Society: Botany, vol. 42, nos. 286-7, vol. 43, no. 288; Zoology, vol. 32, nos. 217-8. Also a copy of a List of the Invertebrate Marine Fauna, drawn up for the Dredging Committee of the British Association, 1860.

Lady Noble.—Two young ravens from the West of Scotland, for the aviary.

Miss Noble.—"Mutton Birds and Other Birds," a book on some of the characteristic birds of New Zealand, by H. Guthrie Smith.

E. A. Payne (Moravian Mission, Nain, Labrador).—A fish spear (kakkivak) with spring forks and barbs, used by the Eskimos for spearing trout through holes in ice.

Mr. Richardson (Board of Agriculture).—Larva and pupæ of magpie moth; and an ichneumon fly.

J. Alaric Richardson.—A very large garfish *(Belone vulgaris)*, for casting.

Utrick A. Ritson, D.L.—A very fine fossil tree *(Sigillaria sp.)*, lower part of stem with roots, from a gannister bed in the Millstone Grit, Crawleyside, near Stanhope-in-Weardale.

Miss Joyce Robson, M.Sc.—A collection of Hydrozoa made by the donor, mounted in the form of microscope slides (50).

Alex. Rosie.—An excellent representative set of British Microlepidoptera, collected and prepared by the donor.

Ernest Scott.—Samples of the successive cave deposits of Kent's Cavern, Torquay, with bones and hyæna's teeth.

Miss Althea R. Sherman.—Copies of papers on North American birds, by the donor: "Carolinean Avifauna in North-Eastern Iowa"; "At the Sign of the Northern Flicker"; "Experiments in Feeding Humming birds during Seven Summers"; "Nest Life of the Screech Owl"; "Nest Life of the Sparrow Hawk."

STANLEY SMITH, D.Sc. (exchange, arranged by him).—Specimens of graptolites, 13 species, mostly from Welsh Silurian beds.

J. F. STEWART.—Blue tit's nest, from box in donor's garden.

MRS. SWORDER.—Two saturnid moths from Tobago, British West Indies.

J. TWEEDY.—A number of Egyptian funereal figures (ushabti).

G. B. WALSH, B.Sc —Examples of a number of the rarer species of British beetles, contributed to the large museum reference collection.

P. WALTHER.—A copy of Hæckel's work, "Art Forms in Nature" (Kunstformen der Natur): 100 plates, mostly coloured, with descriptive text.

J. HENRY WATSON.—Five newly-hatched living leaf-insects *(Phyllium crurifolium)*, natives of the Darjeeling district.

GEO. WEDDELL.—Birds for the aviary: three siskins and a brambling.

The publications received by exchange with British and foreign scientific institutions are acknowledged in a separate list which is published later (in the Transactions) as an appendix to the report.

DONATIONS TO THE ENDOWMENT FUND.

From June 30th, 1914, to June 30th, 1915.

	£	s.	d.
Lord Joicey	1,000	0	0
J. H. Burn	105	0	0
Sir Charles Milburn	100	0	0
William Gibson	52	10	0
Sir Charles Morrison Bell	50	0	0
T. E. Hodgkin	50	0	0
Mrs. Pease	50	0	0
Thomas Taylor	50	0	0
W. J. Benson	25	0	0
Col. R. H. Carr-Ellison	25	0	0
Frederic Straker	25	0	0
J. L. Gracie...	20	0	0
Mrs. Gurney...	20	0	0
Principal W. H. Hadow	10	10	0
Francis Priestman	10	0	0
Miss S. A. Richardson	10	0	0
Mrs. Thompson	10	0	0
Miss Jessica Thompson	10	0	0
Mrs. Mary Willson	10	0	0
W. S. Burton	5	5	0
F. Carrick	5	5	0
W. W. Gibson	5	5	0
Messrs. Hunting & Son	5	5	0
C. C. Leach...	5	5	0
Miss L. H. G. Noble...	5	5	0
George Renwick	5	5	0
Abel Chapman	5	0	0
Mrs. Clay (in memory of T. R. Clay) ...	5	0	0
Dr. Rudolph Messell	5	0	0
John H. Holmes	3	0	0
George Jenkins	2	2	0
T. H. Leathart	2	2	0
Mrs. T. Pumphrey	2	2	0
Frederick Beavan	1	1	0
Dr. William Martin	1	1	0
	£1,696	3	0

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM JULY 1ST, 1914, TO JUNE 30TH, 1915

RECEIPTS	£	s.	d.	£	s.	d.
Balance June 30th, 1914				1	9	1
Members' Subscriptions				345	14	6
Museum Admission Fees	89	2	6			
Education Committee Grant	10	0	0			
				99	2	6
Sale of Guide Books, etc.				4	11	4
Interest on Investments				436	6	11
Sundries	14	3	2			
Grant from Armstrong College	5	5	0			
				19	8	2
Deficit 30th June, 1915				41	13	4
				£948	5	10

PAYMENTS	£	s.	d.	£	s.	d.
Salaries				652	14	9
Advertising				8	16	4
Fuel, Lighting, and Water				90	16	4
Insurance				29	15	11
Materials and Fittings				31	16	0
Postage and Carriage				7	19	0
Printing				25	12	0
Property Tax				14	14	6
Building Repair Fund				40	0	0
Stationery				1	12	0
Publication Account				3	17	2
Subscriptions: Museums Association	1	1	0			
Ray Society	1	1	0			
Sundries	38	9	10			
				40	11	10
				£948	5	10

SAML. GRAHAM } Hon. Auditors.
W. J. BELLERBY }

A. H. DICKINSON, Hon. Treasurer.

BUILDING REPAIR FUND

	£	s.	d.		£	s.	d.
Balance in hand, 30th June, 1914	5	3	4	Damage to railings	8	7	6
Transfer from General Account	40	0	0	Sundry repairs	11	15	6
War Office: for damage to railings	8	7	6	Balance in hand, 30th June, 1915	33	7	10
	£53	10	10		£53	10	10

CRAWHALL LEGACY ACCOUNT

	£	s.	d.		£	s.	d.
Balance, 30th June, 1914	677	17	9	On deposit with Crown Building Society	300	0	0
Interest on Investments	24	0	0	,, Crown Permanent Building Society	300	0	0
Balance of Lepidoptera Account, now closed	3	16	9	Show Cases	55	0	0
Bank Interest on Account	1	8	2	Painting Roof	39	10	0
				British Butterflies	2	7	6
				Balance, 30th June, 1915	10	5	2
	£707	2	8		£707	2	8

PUBLICATION ACCOUNT

	£	s.	d.		£	s.	d.
Sale of Transactions	0	18	9	Half Tone and Line Blocks	4	15	11
Transferred from General Account	3	17	2				
	£4	15	11		£4	15	11

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

LEPIDOPTERA ACCOUNT

	£	s.	d.		£	s.	d.
Balance, June 30th, 1914	9	19	2	Dr. H. Eltringham	25	0	0
Donations	22	2	0	"Mimetic Butterflies"	2	10	0
Bank Interest on Account	0	6	1	Moths	1	0	6
				Balance transferred to Crawhall Legacy Account	3	16	9
	£32	7	3		£32	7	3

ENDOWMENT ACCOUNT

	£	s.	d.		£	s.	d.
Balance, June 30th, 1914	1,334	4	6	Paid for purchase of £1,800 Canadian 4% Registered Stock	1,719	5	0
Donations and Subscriptions as per list in Report.	1,696	3	0	Paid for purchase of £200 Newcastle & Gateshead Water Co. 5% Preference Stock	255	16	4
Bank Interest	9	10	7	Paid for £721 Newcastle & Gateshead Water Co. Consolidated Preference Stock	947	1	9
				Balance, June 30th, 1915	117	15	0
	£3,039	18	1		£3,039	18	1

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1915 :— Taken at cost.

				£	s.	d.
Coppin Bequest—						
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock	2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt	500	0	0
Crawhall Bequest—						
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock			
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock	6,000	0	0
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock			
400	0	0	Armstrong, Whitworth & Co., Ld., 4 per cent. Debenture Stock			
485	0	0	Newcastle and Gateshead Water Company's Ordinary Stock	2,000	0	0
80	0	0	Weardale and Consett Water Company's 10 per cent. Maximum Ordinary Stock			
350	0	0	,, ,, 7 ,, ,, ,,			
Endowment Fund—						
1,800	0	0	Canadian 4 per cent. Registered Stock			
200	0	0	Newcastle and Gateshead Water Co.'s 5 per cent. Preference Stock	2,922	3	1
721	0	0	,, ,, 5 per cent. Consolidated Preference Stock			
				£13,422	3	1

SAML. GRAHAM }
W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

LIST OF MEMBERS

OF THE

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-ON-TYNE

REVISED TO OCTOBER, 1915.

⁂ Except where otherwise stated, the addresses given are in Newcastle-upon-Tyne.

⁂ The letters F.C. in place of the date of election indicate that the member joined the Society in 1903 under Rule 3 as a former member of the Tyneside Naturalists' Field Club.

	Elected.
Adamson, Lt.-Col. C. H. E., J.P., C.I.E. *(V.-P.)*, Crag Hall, North Jesmond	1896
Adamson, Miss C. T., Crag Hall, North Jesmond	1903
Adamson, Richard, F.R.H.S., Winlaton, Blaydon-on-Tyne	F.C.
Addison, J. G., The Grange, East Boldon, S.O.	F.C.
Allan, Edward, Osborne Villas	1903
Allden, W. F., Elmfield Road, Gosforth	1906
Allendale, Right Hon. Lord, Bywell Castle, Northumberland	1911
Anderson, Dr. Robt., 4, Gladstone Terrace, Gateshead	1910
Angus, Lt.-Col. W. M., J.P. *(V.-P.)*, Benwell Cottage	1884
Angus, Jos. G., Westover, Low Fell	1902
Angus, Hugh P., Eslington Villa, Low Fell	1902
Armstrong, Henry, The Grove, Jesmond	1908
Armstrong, J. H., 5, Windsor Terrace	1890
Armstrong, The Right Hon. Lord, J.P., M.A., D.C.L. *(Patron)*, Bamburgh Castle, Northumberland	1889
Armstrong, W., J.P., Elmfield Lodge, Gosforth	1903
Arnott, Spencer L., Woodlands, Killingworth	1904
Askwith, R., Witton Hall, Witton-le-Wear	1902
Atkinson, F. Buddle, J.P., Gallowhill, Morpeth	1911
Atkinson, Geo. A., Williton, Riding Mill-on-Tyne	1899

	Elected.
Atkinson, Matthew H., 21, Windsor Terrace	1904
Atkinson, T. H., Eilans Gate, Hexham	1906
Backhouse, T. W., West Hendon House, Sunderland	F.C.
Bagnall, Richard S., F.E.S., F.L.S., Penshaw Lodge, Co. Durham	1905
Bailes, Thos., Fenwick Terrace, Jesmond Gardens	1884
Bainbridge, Geo. B., Espley Hall, Morpeth	1912
Barnard, The Right Hon. Lord *(V.-P.)*, Raby Castle, Darlington	1903
Baumgartner, Mrs. J. R., 10, Eldon Square	1911
Beane, Francis A., Lloyds' Bank, Collingwood Street	1913
Beatley, Wm. C., M.D., 4, St. Mary's Terrace	1902
Beavan, Frederick, Dene Brow, Jesmond Park West	1912
Beck, W. E., 30, St. Mary's Place	1889
Bedson, Prof. P. P., M.A., D.Sc., F.C.S., Armstrong College	1888
Bell, C. L., J.P., Woolsington, Newcastle	1903
Bell, G. F., 4, Tankerville Terrace	1913
Bell, Sir Hugh, Bart. *(V.-P.)*, Rounton Grange, Northallerton	1905
Bell, John G., 49, Osborne Road	1899
Bellerby, W. J., 4, Kensington Terrace	1910
Belt, Thomas, Bigg Market	1907
Benson, Harry, Denehurst, Jesmond Park East	1896
Blair, Robert, F.S.A., Harton Lodge, South Shields	F.C.
Blayney, R. O., 14, Claremont Place	1903
Boocock, J. T., 80, Falmouth Road, Heaton	1913
Bowden, Thos., J.P., 42, Mosley Street	1888
Bowes-Lyon, Hon. Francis, Ridley Hall, Haydon Bridge	1905
Brackenbury, Hereward I., Benwell Lodge	1905
Brewis, Mrs. A., East Ellesmere, Granville Road	1912
Browne, Sir Benj. C., J.P., D.C.L. Westacres, Benwell	1876
Browne, B. C., Fawdon Park, Fawdon	1911
Brown, John W., Grosvenor House, Monkseaton	1908
Brown, Rev. W. McLean, 22, Hawthorn Road, Gosforth	F.C.
Bryant, Reginald, The Hayes, Corbridge	1911
Bullerwell, R. G. A., M.Sc., Balgonie House, Maddison St., Blyth	1910
Bulman, H. F., The North Cottage, St. George's, Newcastle	1905
Burdon, Col. Rowland, J.P., Castle Eden, Co. Durham	1903
Burnup, John, Brantwood, Gosforth	1884
Burnup, Edwin, 2, Wentworth Place	1904
Burnup, Miss Winnifred E., 2, Wentworth Place	1910
Burt, Right Hon. Thos., P.C., D.C.L., M.P., 20, Burdon Terrace	1885
Burton, W. S., 2, Elmfield Villas, Gosforth	1911

	Elected.
Cackett, Jas. T., 113, Osborne Road	1901
Cadman, Chris. C., North of England Fish Hatchery, Barrasford, Northumberland	1906
Carr, Wm. Cochran, Lower Condercum, Benwell	1904
Carr-Ellison, H. G., 15, Portland Terrace	1908
Challoner, John D., 15, Framlington Place	1898
Charlton, Hugh V., 24, Windsor Terrace	1905
Charlton, John, 6, William Street, Albert Gate, London, S.W.	1903
Charlton, Chas. F., 21, Claremont Place	1912
Chaston, Ed. C., 36, St. George's Terrace	1913
Clark, Isaac, 7, Claremont Terrace	F.C.
Clarke, Henry, 24, Dockwray Square, North Shields	F.C.
Clay, Mrs. (in memory of the late T. R. Clay), 14, Windsor Ter.	1894
Clayton, Major Ed., Walwick Hall, Humshaugh	1907
Clephan, R. Coltman, F.S.A. *(V.-P.)*, Marine House, Tynemouth	1887
Cochrane, A. H. J., Jesmond Dene House	1911
Cochrane, Mrs. Alfred, Jesmond Dene House	1911
Cochrane, Cecil A., Oakfield House, Gosforth	1903
Cochrane, Henry H., Eshwood Hall, near Durham	1915
Cohen, Charles, 32, Osborne Road	1908
Cooke, Randel B., Kilbryde, Corbridge	1905
Cooke, Thos., J.P., 24, Grainger Street West	1889
Cookson, Clive *(V.-P.)*, Oakwood, Wylam, R.S.O.	1903
Cookson, Kenneth ,, ,,	1904
Cookson, Harold, Birchwood, near Malvern	1906
Cooper, R. W., 2, Sydenham Terrace	1911
Corder, Percy, Collingwood Terrace	1911
Corder, Walter S., J.P., Rosella Place, North Shields	1911
Cornett, J. P., Ford Paper Works, Hylton, Sunderland	1913
Cowen, Joseph, Stella Hall, Blaydon-on-Tyne	F.C.
Cowper, J., 7, Framlington Place	1914
Cruddas, Miss Dora, Haughton Castle, Humshaugh	1904
Cruddas, Miss Eleanor ,, ,,	1904
Dendy, F. W., D.C.L., Eldon House, Osborne Road	1905
Devey, Dr. Thos. V., Muker, Richmond, Yorkshire	F.C.
Dickinson, A. H., 52, Dean Street *(Hon. Treasurer)*	1884
Dickinson, Robert, Underwood, Riding Mill-on-Tyne	1910
Dinning, Mrs., 43, Eldon Street	1894
Dixon, J. Askew, Ramshawe, Corbridge-on-Tyne	1905
Dodd, D. Mainland, 3, Fenham Terrace	1902
Dove, Ed. J., J.P., Causey House, Gosforth	1912

	Elected.
Drummond, D., M.D., Saville Place	1902
Dunn, N., Shilbottle Colliery, Lesbury	1902
Durham, The Right Hon., The Earl of, Lambton Castle, Fence Houses, Co. Durham	1903
Durham, The Right Revd., The Lord Bishop of *(V.-P.)*, Auckland Castle, Co. Durham	1902
East, Ivan, Greenhill, Jesmond Park	1912
Eeles, Robert, Jesmond Dene Hall	1914
Elphick, Geo., M.R.C.V.S., 1, Brandling Park	1894
Eltringham, Harry, M.A., F.Z.S., 8, Museum Road, Oxford	1902
Ericsson, Axel F., J.P., Hill House, Jesmond Park	1896
Fenwick, J. C. J., J.P., M.D., Long Framlington, Morpeth	1896
Ferguson, John, Dalton, near Newcastle-upon-Tyne	1885
Ferguson, William, 2, St. Thomas' Place	1905
Finlay, Rev. W., Seaton Burn	F.C.
Forster, John J., J.P., Oakfield, Ryton-on-Tyne	1884
Forster, Fred. E., 32, Grainger Street	1901
Foster, C. D., 24, Grainger Street	1906
Fowkes, W. H., 32, Marine Avenue, Whitley Bay	F.C.
Frazer, T. Burdon, Woodside, Lindisfarne Road	1911
Gardner, John, F.E.S., Laurel Lodge, Hart, West Hartlepool	1911
Gardner, F. W., B.A., 59, Meldon Terrace, Heaton	1913
Gibb, C. J., M.D., Sandyford Park	1862
Gibson, Wm., 3, Windsor Terrace	1877
Gibson, Wm. W., Orchard House, Low Fell	1909
Glendenning, G. H., 13, Eslington Terrace	1913
Goodger, Chas. W. S., 18, Market Street	1898
Gordon, Percy, 64, Osborne Road	1913
Gowans, Dr. T., 4, Abbotsford Terrace	1911
Gracie, John L. *(V.-P.)*, 11, Sydenham Terrace	1896
Graham, Samuel *(V.-P.)*, 107, High Park Road	1885
Green, Newbey S., 29, Brandling Park	1907
Greenwell, F. J., His Honour Judge, Greenwell Ford, Lanchester	1902
Greenwell, Winship, Bothal, Morpeth	F.C.
Grey, Right Hon. Sir Edward, Bart., M P., Falloden, Northumberland	1905
Gurney, Miss H. M., M.D., The White House, Grainger Park Road	1912

	Elected.
Hadaway, George, 1, Camden Street, North Shields	F.C.
Hadcock, Major A. C., Benton Lodge, Longbenton	1901
Hadow, Principal W. H., M.A., Mus. Doc. *(V.-P.)*, Armstrong College	1909
Haggie, A. J., J.P., The Manor House, Long Benton	1914
Hall, Wilfrid, Prior's Terrace, Tynemouth	1903
Hancock, John, 11, Eldon Street	1896
Hand, T. W., Public Library, Leeds	F.C.
Hardie, W. J., Stalheim, Graham Park Road, Gosforth	1912
Harle, W. A., 8, Osborne Avenue	1904
Harrison, Chas., Beacon Grange, Hexham	1886
Harrison, The Misses (in Memoriam A. P. H.), 9, Osborne Terrace, Jesmond	1906
Harrison, Thomas, Eastburn, Hexham	1905
Havelock, John, Eastwood, Jesmond Park East	1907
Henderson, G. E., Framlington Place	1886
Henderson, W. F., Moorfield, Claremont	1884
Herd, T. S., 11, Grey Street	1911
Heron, J. P. Maxwell, 65, Eldon Street	1912
Heslop, Miss Mary K., M.Sc., 6, Eldon Place	1907
Heslop, R. O., J.P., M.A., F.S.A., 12, Eskdale Terrace, Jesmond	1903
Heslop, Jas., South Close, Riding Mill	1914
Hick, Rev. J. M., M.A., 21, Nightingale Road, Southsea	F.C.
Higginbottom, A. H., Simmondley, Adderstone Crescent	1914
Hill, J. J., M.S.A., Emerson Chambers, Blackett Street	1909
Hobbs, A. Holmested, M.D., 24, Ellison Place	1903
Hodgkin, T. E., M.A., Old Ridley, Stocksfield	1903
Hodgkin, Mrs. T. E., ,, ,,	1905
Hodgson, J. D., Linton Villa, Grainger Park Road	1912
Holmes, Stephen, 33, Clayton Road, Jesmond	1903
Holmes, Ellwood, Wyncote, Jesmond Park East	1911
Holmes, J. H., Wellburn, Jesmond Dene Road	1911
Holmes, Miss, ,, ,, ,,	1911
Holmes, William, Woodhurst, Moor Road, Gosforth	1914
Holzapfel, Max, Kenton Lodge, Gosforth	1905
Horsley, Wm. F., St. Helen's Terrace, Low Fell	1913
Howden, Prof. R., M.A., F.R.S.E., 14, Burdon Terrace	1903
Hull, Rev. J. E., M.A., Ninebanks Vicarage, Whitfield	F.C.
Humble, Mrs., Ashburn, Scarborough	F.C.
Hunter, Edward, Wentworth, Gosforth	1902
Hunter, G. B., D.Sc., J.P., The Willows, Clayton Road	1902
Hutchens, Prof. H. J., M.A., M.R.C.S., D.S.O., Corbridge	1907

	Elected.
Hutchinson, William, 16, Hawthorn Road, Gosforth	F.C.
Hutton, J. B., 87, Jesmond Road	F.C.
Irving, J. A., West Fell, Corbridge-on-Tyne	1906
Jackson, Joseph, 10, Leazes Terrace	1888
Jenkins, Geo., 6, Kensington Terrace	1896
Johnson, Rev. W., Brookfield, Rossett Drive, Harrogate	F.C.
Joicey, The Right Hon. Lord *(President)*, Ford Castle, Ford, Northumberland	1888
Joicey, Hon. Sidney Jas. Drever, Ford Castle, Ford, Northumberland	1910
Joicey, Hon. Hugh Edward, Ford Castle, Ford, Northumberland	1910
Joicey, Hon. Jas. Arthur, Longhirst, Morpeth	1906
Jones, Thomas, 6, Queen Street, Durham	F.C.
Kirk, William, J.P., Norton Hall, Stockton	1903
Knothe, Rudolph, 3, Haldane Terrace	1884
Knott, Sir James, Close House, Wylam	1907
Knott, J. Leadbitter, Close House, Wylam	1906
Knowles, W. H., F.S.A., 25, Collingwood Street	1893
Laidler, G. G., 6, Lovaine Place	1884
Laidlaw, P. O., Stonecroft, Fourstones, R.S.O.	1892
Lamb, Edmund G., M.A., Borden Wood, Liphook, Hants	1891
Lambton, Ralph E., 59, Grosvenor Street, London, W.	1898
Lawson, Wilfrid H., Lindisfarne, Ryton	F.C.
Leach, C. C., Seghill Hall, Northumberland	1903
Leathart, T. H., Low Angerton, Hartburn, Morpeth	1904
Lebour, Miss M. V., D.Sc., Zoölogical Department, The University, Leeds	1905
Lisle, George, Bentham Buildings, Side	1906
Lloyd, C. F., Mus. Bac., Stoneleigh, Graham Park Road, Gosforth	1904
Logan, Jas., 10, Eskdale Terrace	1912
Lord, Sir Riley, J.P., Highfield Hall, Gosforth	1887
Losh, John, 269, Westgate Road	1908
Louis, Prof. Henry, M.A., D.Sc., A.R.S.M., 4, Osborne Terrace	1902
Lovibond, T. W., West Jesmond House, Osborne Road	1914
Lunn, Coun. Geo., Moorfield, Gosforth	1912

	Elected.
MacDonald, Archd. E., Ennerdale, Fernwood Road	1896
Maling, E. A., J.P., Blackwell Hall, Darlington	F.C.
Maling, John Ford, Southdene Tower, Saltwell, Gateshead	1903
Manson, Jas. McD., Hillcroft North, Low Fell	1910
Marshall, Frank, Claremont House	1887
Martin, N. H., J.P., F.R.S.E., F.L.S., F.C.S. *(V.-P.)*, Ravensworth, Low Fell, Gateshead	1882
Martin, Dr. W., West Villa, Akenside Terrace	1914
Maughan, W., 13, Mosley Street	1912
McPherson, John E., Sallyport Buildings	1896
Meek, Prof. Alex., M.Sc., F.Z.S., F.L.S., Armstrong College	1895
Meikle, Jas. Ed., Beauclere, Riding Mill-on-Tyne	1907
Mein, M. M., 49, Percy Gardens, Tynemouth	1902
Merz, Chas. H., The Ems, Gosforth	1910
Middleton, Sir Arthur E., Bart., J.P. *(V.-P.)*, Belsay Castle, Northumberland	1884
Middleton, H. N., J.P. *(V.-P.)*, Lowood, Melrose (N.B.)	1884
Milburn, Sir Chas. S., Bart., Guyzance, Acklington	1908
Mitcalfe, J. Stanley, 60, Percy Park, Tynemouth	F.C.
Mitchell, Mrs. E. H., Jesmond Towers	1904
Morris, F. W., Wantage, Beltingham, Bardon Mill-on-Tyne	1915
Moult, John, 3, Gladstone Terrace, Gateshead	F.C.
Napier-Clavering, Col. C. W., *(V.-P.)*, Axwell Park	1908
Newall, F. S., J.P., Castle Hill, Wylam-on-Tyne	1896
Newall, Mrs., 2, Lowndes Street, London, S.W.	1896
Newcastle, Lord Bishop of *(V.-P.)*, Benwell Tower	1908
Newton, Edward, Thirston House, Felton	1889
Noble, Sir Andrew, Bart., K.C.B., F.R.S., F.R.A.S., F.L.S. *(V.-P.)*, Jesmond Dene House	1860
Noble, Lady, Jesmond Dene House	1911
Noble, Miss, Jesmond Dene House	1887
Noble, Major Geo. J. W., 47, South Street, Park Lane, London	1877
Noble, S. W. A., Kent House, Knightsbridge, London, W.	1887
Noble, J. H. B., Sandhoe, Hexham	1904
Noble, Philip E., Manor House, Whalton, Morpeth	1903
Northbourne, The Right Hon. Lord, Betteshanger, Dover	
Northumberland, His Grace the Duke of, K.G., D.C.L., F.R.S. *(V.-P.)*, Alnwick Castle	
Oliver, Arthur Maule, West Jesmond Villa, Osborne Road	1910
Oliver, Prof. Sir Thos., M.D., F.R.C.P., Ellison Place	1889
Ormond, John G., Bywell, Stocksfield	1909

	ELECTED.
Park, A. B., Holly Lodge, Gosforth	F.C.
Parrington, M. W., Hill House, Monkwearmouth	1915
Parsons, Hon. C. A., J.P., F.R.S., M. Inst. C.E., Holeyn Hall, Wylam-on-Tyne	1903
Pattinson, Hugh Lee, 13, Mosley Street	1892
Pease, Howard, J.P., Otterburn Tower, Northumberland	1905
Pease, J. Beaumont, J.P., Pendower, Benwell	1903
Pease, Mrs., Pendower, Benwell	1905
Peile, Henry, Duke's House, Hexham	1910
Perrett, J. R., Glendyn, Jesmond Park West	1905
Peverley, R. B., 23, Highbury, Jesmond	F.C.
Philipson, Sir Geo. H., J.P., M.D., D.C.L., F.R.C.P. *(V.-P.)*, 7, Eldon Square	1863
Philipps, Mrs. Bertram, 34, Hyde Park Gardens, London, W.	1904
Plummer, Sir Walter, J.P., Queen's Square	1906
Potter, Prof. M. C., M.A., Sc.D. *(V.-P.)*, Armstrong College	1889
Potts, Edward, Whitburn Road, Cleadon, Sunderland	F.C.
Priestman, Francis, Shotley Park, Shotley Bridge	1910
Proctor, J. H., Ravenswood, Westgate Road	1910
Pumphrey, Mrs. T., Summerhill Grove	1912
Pumphrey, Bernard, 115, Osborne Road	1902
Pumphrey, Joseph, Hindley Hall, Stocksfield	1911
Punshon, Mrs., Ingleby House, Northallerton	1906
Pybus, F. C., F.R.C.S., Windsor House, Jesmond Road	1913
Pybus, W. Mark, Milburn House, Dean Street	1884
Ramsay, N. F., 131, Osborne Road	1912
Ravensworth, The Right Hon. Lord *(V.-P.)*, Ravensworth Castle, Co. Durham	1904
Reid, W. B., Cross House, Upper Claremont	1882
Reid, Sidney, 26, Claremont Place	1911
Renwick, George, J.P., Springhill, Morpeth	1902
Rich, F. W., 6, Jesmond Gardens	1886
Richardson, Geo. Beigh, Lindum, Jesmond Park	1903
Richardson, Miss Laura, Sandysike, near Brampton	1911
Richardson, J. Alaric *(Hon. Secretary)*, Anster, Grainger Park Road	1897
Richardson, John H., J.P., Kensington Terrace	1881
Richardson, Frank, Clifton Cottage, Clifton Road	1911
Richardson, Lawrence, Elswick Leather Works	1903
Richardson, Miss S. A., Ashfield House, Elswick Road	1881
Richardson, W. G., M.D., 19, Saville Row	1903

	Elected.
Richardson, Edmund R., Monkton Lodge, Jarrow	1911
Ridley, Right Hon. Viscount *(V.-P.)*, Blagdon, Cramlington	1905
Ridley, C. A., 6, Ellison Place	1915
Ritson, U. A., J.P., Jesmond Gardens	1887
Ritson, W. H., J.P., Springwell Hall, Durham	1902
Robson, C. E. *(Hon. Secretary)*, Priorsdale, Clayton Road	1903
Robson, John S., Sunnilaw, Claremont Gardens	1887
Robson, Mrs. M. A., 6, Collingwood Terrace	1905
Robson, Robt., 13, Framlington Place	1884
Rodgers, Major R. M., 21, Oaklands, Gosforth	1908
Rogerson, John E., J.P., Mount Oswald, Durham	1880
Ross, Charles, Fairfield, Westoe, South Shields	1915
Runciman, Rt. Hon. Walter, M.P., Doxford Hall, Chathill	1912
Ryott, W. H., 8, Windsor Terrace	1884
Sanderson, Thos., 3, Westfield Avenue, Gosforth	1913
Sanderson, W. J., J.P., Warkworth	1889
Scorfield, E. S., 5, Osborne Terrace	1887
Scott, Ernest, 5, Colbeck Terrace, Tynemouth	1901
Sharp-Naters, John G., Stelling Hall, Stocksfield-on-Tyne	1883
Sharp, Wm., Blythswood South, Osborne Road	1883
Simpson, J. B., J.P., Bradley Hall, Wylam-on-Tyne	1903
Simpson, Thos., The Crofts, Hepscott, Morpeth	1888
Sisson, George, 26, Elvaston Road, Hexham	1899
Sisson, J. Arnott, 4, Fenham Terrace	1902
Smart, G. S., Corchester, Corbridge-on-Tyne	1902
Smith, Clarence D., Lough Brow, Hexham	1909
Smith, George, Brinkburn Villa East, Elmfield Road, Gosforth	1884
Smith, John, 128, Rye Hill	1908
Smith, Lancelot, Piper Close, Corbridge-on-Tyne	1909
Smith, Mrs., Hencotes House, Hexham	1907
Smythe, Dr. J. A., 10, Queen's Gardens, Benton	1913
Spain, Col. Geo. R. B., 18, Haldane Terrace	1907
Spence, R. F., Backworth	F.C.
Spence, Philip, Mellbreak, Elmfield Park, Gosforth	1912
Spencer, Ralph, Netherwitton Hall, Morpeth	1911
Stephens, Rev. T., Horsley Vicarage, Otterburn	F.C.
Stephenson, Dr. Clement, Sandyford Villa	1908
Storey, Samuel, J.P., Paxton House, near Berwick-on-Tweed	F.C.
Strachen, R. A., 16, Ivy Road, Gosforth	F.C.
Straker, F., J.P., Angerton Hall, Morpeth	1888
Straker, John C., J.P., The Leazes, Hexham	1903

	Elected.
Straker, Jos. H., Howden Dene, Corbridge	1885
Straker, Chas. E., High Warden, Hexham	1912
Sutherland, A. Munro, Thurso House, Fernwood Road	1904
Sutherland, James, Summerhill, Alnwick	1884
Swan, C. V., Singleton House, Jesmond	1909
Swan, E. W., The Pele Tower, Corbridge	1912
Swan, Mrs. A. S., Daneswood, North Avenue, Gosforth	1913
Swanston, William, 7, Sydenham Terrace	1902
Talbot, John, M.A., B.Sc., 4, Brandling Park	1912
Taylor, Thomas, J.P., Chipchase Castle, Wark-on-Tyne	1903
Temperley, Henry, 7, Lambton Road	1909
Temperley, W. A., 1, Osborne Avenue	1904
Temperley, Nicholas, 4, Carlton Terrace, Low Fell	1914
Thelwall, C. E., 36, Percy Gardens, Tynemouth	1813
Thompson, Mrs. G., The Cottage, Whickham	1903
Thompson, Miss Jessica, The Cottage, Whickham	1889
Thompson, T. W., 117, Pilgrim Street	1906
Thompson, R. J., 38, Eldon Street	1913
Thomson, Miss M. H., 22, Wentworth Place	1906
Thomson, James, M.A., 22, Wentworth Place	1911
Trechmann, Chas. O., Ph.D., F.G S., Hudworth Tower, Castle Eden	1898
Trevelyan, F. B. T., 1, Victoria Terrace, Newbiggin-by.the-Sea	1908
Turner, G.B., 74, Warrington Road	1909
Turner, W. Leonard, 8, Albert Drive, Low Fell	1914
Waddilove, Geo. H., J.P., Brunton, Hexham	1904
Waggot, Jas. B., 19, Percy Park Road, Tynemouth	1911
Wallace, Thos., 42, Mosley Street	1912
Wallace, H. S., F.E.S., 6, Kayll Road Villas, Sunderland	1913
Walker, John D., J.P. *(V.-P.)*, 21, Pilgrim Street	1888
Walther, P., 44, Sanderson Road	1906
Walther, W., Eastfield House, 15, Granville Road	1912
Ward, Percy F., 27, Mosley Street	1907
Watson-Armstrong, Hon. W., Cragside, Rothbury	1912
Watson, Mrs. Spence, Bensham, Gateshead	1912
Watts, Rev. Arthur, F.G.S., The Rectory, Witton Gilbert	1903
Weddell, George, North Cottage, Adderstone Crescent	1905
Weeks, John G., J.P , Bedlington Colliery	1889
Welch, Geo., 4, Devonshire Terrace	1912
Welford, Richard, M.A., F.R.A.S., J.P., Thornfield, Gosforth	1911

	Elected.
White, Mrs. W. H., The Cottage, Killingworth	F.C.
Wilson, Henry B., 11, Osborne Avenue	1907
Wilson, John, 12, Pilgrim Street	1887
Wilson, Cuthbert B., 49, Grey Street	1908
Wise, Frederick, Heddon Hall, Wylam	1914
Wood, J., J.P., Coxhoe Hall, Coxhoe, Durham	1903
Wood, James Scott, 90, Falmouth Road, Heaton	F.C.
Wood, Sir Lindsay, Bart. *(V.-P.)*, The Hermitage, Chester-le-Street	1875
Woodcock, Alfred, M.Sc., 23, Lesbury Road, Heaton	1907
Woods, Jas. E., J.P., Swarland Park, Felton	1896
Woolacott, D., D.Sc., 3, The Oaks West, Sunderland	F.C.
Wright, Jos., 7, St. Mary's Place	1911
Young, W. H., F.Z.S., F.L.S., 10, Marden Road, Whitley Bay	1901
Zöllner, Louis, 6, Osborne Terrace	1904

HONORARY MEMBERS.

Brady, Prof. G. S., M.D., LL.D., D.Sc., F.R.S. *(V.-P.)*...	... Park Hurst, Endcliffe, Sheffield.
Baker, J. G., F.L.S., F.R.S. ...	.. Kew Gardens, London.
Bidwell, Edward, M.B.O.U. ...	... 1, Trigg Lane, London.
Garwood, Prof. E. J., M.A., F.G.S....	University College, London.
Jackson, A. Randell, M.D., D.Sc.	... 67, Hoole Road, Chester.
Mennell, Henry T., F.L.S. ...	... Park Hill Rise, Croydon.
Norman, Rev. Canon A. M., D.C.L., LL.D., F.L.S., F.R.S.	... Red House, Berkhamsted, Herts.
Oliver, Prof. D., LL.D., F.L.S., F.R.S.,	10, Kew Gardens, London.
Perkins, V. R.	... Wotton-under-Edge, Gloucester.
Raine, Frederic	... 5, Avenue Riondet, Hyères, Var, France.
Wright, Rev. R. Stewart ...	... Haydon Bridge.

ASSOCIATES.

Beddows, Miss, Newcastle High School	1911
Bulman, Thomas, 40, Wingrove Avenue	1907
Clague, Chas. Ernest, 5, Saville Row	1909
Clague, Wm. Douglas, 5, Saville Row	1909
Coyle, W., 36, Stanton Street	1910
Dinning, Miss J., The School, Simonburn, Humshaugh	1908
Edmunds, Miss Annie, The High School	1909
Harrison, J. W. H., B.Sc., 181, Abingdon Road, Middlesbrough	1915
Jeffrey, John, B.Sc., 59, Grove Street	1912
Jewson, Miss Sibyl, B.Sc., 2, Lovaine Terrace	1914
Knowles, Miss, Diocesan House of Mercy, Gosforth	1915
Nicholson, Geo., 26, Lancaster Street	—
Patterson, J. E., 2, East Avenue, Benton	1906
Peacock, A. D., M.Sc., F.E.S., Armstrong College	1911
Richardson, Wm., 35, Newlands Road, High West Jesmond	1914
Rosie, David, 224, Ellesmere Road	—
Sister Teresa, Diocesan House of Mercy, Gosforth	1915
Stephenson, J. W., 80, Biddlestone Road, Heaton	—

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM AND NEWCASTLE-UPON-TYNE.

REPORT OF THE COUNCIL

FOR 1915–1916.

THE great War has spread during the course of the year until the whole of Central Europe has become one huge battlefield. The struggle is being waged with grim determination on land and sea, while in the laboratories and factories, men and women have been engaged in perfecting and producing munitions. In these circumstances, it is not a matter of wonder that there has been little inclination or leisure for the pursuit of Natural History.

Armstrong College is still occupied as a Military Hospital: hence the arrangement by which sections of its educational work are carried on in certain parts of the Hancock Museum has been continued. The use of the library for a week during June in which to hold the Cambridge Higher Local Examination was again granted. It is a matter of satisfaction to the Council to help in such work.

The financial resources of the country have been urgently needed to meet the cost of conducting the war: this has naturally affected contributions to the Endowment Fund. One lesson which has been taught is that in the future more thought and attention must be given to scientific research in its various branches, and for this purpose provision must be made. It is hoped that after the end of the War the Council may have the support of those interested in their particular work and be enabled to establish the Fund on such a basis as will enable them to make the collections in the Museum of greater educational value.

The roll of members shews that during the year there has been a loss owing to death and resignation of 25 : on the other hand 14 new members have been elected. The total number of members and associates is 396. The generous and loyal support of these subscribers has enabled the Council to continue the work of the Society during this trying and eventful year.

The register shews that 17,613 visitors passed through the turnstile during the twelve months under review, which compares with 12,821 for 1914–1915. This includes 1,175 children from the Newcastle Council Schools. The increase in numbers is due to the fact that soldiers and sailors in uniform were admitted free to the Museum, and the Council are gratified that so many have taken advantage of this privilege, spending many hours usefully and happily in the inspection of the collections and extending their knowledge of natural history. It is hoped that such interest will induce some of them to become earnest students of nature. The attendance of the general public has been somewhat better, although the support from this source falls short of the average of former years and leaves much to be desired.

Reference was made above to the attendance of children from the Council Schools, who were admitted under an arrangement made four years ago. Those who came were almost entirely from Rutherford College. The Council regret that more did not attend, but realise that it has been a difficult year to plan school work owing to the enlistment of teachers. It is desirable that when normal conditions again obtain, more observant and systematised visits should be paid to the Museum. Boys from the Newcastle Royal Grammar School have come regularly : for them a course of instructive talks was prepared and given. Many of these boys shew interest and aptitude, and it is an earnest wish that these talks may help to direct and develop a taste for scientific study.

It has fortunately not been found necessary to expend much on repairs. Owing to labour difficulty and high cost of materials, the pointing of the outside of the Museum, to which reference was made last year, has been deferred. The caretaker's house has been repointed where necessary, papered and painted inside.

Progressive work on the collections has necessarily been slow, owing to a reduced staff, whose time and energy have been chiefly directed to the examination and preservation of the collections generally. The Curator, Mr. Gill, was granted leave of absence last July, to undertake work in connection with the Friends' Ambulance Unit, and is at present in France engaged on Military Hospital train work.

Wm. Voutt, who so faithfully served the Society for 32 years as caretaker, fell ill towards the end of December, and was obliged to undergo an operation from which he did not recover. He had been associated with the Hancock Museum from its building, and combining willingness and industry with his knowledge of the place and its collections, his loss to the Society has been great. It is a matter of congratulation to the Council that the Assistant Curator, Mr. Fletcher, has been able to carry on the work with the help of Miss Scott. It was, however, found necessary to appoint another lady on the staff, Miss Hepburn, who is proving a valuable assistant, A. E. Bennett has been appointed as caretaker. A. Spencer, who had charge of the grounds and boiler-house for upwards of 20 years, has resigned his position.

The acquisitions received during the year, of which a full list appears on another page, are valuable and interesting; especially so are those dealing with Ethnology, a department which has become so enriched as to necessitate some re-arrangement of the specimens when such work can be undertaken.

The exhibit of wild flowers continues to attract visitors, who come regularly to inspect the specimens and to seek help in the identification of plants found during their rambles. The supply of flowers has come chiefly from Miss Doris Hill, Mr. Randle B. Cooke and Mr. Nicholas Temperley, to whom thanks are recorded for their help.

A modified programme of Field Meetings was arranged for May, June and July, under the guidance of Mr. Richard Adamson, F.R.H.S. In view of the occupation of the coast by the military, no autumnal meetings were included. The attendance has shewn an encouraging improvement, but it is a matter of regret that so few young people appear to be interested in field work.

Owing to the stringent regulations as regards lighting and to the possible danger from aircraft which might occur where a number of people assemble under one roof, it was deemed inadvisable to hold any lectures during the winter. There was also the difficulty of securing lecturers, many of those who so generously help, having enlisted or being engaged on war work.

The "Round Table" meetings in the winter evenings have been continued; the subjects under discussion have been chiefly insects and plants, but microscope work including the preparing and mounting of sections has also claimed attention.

The competition for the Hancock Prize has not been encouraging this year. Only five essays were received, and of these, four were from juniors, who were too much under the influence of book work and did not rely enough upon personal observation. Acting on the recommendation of the adjudicators, the Council decided to withhold the full prize; but as an encouragement awarded a special prize of the value of 21s. to Miss Dorothy Hardy, whose work shewed the most promise. The essays were again submitted to the Rev. J. E. Hull and Mr. Geo. Bolam, who carefully examined and reported upon the work; the thanks of the Council are accorded to these gentlemen for their trouble and care.

Many old and valued members have passed away during the year. A great loss was that of Sir Andrew Noble, Bart., K.C.B., &c., who was the oldest living member of the Society, which he joined in 1862. He acted as Hon. Sec. from 1875 to 1887, and was elected a Vice-President in 1888. Sir Andrew was keenly interested in scientific research: he gave of his wide experience and shrewd knowledge to the affairs of the Society, which he was always ready and generous to help. The Rev. W. McLean Brown, an honorary secretary of the Tyneside Naturalists' Field Club, who on its amalgamation with the Natural History Society, was elected on the Council. Mr. Brown was an excellent botanist and lectured frequently to the members. Dr. C. S. Gibb, a member since 1862. The Right Hon. Viscount Ridley, a Vice-President and Trustee, who was actively interested in the work of the Society, especially the section of botany. Mr. John Hancock, nephew of the eminent naturalist. The Hon. Sidney Joicey, son of the President, who was killed in France. Mr. R. Oliver Heslop, a well-known writer on local history and folk lore; and others.

Vol. IV. Part II. of the Transactions is now in the press and will be issued shortly. The work of the Card Index, owing to pre-occupation in other directions, has only made slow progress. Help in this somewhat laborious and tedious work would be welcomed.

As regards the Accounts and Balance Sheet, the cost of upkeep has been greater owing to advance in prices; but thanks to the support of the members, to the yield which is derived from the Endowment Fund and to certain economies, the Council have been enabled to meet expenses.

Lastly, in the continued absence of the Curator, it is with pleasure that the Council acknowledge the valuable work of Mr. H. Fletcher and the other members of the Museum staff.

It is with much regret that the Council learn since the aforegoing was written, of the death of Mr. N. H. Martin, a Vice-President of the Society. He became a member in 1882, and entered whole-heartedly into the duties of Hon. Sec., which office he occupied from 1902 to 1910. Mr. Martin was keenly interested in scientific work and enlisted the support of his friends in this direction, largely increasing the membership: it was owing to his foresight, personal effort and liberality, that the Endowment Fund was started. His loss is also a serious one to the Society.

REPORT ON MUSEUM WORK.
1915–1916.

As stated in the report of last year, "the Hancock Museum has had its workings disturbed to a certain extent by the war." This has been intensified this year by the absence of the Curator, Mr. E. Leonard Gill, who is engaged in ambulance work in France, and by the illness and subsequent death of Mr. Wm. Voutt, the late Caretaker. The presence of various departments of Armstrong College has practically confined our attentions to the main rooms, but though, excepting the fish collection, little progress has been made as far as public exhibitions are concerned, a considerable amount of work has been done upon the reference collections ; the progressive work has also been affected by the strong necessity for economy.

Following the arrangements of the last two years, the report is given under various headings.

Fishes.

A few fishes have been cast this year—one or two varieties of trout, chub, cat-fish, etc.—but the main work in this section has been in arranging the cases. As many new casts had to be worked into the collection, we took the opportunity of emptying the cases and repainting the backgrounds. The collection is now practically completed, the Salmonidae including the "Life History of the Salmon" being particularly pleasing. At the beginning of the year we obtained a new set of type and many new fish labels have been printed, whlch, from the point of view of legibility and neatness, are a great improvement on the old.

Butterflies and Moths.

It was mentioned in the last report that we had got together a number of exotic moths, some of which had been purchased, in order to continue the series of Lepidoptera. The butterflies were of course well represented by means of Dr. Eltringham's collection. We have been able to arrange four cases of moths for public exhibition, and the whole forms a very fine series.

I should like to record our indebtedness to Mr. Alfred Woodcock, M.Sc., who so kindly gave up a fortnight of his holidays in classifying the moths used in the cases.

Diptera.

Owing to the kindness of Mr. Wilfrid Hall, who presented to the Museum a series of models illustrating the life history of the house-fly, we have been enabled to set up a small case showing the danger of the house-fly as a carrier of disease. Messrs. Mappin and Webb of London and Messrs. S. Finney and Co. of Newcastle lent us various fly-traps and syringes. Dr. Kerr, the Medical officer of Health, sent us a quantity of leaflets, and with the aid of large explanatory labels an attractive if somewhat gruesome exhibit has been formed. Also we have had on sale the various pamphlets on the subject, published by the Zoological Society and the British Museum.

A case of "Blood-sucking Flies" has been prepared to be placed in the insect series. Photographs as well as the insects themselves were used, and labels were written giving a short account of "Malaria" and "Sleeping-Sickness." Mr. Geo. B. Walsh gave us various species of the "Tsetse-fly' and Mr. Richard Bagnall a few specimens of the "Ked" or Sheep "Tick."

Insect Collections.

A great deal of time has been given to overhauling the insect collections. They have been treated for mould, in some cases repapered and the insects remounted. The following collections were amongst those attended to :—Bold collections of Hymenoptera and Hemiptera, Watson collection of British and Foreign Lepidoptera, and the Wingate collection of Diptera. On Saturdays, during the winter, Mr. Geo. B. Walsh was working upon the large reference collection of Coleoptera.

Wild Flowers.

Up to the present we have managed to keep up a good display of wild flowers, for which we are indebted to Mr. Randle B. Cooke, Miss A. Edmunds, Miss Doris Hill, the Misses and Master J. Richardson, and Mr. Edw. Potts.

Printing.

Miss Scott has very efficiently taken this work in hand, and with the new machine and type excellent labels are turned out. The greatest number have been in connection with the fish collection, but some have been done in large type for the insect cases.

Oddments.

The Reptile cases have been cleaned and repainted.

Some time has been taken up refilling the bottles containing fluid-preserved specimens, the squid tank, etc.

The two specimens of the Great Auk and the egg have been stored in the bank for the duration of the war.

Lessons and "Talks."

The Grammar School, during the two winter terms, sent three classes of boys each week. The lessons lasted twenty minutes, and dealt with sponges, corals, crabs and lobsters, insects, etc.

I have given talks to two parties of soldiers on the "Fly-pest" and one to the Spennymoor Naturalists' Field Club on "Starfishes."

Donations.

A list of donations is given in a separate part of the report. As was to be expected, the number of donations was not so great as usual, but the Museum has been particularly fortunate this year in the number of ethnological specimens which have been added to its collections.

I cannot conclude this report without expressing how deeply the staff feels the loss of Mr. Wm. Voutt. His personal qualities, unfailing readiness and consideration made him not only an efficient member of the staff, but one with whom it was a pleasure to work.

HERBERT FLETCHER,
Assistant Curator.

MUSEUM STAFF

Curator	E. Leonard Gill, M.Sc.
Assistant	Herbert Fletcher.
Lady Assistants	Miss Gladys M. Scott. ,, I. M. Hepburn.
Attendant	William Voutt.
Gardener	Albert Spencer

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.
R. S. Bagnall, F.E.S., F.L.S.
Rev. W. McLean Brown.
Harry Eltringham, M.A., F.Z.S.
Samuel Graham.

Prof. G. A. Lebour, M.A., D.S.
Prof. Alex. Meek, M.Sc.
Prof. M. C. Potter, M.A., Sc.D.
Geo. B. Walsh, M.Sc.

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 18th, 1915.

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey.

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Ridley.
Lord Barnard.
Lord Ravensworth.
The Bishop of Durham.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Andrew Noble, Bart., F.R.S.
Sir G. H. Philipson, M.D., D.C.L.
Sir Lindsay Wood, Bart.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Col. C. W. Napier-Clavering.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
R. Coltman Clephan, F.S.A.
Clive Cookson.
J. L Gracie
Samuel Graham.
Principal W. H. Hadow, M.A., Mus. Doc.
N. H. Martin, F.R.S E., F.L.S., F.C S.
H. N. Middleton.
Prof. M. C. Potter, M.A., Sc.D.
J. D. Walker, J.P.

COUNCIL

H. P. Angus.
G. A. Atkinson.
R. S. Bagnall, F.E.S., F.L.S.
W. E Beck.
H. I. Brackenbury.
Edwin Burnup.
John D. Challoner.
Wilfred Hall.
T. E. Hodgkin, M.A.
Prof. H. J. Hutchens, M.A. M.R.C.S., D.S.O.
Prof. A. Meek, M.Sc.
George Sisson.

HON. SECRETARIES

C. E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30th, 1916.

F. H. Alexander.—A few specimens of *Limax maxima*; a few specimens of *Niptus hololeucus*.

T. W. Backhouse, F.R.A.S., F.R. Met. Soc.—Meteorological Observations, chiefly at Sunderland.

R. S. Bagnall, F.E.S.—Various reprints of papers by the donor on Thysanoptera, Symphyla, etc.

R. Bainbridge.—A death's head moth caught at Scotswood Bridge.

Herbert Bolton, M.Sc., F.G.S., F.R.S.E.—Reprint of paper by donor, "The Fauna and Stratigraphy of the Kent Coalfield."

Isaac Clark.—A raven's nest from the Border.

Brodie Cochrane.—A piece of Baryta.

Mrs. Dinning.—Models by John Hancock; setting-boards; various drawings and reprints.

G. A. Dunlop.—Five beetles collected on Holy Island.

Dr. H. Eltringham.—Reprints of papers by the donor: "Further Observations on the Structure of the Scent Organs in certain Male Danaine Butterflies," 1915; "Some Experiments on the House-fly in relation to the Farm Manure Heap."

Bertram Hassell.—Shells and butterflies, partly collected abroad.

Miss Hill.—A live toad.

D. Horsley.—Various minerals, etc., from Rhodesia.

India Office (Secretary of State for India in Council).—Vol. VI. (Rhynchota) of the "Fauna of British India" series.

A. Randell Jackson, M.D., D.Sc.—Reprint of paper by the donor: "On some Arthropods observed in 1915.

Charles Janet.—Two papers by the donor: "L' Alternance Sporophyto-Gamétophytique de Générations chez les Algues," 1914; "Note Préliminaire sur l' Oeuf du Volvox globator," 1914.

G. F. Mackrow.—Two Andamanese bows and a few arrows; two Zulu assegais; a hubble-bubble from Hodeidah; model of Masoula boat from Madras; two hanging birds' nests from Elephanta Island, Bombay; palm-leaf punkas, etc.

Geo. E. Mason.—Various bones of extinct Chiroptera.

Lieutenant H. C. McBratney.—Spears, bows and arrows, paddle, etc., from Sarawak (deposited on loan).

Prof. Alex. Meek, M.Sc.—A five-bearded rockling (*Motella mustela*). Two specimens of *Amphioxus lanceolatus* from Naples.

HENRY TUKE MENNELL, F.L.S.—The Journal of the Linnean Society: Botany, vol. 41, no. 281, vol. 43, nos. 289–90; Zoology, vol. 31, nos. 209–10, vol. 32, nos. 214 and 219–20. Transactions, second series: Botany, vol. 8, part 7; Zoology, vol. 16, parts, 4–5, vol. 17, part 1. Proceedings 127th Session (Nov., 1914–Jan., 1915) Also List of Officers and Fellows, 1915–16.

WILLIAM MOORE.—A "Flying-Fox" in case. Shot near Kiama, N.S.W., Australia, in 1896.

F. R. NORMAN.—Sheaf of poisoned arrows (made by the Hausa people, Northern Nigeria); Hausa iron sword; dagger in brass sheath; Hausa leatherwork, brass trays, etc.; grass sleeping mat and various specimens of grasswork made by natives of Northern Cameroons.

E. A. PAYNE.—Stone lamp, cooking pot, etc., from Labrador.

PHOENIX ASSURANCE CO., LTD.—"Roman and Mediaeval Discoveries in London."

RAY SOCIETY.—"The British Marine Annelids," vol. 3, part 2; "Principles of Plant Teratology," vol. 1; British Freshwater Rhyzopoda and Heliozoa," vol. 3.

DONALD ROSIE.—A number of Diptera (Flies) many species of which were not in the Museum collection.

SIDNEY ROACH.—Four shells from Ascension, South Atlantic.

MR. SMITH.—A stone-crab *(Lithodes maia)* found on Cullercoats Sands.

MISS SPAIN.—Box of minerals and shells collected in Australia and East Indies; three stuffed birds: kingfisher, bullfinch and hoopoe; two snouts of saw-fish from East Indies.

MAJOR SPAIN.—Various ethnological objects collected chiefly in Rhodesia and Matabeleland: six knobkerries, bow and arrows, various spears and assegais, native head-dress and knee ornaments, two fly-whisks, witch-doctor's bones, some good examples of native bead-work, etc.—two elephant's tusks, rhinoceros horn and minerals from Rhodesia.

DONATIONS TO THE ENDOWMENT FUND.

FROM JULY 1ST, 1915, TO JUNE 30TH, 1916.

	£	s.	d.
Sir George Noble, Bart.	100	0	0
Sir Hugh Bell (1915 and 1916) ...	100	0	0
Joseph H. Straker, Esq.	50	0	0
Lady Noble	2	10	0
	£252	10	0

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM JULY 1ST, 1915, TO JUNE 30TH, 1916

RECEIPTS	£	s.	d.	£	s.	d.
Members' Subscriptions				347	8	6
Museum Admission Fees	113	12	8			
Education Committee Grant	10	0	0			
				123	12	8
Sale of Guide Books, etc.				6	11	7
Interest on Investments				528	5	8
Sundries	7	9	8			
Grant from Armstrong College	105	5	0			
				112	14	8
Deficit 30th June, 1916				13	18	4
				£1,132	11	5

PAYMENTS	£	s.	d.	£	s.	d.
Deficit, July 1st, 1915				41	13	4
Salaries				654	5	0
Advertising				0	6	6
Fuel, Lighting, and Water				80	16	11
Insurance				40	4	8
Materials and Fittings				12	2	4
Postage and Carriage				6	4	8
Printing				39	2	11
Property Tax				25	16	9
Building Repair Fund				40	0	0
Deposit Account				100	0	0
Stationery				1	5	0
Publication Account				58	4	8
Subscriptions: Museums Association	1	1	0			
Ray Society	1	1	0			
Sundries	30	6	8			
				32	8	8
				£1,132	11	5

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

BUILDING REPAIR FUND

	£	s.	d.		£	s.	d.
Balance, July 1st, 1915	33	7	10	Sundry repairs	5	9	5
Transferred from General Account	40	0	0	Balance, June 30th, 1916	67	18	5
	£73	7	10		£73	7	10

PUBLICATION ACCOUNT

	£	s.	d.		£	s.	d
Sale of Transactions	0	16	4	Line Blocks	0	9	6
Transferred from General Account	58	4	8	Transactions, Vol. IV., Part 2	58	11	6
	£59	1	0		£59	1	0

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

ENDOWMENT ACCOUNT

	£	s.	d.		£	s.	d.
Balance, June 30th, 1915	117	15	0	Paid for purchase of 5% Exchequer Bonds	370	0	0
Donations and Subscriptions	252	10	0	Balance, June 30th, 1916	3	6	7
Bank Interest	3	1	7				
	£373	6	7		£373	6	7

DEPOSIT ACCOUNT

	£	s.	d.		£	s.	d.
Balance, June 30th, 1915	610	5	2	On deposit with Crown Building Society } Crawhall Bequest	300	0	0
Interest on Investments	24	0	0	,, Crown Permanent Building Society ... } Crawhall Bequest	300	0	0
From General Account	100	0	0	Alterations to Coral Cases...	11	15	0
Bank Interest on Account	2	2	9	Balance, June 30th, 1916	124	12	11
	£736	7	11		£736	7	11

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1916:— Taken at cost.

				£	s.	d.
Coppin Bequest—						
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock	2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt	500	0	0
Crawhall Bequest—						
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock			
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock	6,000	0	0
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock			
400	0	0	Armstrong, Whitworth & Co., Ld., 4 per cent. Debenture Stock			
485	0	0	Newcastle and Gateshead Water Company's Ordinary Stock	2,000	0	0
80	0	0	Weardale and Consett Water Company's 10 per cent. Maximum Ordinary Stock			
350	0	0	,, ,, 7 ,, ,, ,,			
Endowment Fund—						
1,800	0	0	Canadian 4 per cent. Registered Stock			
421	0	0	Newcastle and Gateshead Water Co.'s 5 per cent. Preference Stock	3,292	3	1
500	0	0	,, ,, 5 per cent. Consolidated Preference Stock			
370	0	0	5 per Cent. Exchequer Bonds			
				£13,792	3	1

SAML. GRAHAM, W. J. BELLERBY, Hon. Auditors.

A H. DICKINSON, Hon. Treasurer.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM AND NEWCASTLE-UPON-TYNE.

REPORT OF THE COUNCIL

FOR 1916–1917.

For the third successive year the Great European War has dominated the thought and claimed the energy of the nation: the help of every available man and woman has been needed and the resources of the country taxed to carry on the stern struggle in which Britain stands side by side with her Allies. There has been less time to devote to Natural History and the number of workers has been fewer. So far as the Hancock Museum is concerned the time of the staff has been directed upon the conservation of the collections, and it has not been possible to undertake much work of a progressive character.

Several of the younger members of the Society, men of promise and ability, have made the great sacrifice during the year under review. Of these, mention may be made of Major J. Leadbitter Knott, who interested himself in the social and political life of Newcastle; Captain Reginald E. Bryant, member of the Council, a keen sportsman and naturalist; Lieutenant Hugh V. Charlton, a gifted artist and naturalist, whose brush cleverly depicted bird life, and his younger brother, Captain J. M. Charlton, a good ornithologist, who though not actually a member, was a frequent visitor to the Museum, to which he presented specimens from time to time. Other members are serving with the Colours at home and abroad, and it is earnestly hoped that they may be spared to return in safety. Amongst the older members who have been lost to the Society are Professor Daniel Oliver, L.L.D., F.L.S., F.R.S., one of the Keepers of Kew Herbarium, who passed away at the ripe old age of 86. He acted as one of the Honorary Secretaries of the Field Club during 1857 and 1858, and was elected an Honorary Member of the Society in 1864, his connection with the Society extending over 68 years. Mr. Arch. E. Macdonald, a keen observer and writer, who under the name of "Whist" did much in the local press to enlist interest in nature. Sir Benjamin C. Browne, D.C.L., who joined as a member in 1876. Mr. C. Harrison of Hexham, a member of 30 years standing; and others, whose loss is deplored.

The membership has been reduced by 18 through deaths and resignations, but it is pleasing to record that 22 new members have been elected. The total number of members and associates is 398, and the Council are grateful for their continued loyal support, which has lightened their task of administering the affairs of the Society.

One bright and noticeable feature in the life of Newcastle during 1916 was the Meeting of the British Association (after a lapse of 27 years) under the genial presidency of Sir Arthur Evans, D.Litt., Lld., P.S.A., F.R.S., the eminent Archæologist. Under war conditions, which interfered with facilities of travel and accommodation, it was deemed advisable that the social amenities, which usually form a pleasant part of the meetings, should be abandoned and that work and interest be concentrated on the educational and scientific side. It was agreed at the close of the meeting that, although the number who attended fell short of that of other years, the proceedings were highly successful. This success was largely due to the energy and enthusiasm of the Chairman, Principal W. H. Hadow, M.A., Mus. Doc., the Honorary Secretaries, Dr. P. Phillips Bedson and Mr. E. Fraser-Smith and their local Committees, whose arrangements for the comfort of the visitors and the holding of the sectional meetings surmounted the exceptional difficulties. The Lord Mayor of Newcastle, Councillor Geo. Lunn, also entered heartily into the work of the Association, holding a Reception on Wednesday evening, September 6th, in the Laing Gallery, which gave those visitors whose sectional work lay in different centres of the city, an opportunity of meeting and exchanging courtesies with their friends. The Hancock Museum was thrown open to the visitors, many of whom took the opportunity of studying the various collections which held special interest.

In the continued occupation of Armstrong College as a Military Hospital, students attending the Biological and Art Sections have again found temporary accommodation in the Hancock Museum, and the Examinations for the Cambridge Higher Locals were once more held in the Library during the month of June.

The number of visitors who passed tbrough the turnstile for the twelve months ending June 30th, 1917, was 22,242, which compares with 17,613 for the preceding year. This is a gratifying record of progress. Soldiers and sailors, stationed in the district and in the hospitals, continue to visit the Hancock Museum in large numbers, forming the majority of visitors, but there is also an increase in the support given by the public.

The number of children from the Council Schools of Newcastle, who visit by arrangement, numbered 1,210, practically the same as last year. Until normal conditions again obtain, and the difficulty with regard to teachers and classes is removed, it can scarcely be expected that a systematic plan of teaching Natural History can be formulated and followed with success.

Boys from the Grammar School have again come, under the charge of Masters, and during the earlier part of the year had the benefit of short lectures and talks by a member of the Staff. Many of them display a keen and intelligent interest in the subject.

The Curator's Report contains an account of an interesting experiment made with the object of encouraging children in nature study.

Only such small repairs as were absolutely necessary have been carried out in view of the increased cost of material and the shortage of labour. It should be pointed out, however, that when the times are again favourable, there will be a considerable amount of work to be done on the outside of the Museum, for which provision must be made.

The Curator, Mr. E. Leonard Gill, M.Sc., is still engaged on Military Hospital work in France. As a temporary measure, his father, Mr. J. J. Gill, was engaged last October, and with Miss Scott, has shared the responsibility of the care of the collections. Mr. H. Fletcher is no longer on the Staff. H. Stones was appointed in the autumn to look after the grounds, take charge of the boiler-house and the heating of the building.

The Wild Flower Exhibit has proved no less attractive and useful than in other years.

A modified programme of Field Meetings was again arranged. Owing to lack of facilities and increased cost of travel, places within easy reach were chosen and under the energetic and enthusiastic leadership of Mr. Nicholas Temperley success has been assured.

The "Round Table" Meetings were also carried on during the winter evenings each month; the attendance was small, but considerable interest was shewn, particularly in entomology, and it is hoped that these meetings will attract greater numbers in future and happier times.

Much greater interest was aroused in the Hancock Prize Competition than has been the case for some years past. The number of essays submitted was 18; of these 13 were from junior competitors, the quality of whose work was exceptionally good. Thanks to the generosity of a few members, the Council were enabled to award three extra prizes, the successful competitors being :—

Hancock Prize: Mr. J. E. Ruxton, Blackhill.
Second Prize: Mr. P. Charlton, Chopwell.

JUNIORS.

First Prize: Miss W. D. M. Hull, Ninebanks Vicarage.
Second Prize: Master F. Baxter, Newcastle.

It was no easy task to examine and judge the relative merits of these papers, and the thanks of the Council are accorded to Mr. Geo. Bolam and Mr. Abel Chapman for undertaking the work.

Volume IV. Part 2 of the Transactions was issued during the year.

The Endowment Fund has been kept open by the generosity of a few friends, and the Council would welcome further donations from any who are inclined to help. This Fund, part of which has been invested in War Loan, has materially helped the financial position and, with the exercise of economy, enabled the Council to carry on the affairs of the Society.

In conclusion, the Council realise and appreciate the interest, industry and effort with which the Curators and the Staff have met the difficulty of working under war conditions.

CURATOR'S REPORT ON MUSEUM WORK.

1916–1917.

In previous Curator's Annual Reports much progressive work has been commented on, but as I stated in my first Monthly Report to the Council, when I assumed the Temporary Curatorship towards the end of last October, with the present depleted Museum staff, and especially with the absence of the Curator and Assistant Curator, no distinctively progressive work could be looked for. The most we could hope to do, would be to endeavour to preserve the fine collections in some measure of good order and efficiency, and this has been our chief aim during the past year, in which we may fairly claim some measure of success. With this end in view the whole of the Desk Cases in the Zoology Room and most of those in the Bird Room have been cleaned out, damaged specimens repaired, and everything left in good order. A similar work has been done in the Ethnology Gallery. Not much has been attempted with the Wall Cases with the exception of the large Reptile Case, which has been thoroughly overhauled, the inside of the case re-tempered many of the specimens carefully cleaned, and the jars refilled with spirit. The last-mentioned work has been done with most of the spirit preparations in the Zoology Room. We are much indebted to Prof. Meek for help in naming for us a large number of specimens, chiefly tropical lizards, in the reptile and other cases. The Rock Pool and the Squid Tank have received a good deal of attention, and much re-labelling has been done, especially with the Fish Collection. For the latter work the printing press has been of very great use. Most of the Store Cupboards have been cleaned out and the contents re-arranged; and in this connexion I may allude to a much needed piece of work of which a commencement has been made, viz., the collecting together of the very numerous Transactions and other papers received from learned Societies all over the world during recent years. Some of the more valuable of these will, no doubt, in the near future be suitably bound, for better preservation and easier reference.

Much of the above work would have been difficult, if not impossible, at ordinary times, when more progressive work was being undertaken, and we are glad of the opportunity afforded us of doing many things that greatly needed attention.

All the books in the Museum Library have been taken down and cleaned, and each checked off with the typed Catalogue. This catalogue is being brought up to date, by entering the large number of books which have been added to the Library for some time past. A valuable addition has recently been made, by the gift of about 150 volumes, chiefly on Natural History subjects, from the Library of the late John Simm of West Cramlington. These have been presented by his daughter, Mrs. J. A. Wilson, in memory of her father, and many of the books are of considerable value, and some have been in constant use by the Staff, since their arrival at the Museum.

A pleasing feature last autumn was the meeting of the British Association in Newcastle. Many of the members visited the Museum, and inspected our collections, several of the specialists in two or three departments rendering valuable service in looking over and checking the names on some of the labels. Among these particular mention may be made of Dr. Haddon and Prof. Seligmann, who expressed much delight with our ethnological specimens, correcting some of the labels and giving advice in one or two directions; Dr. Bather, who spent some time examining the crinoids, correcting labels and naming some of the unidentified specimens; and Mr. D. M. S. Watson of the British Museum, who has been a frequent visitor to our Museum. Other British Association visitors were very complimentary on the excellence of our exhibits in various departments.

The show of wild flowers in the Entrance Hall has been well maintained throughout the summer. We are greatly indebted to several friends for kindly supplying these, particularly to Mr. Randle B. Cooke, Mr. Nicholas Temperley, Mr. Clarence D. Smith, Miss Doris Hill, and Miss Joyce Robson.

A list of donations appears on another page, but in addition to the gift of books already referred to, special allusion should be made to the very extensive and valuable collections, accumulated during many years of earnest and successful research work by Dr. G. S. Brady, F.R.S. of Sheffield (formerly Professor of Natural History in the Armstrong College). These he has presented to the Museum, and they consist partly of a large number of microscope slides and partly of specimens preserved in spirit, illustrating various forms of minute marine life, many of them being the original type specimens described in articles and papers by Dr. Brady, a number of which were published in our Transactions. The specimens are chiefly Ostracoda, Copepoda, Entomostraca and Microzoa of other allied groups, as well as numerous specimens of Diatomaceae, many of these being mounted and named by Prof. G. O. Sars, the well-known Norwegian scientist. In presenting these collections, Dr. Brady remarks that much work remains to be done on them, which his advancing years preclude his undertaking, but he hopes that in the future some other naturalist may find time and inclination to pursue the study which he has felt compelled to abandon; and in this case the very extensive collection of specimens now deposited in the Museum will furnish ample material for much further research.

We had a brief visit from the Curator, E. L. Gill, at home "on leave" during the Christmas week, and he was able to give us some useful hints as to work needing attention.

The attendance of the public throughout the past year has been much above the general average, being upwards of 22,000 as against 17,000 the previous year. This has been notably the case at special holiday times, the numbers on Easter Monday, 1562, and on Whit Monday, 725, furnishing a record for those dates. The Museum continues to be visited by large numbers of soldiers and sailors, who are admitted free.

One piece of what may perhaps be styled progressive work has been attempted in connexion with our holiday visitors. Large numbers of boys and girls come into the Museum, especially at such times, and I had often wished it were possible to do something to increase their interest in the exhibits. A little before Easter I happened to read in the "Museums Journal" an account of an interesting experiment tried in one of the American Museums, where small cards, each containing a question on the objects in the Museum, were given out to young people. This seemed to me such an excellent idea that I resolved to try it in our Museum, substituting short papers of questions for the cards employed in the Providence Museum, Rhode Island, U.S.A. With the assistance of Mr. Hugh Richardson, Prof. Meek and my son, E. L. Gill, I have been able to provide several papers, each containing six questions, which were distributed at Easter, Whitsuntide and Race Wednesday. Many of these papers were taken and answered by boys and girls, and the results have been encouraging for the continuation and further development of the practice in future. The questions so far given have been on birds, eggs, fishes and general zoology, and all the questions could be answered from reference to the exhibits in the Museum cases. We may hope that this experiment will help to foster, in some of our juvenile visitors, a taste for Natural History, and, in any case, it cannot fail to bring out increased powers of observation in those who try to answer the questions.

We are very grateful for the kind assistance continually received from the College Staff located in the Museum, from the Honorary Curators, particularly Mr. R. S. Bagnall and Mr. G. B. Walsh, and from Mr. George Bolam, Mr. W. H. Young, Mr. A. M. Oliver and others, whose long continued help in the Museum is greatly valued.

I cannot conclude without expressing high appreciation of the way in which my colleagues on the staff have risen to the occasion in their endeavour to carry on with efficiency the work of the Museum, in the continued absence of those, with much greater knowledge and experience, on whose shoulders this work has usually rested. JOSEPH J. GILL.

MUSEUM STAFF

CURATOR	E. LEONARD GILL, M.Sc.
DEPUTY CURATOR	JOSEPH J. GILL.
LADY ASSISTANTS	MISS GLADYS SCOTT. ,, I. M. HEPBURN.
ATTENDANT	A. E. BENNETT.
GARDENER	H. STONES.

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.	Prof. G. A. Lebour, M.A., D.Sc.
R. S. Bagnall, F.E.S., F.L.S.	Prof. Alex. Meek, M.Sc.
Harry Eltringham, M.A., F.Z.S.	Prof. M. C. Potter, M.A., Sc.D.
Samuel Graham.	Geo. B. Walsh, M.Sc.

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 27th, 1916.

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey.

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Grey.
Lord Barnard.
Lord Ravensworth.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Geo. J. W. Noble, Bart.
Sir Lindsay Wood, Bart.
Sir G. H. Philipson, M.D., D.C.L.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Col. C. W. Napier-Clavering.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
Clive Cookson.
R. Coltman Clephan, F.S.A.
Samuel Graham.
H. N. Middleton.
Principal W. H. Hadow, M.A., Mus. Doc.
Prof. M. C. Potter, M.A., Sc.D.
J. L Gracie
J. D. Walker, J.P.
Prof. A. Meek, M.Sc.

COUNCIL

Hugh P. Angus.
G. A. Atkinson.
R. S. Bagnall, F.E.S., F.L.S.
H. I. Brackenbury.
Edwin Burnup.
J. D. Challoner.
J. J. Hill, M.S.A.
T. E. Hodgkin, M.A.
Prof. H. J. Hutchens, M.A., M.R.C.S., D.S.O.
Hon. J. Arthur Joicey.
John Talbot, M.A., B.Sc.
Ernest Scott.

HON. SECRETARIES

C E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1917.

BASIL ANDERTON, B.A.—A locust, from Egypt; also a copy of "Thomas Bewick, the Tyneside engraver," presented by the author.

RICHARD S. BAGNALL, F.E.S., F.L.S.—Some beetles; also Myriapods in tubes, and a few Ticks.

J. S. BELL.—A gooseander, from the North Tyne, near Bellingham.

MISS A. BERKELEY.—Four boxes of minerals and fossils.

GEORGE S. BRADY, M.D., D.Sc., LL.D., F.R.S.—A large number of specimens of minute marine life, chiefly Entomostraca, Ostracoda, Copepoda, Diatomaceae, etc., contained in about two thousand microscope slides and spirit preparations in tubes, and forming a portion of Dr. Brady's extensive collections, accumulated during many years of research work. Also several Note Books with illustrations of many of the above specimens, etc.; and a large number of deep cardboard cells for future use in microscopic mounting.

C. F. CUTTER.—A photograph of the "General Sherman Tree."

MISS DEAN.—Butterflies, moths and beetles, from the Argentine.

MISS A. EDMUNDS.—Some wax moth larvæ.

C. D. FORSTER.—Specimen of "Slickensides," from Keswick.

H. C. FULTON (Kew).—Specimen of shell, Ariophanta rosseliana.

H. W. GARBUTT (Bulawayo).—Gold-bearing Quartz, from Rhodesia, South Africa.

J. J. GRACIE.—A copy of G. Bolam's "Birds of Northumberland."

MISS HOLMSTEAD (per Dr. Hobbs).—A fine specimen of the King Penguin.

INDIA OFFICE (Secretary of State for India in Council).—The Fauna of British India Series; Coleoptera (Curculionidæ, part 1), by G. A. K. Marshall, D.Sc.; Coleoptera (Lamellicornia, part 2) by G. J. Arrow; Orthoptera (Acridiidæ) by W. F. Kirby, F.L.S.

D. MADDOCK.—Beetles, cockroaches and spiders, from Jamaica and the Canary Islands.

PROF. A. MEEK, M.SC., F.L.S.—A copy of his new book, "The Migration of Fish"; two flying dragons, from Malaya; two lampreys, from Maldon, Essex.

HENRY TUKE MENNELL, F.L.S. – Transactions of the Linnean Society; Zoology, vol. 17, part 2, vol. 11, part 13; Botany, vol. 8, part 8; Proceedings of the Linnean Society (Nov., 1915 to June, 1916); Journal, vol. 32, No. 231, vol. 33, Nos. 222, 223, vol. 43, Nos. 291, 292, 293; also list of Officers and Fellows, 1916–17.

MISS MILROY.—Models of Sealing Boat and Esquimaux Kayak.

GEORGE NICHOLSON.—Fossil shell, Spirifer, from the Limestone Quarries, near Stanhope, Weardale.

A. M. OLIVER.—Four specimens of shell, Paludestrina jenkinsi, from Basingstoke Canal, Crookham, Hants.

PROF. F. W. OLIVER.—Two pencil sketches of the Old Hospital at Chibburn, by the late Prof. Daniel Oliver, LL.D., F.L.S., F.R.S., and a photograph of the four Keepers of the Herbarium at Kew, including the late Dr. Oliver.

JOHN PROUDLOCK (Seaton Delaval).—Fossil shells (Anthracoptera) from the Crofton Pit.

THE RAY SOCIETY (by subscription).—British Marine Annelids, vol. 3, part 2, plates, by Prof. McIntosh, M.D., LL.D., F.R.S.; Principles of Plant Teratology, vol. 2, by W. C. Worsdell, F.L.S.

J. ALARIC RICHARDSON.—Coke breeze, for furnaces; also a quantity of boarding for shelves.

MISS LAURA RICHARDSON.—Four dragon flies from Windermere.

MISS RICHARDSON (Jesmond).—Model of Indian Temple, from Nagapatam, near Madras.

JOHN ROBSON.—A sparrow hawk, from Broomhill, Acklington.

ROBERT ROBSON.—Twenty-six local birds, contained in eleven cases.

T. SHEPPARD, M.SC., F.G.S. (Hull Museum).—Some leaves referring to this district, from the "Natural History of England," 1759-62, and from Dr. A. S. Granville's "Spas of England," 1841.

E. W. STAVELEY.—Two young herring gulls, from St. Bees, a yellow hammer and two linnets, for the Aviary.

A. H. STRAKER.—A little owl, from Billeston, Leicester. "One of Lilford's Owls."

THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY).—Catalogue of Freshwater Fishes of Africa, vol. 4, by G. A. Boulenger, F.R.S.; Catalogue of Ungulate Mammals, vol. 5, by the late Richard Lidekker, F.R.S, ; Catalogue of Cretaceous Flora, part 2, by Marie C. Stopes, D.Sc., F.L S.; Guide to Disease Carrying Insects and Ticks, by L. Fletcher; The Louse and its Relation to Disease, by Bruce F. Cummings.

GEORGE B. WALSH, M.Sc.—A green lizard; also several rare beetles for the large Reference Collection.

MRS. WHITTINGHAM.—A mineral with quartz, and a rock with fossil corals.

MRS. J. A. WILSON (Cramlington).—About 150 books, chiefly on Natural History, from the Library of her father, the late John Simm of West Cramlington.

The publications received by exchange with British and foreign scientific institutions are acknowledged in a separate list which is published later (in the Transactions) as an appendix to the report.

DONATIONS TO THE ENDOWMENT FUND.

FROM JULY 1ST, 1915, TO JUNE 30TH, 1917.

	£	s.	d.
Thomas Reed	25	0	0
B. A. (Grant from Local Committee) ...	25	0	0
Mrs. M. A. Robson	20	0	0
Abel Chapman	5	0	0
C. E. Thelwall	3	3	0
	£78	3	0

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM JULY 1ST, 1916, TO JUNE 30TH, 1917

RECEIPTS	£ s. d.	£ s. d.
Members' Subscriptions		353 17 3
Museum Admission Fees	160 15 10	
Education Committee's Grant	10 0 0	
		170 15 10
Sale of Guide Books, etc.		8 13 0
Interest on Investments		489 10 2
Sundries		14 8 9
Transferred from Publication Account		0 17 11
		£1,038 2 11

PAYMENTS	£ s. d.	£ s. d.
Balance due Treasurer, July 1st, 1916		13 18 4
Salaries		632 8 8
Fuel, Lighting, and Water		100 1 4
Insurance		39 12 9
Materials and Fittings		10 13 1
Postage and Carriage		11 4 5
Printing		27 1 9
Property Tax		42 10 2
Building Repair Fund		75 0 0
Stationery		1 10 0
Subscriptions : Museums Association	1 1 0	
Ray Society	1 1 0	
Sundries	28 2 3	
		30 4 3
Balance in hand, June 30th, 1917		53 18 2
		£1,038 2 11

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

BUILDING REPAIR FUND

	£ s. d.		£ s. d.
Balance, 1st July, 1916	67 18 5	Sundry repairs	32 17 7
Transferred from General Account	75 0 0	Balance, 30th June, 1917	110 0 10
	£142 18 5		£142 18 5

PUBLICATION ACCOUNT

	£ s. d.		£ s. d.
Sale of Transactions	0 17 11	Balance, 30th June, 1917, transferred to General Account	0 17 11
	£0 17 11		£0 17 11

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

ENDOWMENT ACCOUNT

	£	s.	d.		£	s.	d.
Balance, July 1st, 1916	3	6	7	Paid for purchase of 5% War Loan, 1929-1947	48	0	0
Donations and Subscriptions	78	3	0	Balance, June 30th, 1917	34	4	0
Bank Interest	0	14	5				
	£82	4	0		£82	4	0

DEPOSIT ACCOUNT

		£	s.	d.		£	s.	d.
Balance, July 1st, 1916—					On deposit with Crown Building Society } Crawhall Bequest	300	0	0
In Bank	124 12 11				,, Crown Permanent Building Society ... } Crawhall Bequest	300	0	0
In Building Societies	600 0 0	724	12	11	Paid for purchase of 5% War Loan 1929–1947	142	0	0
Interest on Investments		24	0	0	Balance, June 30th, 1917	9	10	2
Bank Interest on Account		2	17	3				
		£751	10	2		£751	10	2

SAML. GRAHAM }
W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1917 :—

£	s.	d.		Taken at cost. £	s.	d.
Coppin Bequest—						
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock	2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt	500	0	0
Crawhall Bequest—						
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock			
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock	6,000	0	0
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock			
400	0	0	Armstrong, Whitworth & Co., Ld., 4 per cent. Debenture Stock			
485	0	0	Newcastle and Gateshead Water Company's Ordinary Stock	2,000	0	0
80	0	0	Weardale and Consett Water Company's 10 per cent. Maximum Ordinary Stock			
350	0	0	,, ,, 7 ,, ,, ,,			
Endowment Fund—						
1,800	0	0	Canadian 4 per cent. Registered Stock			
421	0	0	Newcastle and Gateshead Water Co.'s 5 per cent. Preference Stock			
500	0	0	,, ,, 5 per cent. Consolidated Preference Stock	3,482	3	1
370	0	0	5 per cent. Exchequer Bonds			
200	0	0	5 per cent. War Loan, 1929-1947			
				£13,982	3	1

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM AND NEWCASTLE-UPON-TYNE.

REPORT OF THE COUNCIL.

FOR 1917–1918.

The outstanding feature of the year under review is the great increase in the number of visitors to the Hancock Museum. The turnstile registered this number at 31,640, which compares with 22,242 for the year 1917 and 17,613 for the year 1916, and constitutes a record since it was placed in the entrance hall. While therefore the prosecution of the Great War has demanded and claimed the time and energy, and limited the work of those intent on the serious study of natural history, it is pleasing to find that when opportunity has occurred, such large numbers have found recreation and instruction in visiting and inspecting the collections. Of these visitors a large proportion have been soldiers and sailors, convalescent from the local military hospitals or stationed in the district, who have been admitted free.

The membership has been well maintained, the total number on the roll, including associates, being 389. The loyal support given to your Council in these times of exceptional difficulty gives them courage to continue their work. By death and resignation there has been a loss of 21, while 12 new members and associates have been elected. Of those whose death is deplored are His Grace the Duke of Northumberland, a Vice-President and Trustee who was elected in 1899, and was ever interested in the affairs of the Society; Sir Geo. Hare Philipson, another Vice-President, who joined in 1863, and whose genial help at the lectures given for children over which he frequently presided will be missed ; one who will be greatly missed too by all connected with the Museum is Prof. G. A. Lebour, whose name was a household word to all interested in geology; ever ready to help by his practical advice and closely associated with the Society in earlier years his memory will live in his work; Sir Walter Plummer, Sir Charles Milburn, Bart., Messrs. Wm. Gibson, 1877, W. B. Reid, 1882, Thos. Bowden, 1888, and others.

The east and west corridors and library are still being used by the biological and art staffs of Armstrong College, where the students are enabled to carry on their class work; and the library was again utilised for the holding of the Cambridge Higher Local Examinations.

The time of the Curators has been chiefly spent upon cleaning and painting the insides of the cases and the preservation of the individual specimens, and it is gratifying to find that many visitors during the year have spoken of the excellent condition and display of the exhibits. Many valuable acquisitions have been received during the year, more particularly in the entomological section, and these have entailed careful examination and rearrangement.

Children from the Council Schools have continued to come in charge of their teachers under the arrangement made a few years ago. It is greatly to be regretted that the plan of instruction with which this scheme was instituted has been suspended, but when peace is declared an attempt will again be made to set it in operation. Meantime it is a hopeful sign that while class work has not been possible, individual boys and girls have come to the Museum in increasing numbers, and shewn both interest and intelligence in dealing with the papers which have been prepared for them to answer.

There has fortunately not been much expenditure necessary in repairs; only what has been absolutely essential has been carried out, but when labour and material are again obtainable on reasonable conditions, your Council realise that a general overhaul of the buildings must be undertaken.

The exhibit of wild flowers displayed in the vestibule has been well maintained, thanks to the help of Messrs. Randle B. Cooke, Nicholas Temperley, and others. Many visitors come regularly for help in identification.

The Field Meetings, under the helpful leadership of Mr. W. E. Beck have been continued, the places visited being all near at hand; much good work has been done, especially in the entomological section.

During the winter the monthly "Round Table" meetings were held, and though the attendance in the dark evenings leaves something to be desired, there has been no lack of interest on the part of those who were present.

In view of the need for increasing food supply and to help those seeking for information, Prof. Potter, M.A., Sc.D., with his assistants, Miss Cunnington, B.Sc. and Miss Davy, M.Sc., gave a series of four lectures on economic botany in the autumn, which were much appreciated. In furtherance of this work an exhibit of garden pests, illustrating their life history and the method of combating their ravages, has been set up in the Museum, thanks to Prof. D. A. Gilchrist, M.Sc., and Mr. R. A. Harper Gray, M.A., M.Sc.

The Hancock Prize Competition only brought forward five essays. That of the successful candidate, Master Matthew Wright, a boy of 12½ years, who took moorland bird life for his subject, showed remarkable promise for one so young. To the examiners who judged the essays, the Rev. J. E. Hull and Mr. George Bolam, our thanks are accorded.

Vol. V. Part 1 of the Transactions is going through the press and will shortly be issued.

The Financial Statement calls for little comment. Thanks to careful administration the Hon. Treasurer has been enabled after providing for the necessary expenditure to finish the year with a balance in hand. Expenses are increasing, however, especially in the cost of fuel, lighting and maintenance, for which provision must be made.

The Endowment Fund has been kept open, and while it is scarcely opportune to appeal for donations when the national claims are so great, additional help will be appreciated. Investment in the War Loan to the amount of £200 has been made from donations previously promised and received during the year.

Lastly, your Council have pleasure in bearing testimony to the excellent work so willingly undertaken and so carefully executed by the Curators and Staff, to whom their thanks are given.

NEW MEMBERS ELECTED

FROM 1ST JULY, 1917, TO 30TH JUNE, 1918.

Geo. Angus, 37, Percy Park, Tynemouth.

Lady Browne, Westacres, Benwell.

James Cooke, Kilbryde, Corbridge.

Rev. Mark Fletcher, M.A., F.G.S., The Vicarage, Benton.

E. W. F. Fraser-Smith, 2, Jesmond Gardens.

W. M. Levins, Ellison Place.

Leonard Macarthy, Benwell Park.

A. H. May, 15. Athole Gardens, Kelvinside, Glasgow.

E. T. Nisbet, Birnie Knowes, Cullercoats.

N. S. Robinson, The Willows, Gosforth.

W. N. C. Wilson, National Provincial Bank.

ASSOCIATE MEMBER.

Herbert Egglishaw, 6, Stanley Street, Houghton-le-Spring.

CURATOR'S REPORT ON MUSEUM WORK.

1917–1918.

As was the case last year the Curator's work in the Museum has been mainly in the direction of renovation and rearrangement. It would be quite impossible in any one year to go entirely through the collections, but each year a large number receive needed attention, and we endeavour to ensure that no part of our extensive collections, in so many departments, shall be long neglected.

During the past twelve months most of the Store Cupboards have been turned out and their contents examined; the Zoology Wall Cases have been thoroughly renovated, and each object separately cleaned; the Wingate Collection of Diptera, the Rev. J. E. Hull's British Spiders, the Hancock Collection of Birds' Eggs and Nests, the Angas Collection of Shells, the Charlton Collection of Bird Skins and other natural history objects, several collections of Butterflies and Moths, including the splendid Raine Collection and many of Dr. Eltringham's, Miss Lebour's large collection of Foreign Shells, Dr. Brady's spirit specimens of Entomostraca, &c., and his large collection of microscopic slides, as well as many other objects in the Museum have all had attention during the year. The Desk Cases in the Geology Room have been gone through, every specimen cleaned, some of the cases rearranged, and much new labelling done. The Library has again been overhauled, all the books and shelves cleaned, and the books checked off with the Typed Catalogue. The work of looking up and sorting the very numerous Transactions of Learned Societies has been continued, but its completion will be a matter of years, in the very limited time it is possible to devote to it.

The attendance of visitors to the Museum has again been encouraging, and the numbers, especially at holiday times, show a marked tendency to increase. Each of the special holidays of the year, Easter, Whitsuntide, Race Week, the August Bank Holiday, the School Holiday in October, and Christmas and

New Year, brought an influx of visitors, in most cases the numbers being in excess of those of previous years. The total attendances show a very great advance, upwards of 31,000 visiting the Museum during the year, as against 22,000 last year, and 17,000 the previous year.

Papers of questions for boys and girls have again been given out, the number at the New Year holiday reaching high-water mark, being 124 papers taken and answered during three days of special holiday. As was to be expected the demand for these papers has fallen off for the summer, but a fair number have since been given out, and in most cases well answered.

The display of Wild Flowers in the Entrance Hall has been well maintained, thanks chiefly to the kind assistance of Mr. Randle B. Cooke, who has been indefatigable in bringing specimens. We are also indebted to Mr. Nicholas Temperley and other naturalists for further contributions. Prof. Potter, head of the Botanical Department of Armstrong College, has set out for exhibition a number of specimens illustrating plant diseases, and showing the ravages of insects on potatoes, cabbage, wheat, and other plants. Through the kindness of Mr. Harper Gray, M.A., M.Sc., of the Agricultural Zoology Department of the College we have been able to exhibit a large number of cases of Insect Pests, chiefly those injurious to plant life. Each case shows the life history of the insect, and directions are given for checking its ravages.

In the late autumn a course of four Saturday afternoon lectures on Economic Botany was given in the Museum by Prof. Potter and two of his lady assistants. These were fairly well attended, and dealt with such practical subjects as "A Loaf of Bread," "Sugar," "The Potato and its Diseases," "Yeast."

Another lecture given in the Museum in the early summer, was by Prof. Hatton, Principal of the King Edward VII. School of Art. He dealt with the "Interpretation of Nature, by Blake and Turner," and exhibited a number of beautiful examples of the work of both artists.

Many parties of boys and girls from various schools have visited the Museum usually accompanied by masters or lady teachers. A few brief lessons have sometimes been given by the latter, but the regular natural history teaching formerly given by members of the Museum staff is not at present possible. The schools represented have been the Royal Grammar School, Rutherford College, Sandyford School, and several ladies' schools. The Museum has also been visited by parties of local Field Club members on several occasions.

In the difficulties under which we sometimes suffer from the absence of our regular Curators we have again to express our thanks to the College Professors, whose classes are conducted under our roof, as well as to Mr. R. S. Bagnall, Mr. G. B. Walsh, Dr. J. W. Heslop Harrison, and others, who have always been so ready to give help and advice when needed. In this connexion I must refer to the late Prof. Lebour, whose cheery presence in the Museum is much missed, and whose help in matters geological was greatly valued.

As usual a list of Donations will be found on another page, but it may be well to call special attention to a few of these. Further instalments of Dr. Brady's extensive collections have been received, and after being carefully examined, cleaned and repacked, have been stored with the specimens previously received, ready for future inspection.

Dr. Eltringham of the Hope Department, Oxford University, has presented the whole of the original drawings, made for his work on African Mimetic Butterflies, on which he is the recognised authority.

Miss M. V. Lebour, D.Sc., has presented her fine collection of Foreign Shells, containing specimens from every quarter of the world. These are contained in twenty-eight small cabinets of four drawers in each, and one box of shells too large for the cabinets.

The very large collection of Butterflies and Moths made by the late John Finlay is a valuable acquisition. They fill three large cabinets with 12, 26, and 28 drawers respectively, most of the drawers containing upwards of one hundred specimens.

The two brothers, Capt. J. M. Charlton and Lieut. Hugh V. Charlton, whose death in their country's service has deprived natural science of two most ardent and promising votaries, have bequeathed to the Museum the whole of their Natural History collections. These consist of over fifty birds and mammals mounted in cases, and a large number of skins, chiefly birds, and many other natural history objects. The collections form a pleasing memento of two talented young naturalists who had shown great interest in the Museum and the work of our Natural History Society.

JOSEPH J. GILL.

MUSEUM STAFF

Curator	E. Leonard Gill, M.Sc.
Deputy Curator	Joseph J. Gill.
Lady Assistants	Miss Gladys Scott. ,, I. M. Hepburn.
Attendant	A. E. Bennett.
Gardener	H. Stones.

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.
R. S. Bagnall, F.E.S., F.L.S.
H. Eltringham, M.A., D.Sc., F.Z.S.
Samuel Graham.
Prof. G. A. Lebour, M.A., D.Sc.
Prof. Alex. Meek, M.Sc., F.Z.S.
Prof. M. C. Potter, M.A., Sc.D.
Geo. B. Walsh, M.Sc.

AFTERNOON LECTURES HELD DURING THE SESSION 1917–1918.

1917.

Nov. 24.—Prof. M. C. Potter, M.A., Sc.D.: "A Loaf of Bread."

Dec. 1.—Miss Davy, M.Sc.: "Sugar."

Dec. 8.—Prof. M. C. Potter, M.A., Sc.D.: "The Potato, and some of its Diseases."

Dec. 15.—Miss Cunnington, B.Sc.: "Yeast."

1918.

June 3.—Prof. R. G. Hatton, A.R.C.A. (Lond.): "The Interpretation of Nature by Blake and Turner."

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, November 1st, 1917.

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey.

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Grey.
Lord Barnard.
Lord Ravensworth.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Geo. J. W. Noble, Bart.
Sir Lindsay Wood, Bart.
Sir G. H. Philipson, M.D., D.C.L.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Col. C. W. Napier-Clavering.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
Clive Cookson.
R. Coltman Clephan, F.S.A.
Samuel Graham.
H. N. Middleton.
Principal W. H. Hadow, M.A., Mus. Doc.
Prof. M. C. Potter, M.A., Sc.D.
J. L Gracie
J. D. Walker, J.P.
Prof. A. Meek, M.Sc.

COUNCIL

Hugh P. Angus.
R. S. Bagnall, F.E.S., F.L.S.
W. E. Beck.
Edwin Burnup.
Wilfrid Hall.
J. J. Hill, M.S.A.
T. E. Hodgkin, M.A.
Hon. J. Arthur Joicey.
Prof. J. A. Menzies, M.A., M.D.
John Talbot, M.A., B.Sc.
Ernest Scott.
George Sisson.

HON. SECRETARIES

C E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30th, 1918.

THOMAS N. BEE.—Two stoats in winter dress.

ROBERT BLAIR, F.S.A.—A number of weapons, a German gas mask, and other objects of interest from the Newcastle Archæological Society, collected by W. H. Cullen.

GEORGE BOLAM.—A whiskered bat (new species for local fauna).

GEORGE S. BRADY, M.D., D.Sc., LL.D., F.R.S.—Manuscripts and working drawings of Crustacea.

H. ELTRINGHAM, D.Sc.—The original drawings for his work on "African Mimetic Butterflies," arranged in nine frames.

H. FISHER.—A lily of the valley in fruit.

W. H. FOWKES.—A butterfly (Neptis sp.) from Roorkee, N.W.P., India.

A. HUME.—A small collection of fossils.

MRS. E. L. JAMESON.—A large snake in case.

MISS MARIE V. LEBOUR, D.Sc.—A large collection of foreign shells, contained in 28 cabinets, of four drawers each, and a box of specimens too large for the cabinets.

STEWART McDONALD.—A king locust.

MRS. MOFFATT.—A large collection of British butterflies and moths, contained in three cabinets, of 12, 26 and 28 drawers respectively. The work of the late John Finlay.

MISS POWELL.—A large assortment of rocks and fossils, collected by her father and grandfather.

JOHN PROUDLOCK.—A Dauberton's bat and a long-eared bat, both mounted by George Bolam.

COL. REED.—A white mole, from J. C. Gibson's Milkhope Farm, Blagdon.

J. ALARIC RICHARDSON.—A number of insects from Windermere.

MISS ROBERTSON.—A large collection of minerals.

CHARLES ROBSON, per George Bolam.—A noctule, caught at Talbot Constable, E. Yorks., and a whiskered bat, caught near Chester-le-Street.

MISS E. L. ROOKE.—A snake bird or darter, shot near Meanee, India.

ROYAL DUBLIN SOCIETY.—Scientific Proceedings, vol. xv., Nos. 15–23 (Oct., 1916—Aug., 1917); Economic Proceedings, vol. 2, Nos. 12, 13 (Sept., 1916—Mar., 1917).

ERNEST SCOTT.—A copy of "The Diseases of Trees," by Prof. R. Hartig.

CLARENCE D. SMITH.—A dragon fly, an ichneumon, and a pair of giant sawflies (*Sirex gigas*).

L. SMITH.—A branch of the old Mulberry tree blown down in Saltwell Park, Gateshead. [This was planted in our greenhouse and has taken root, and come out in full leaf with several fruits.]

J. STAFFORD.—A very fine blue dragon fly (*Aeschna juncea*).

MRS. STURGE and MISS S. A. RICHARDSON.—A sprig of the spindle tree (*Euonymus Europæus*) in fruit.

MISS CAMERON SWAN.—A small collection of fossils.

J. NEY TATE.—A number of moths.

MRS. J. W. TWINBERROW.—A model passage boat.

D. WOOLACOTT, D.Sc.—Norwegian rocks from the Scandinavian Drift, found in Warren House Gill, north of Castle Eden Dene, on the Durham coast.

The publications received by exchange with British and Foreign scientific institutions are acknowledged in a separate list which is published later in the Transactions as an appendix to the report.

DONATIONS TO THE ENDOWMENT FUND.

FROM JULY 1ST, 1915, TO JUNE 30TH, 1918.

	£	s.	d.
Sir Geo. J. W. Noble, Bart.	100	0	0
Sir Hugh Bell, Bart.	50	0	0
Thomas Reed	10	0	0
	£160	0	0

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM JULY 1ST, 1917, TO JUNE 30TH, 1918.

RECEIPTS				£	s.	d.
Balance, 1st July, 1917				53	18	2
Members' Subscriptions				349	10	0
Museum Admission Fees	212	9	9			
Education Committee's Grant	10	0	0			
				222	9	9
Sale of Guide Books, etc.				11	6	0
Interest on Investments				540	19	3
Sundries				18	6	10
				£1,196	10	0

PAYMENTS				£	s.	d
Salaries				635	18	0
Advertising				2	7	6
Fuel, Lighting, and Water				96	2	3
Insurance				35	5	2
Materials and Fittings				8	6	2
Postage and Carriage				5	15	3
Printing				24	6	6
Property Tax				42	10	2
Building Repair Fund				40	0	0
Stationery				3	8	3
Publication Account				48	13	7
Subscriptions: Museums Association	1	1	0			
Ray Society	1	1	0			
Sundries	26	1	10			
				28	3	10
Transferred to Deposit Account				200	0	0
Balance in hand, June 30th, 1918				25	13	4
				£1,196	10	0

SAML. GRAHAM } Hon. Auditors.
W. J. BELLERBY }

A. H. DICKINSON, Hon. Treasurer.

BUILDING REPAIR FUND

	£	s.	d.		£	s.	d.
Balance, 1st July, 1917	110	0	10	Sundry repairs	33	3	6
Transferred from General Account	40	0	0	Balance, 30th June, 1918	116	17	4
	£150	0	10		£150	0	10

PUBLICATION ACCOUNT

	£	s.	d.		£	s.	d.
Sale of Transactions	27	5	5	Line Blocks	5	6	3
Transferred from General Account	48	13	7	Transactions, Vol. V. Part 1	70	12	9
	£75	19	0		£75	19	0

SAML. GRAHAM, W. J. BELLERBY, Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

ENDOWMENT ACCOUNT

	£	s.	d.		£	s.	d.
Balance, July 1st, 1917	34	4	0	Paid for purchase of 5% War Stock 1929—1947	188	3	6
Donations and Subscriptions	160	0	0	Balance, June 30th, 1918	8	7	1
Bank Interest	2	6	7				
	£196	10	7		£196	10	7

DEPOSIT ACCOUNT

				£	s.	d.			£	s.	d.
Balance, July 1st, 1917—							On deposit with Crown Building Society	Crawhall Bequest	300	0	0
In Bank	9	10	2				,, Crown Permanent Building Society ...		300	0	0
In Building Societies	600	0	0								
				609	10	2	Balance, June 30th, 1918		470	4	9
Interest on Investments				24	0	0					
Transferred from General Account				200	0	0					
Grant from Armstrong College				100	0	0					
Income Tax repaid to April, 1918				129	9	1					
Bank Interest on Account				7	5	6					
				£1,070	4	9			£1,070	4	9

SAML. GRAHAM
FRANK RICHARDSON } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1918:— Taken at cost.

				£	s.	d.
Coppin Bequest—						
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock	2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt	500	0	0
Crawhall Bequest—						
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock	6,000	0	0
1.900	0	0	North-Eastern Railway Company's $4\frac{1}{2}$ per cent. Preference Stock			
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock			
400	0	0	Armstrong, Whitworth & Co., Ld., 4 per cent. Debenture Stock	2,000	0	0
485	0	0	Newcastle and Gateshead Water Company's Ordinary Stock			
80	0	0	Weardale and Consett Water Company's 10 per cent. Maximum Ordinary Stock			
350	0	0	,, ,, 7 ,, ,, ,,			
Endowment Fund—						
1,800	0	0	Canadian 4 per cent. Registered Stock	3,670	6	7
421	0	0	Newcastle and Gateshead Water Co.'s 5 per cent. Preference Stock			
500	0	0	,, ,, 5 per cent. Consolidated Preference Stock			
789	9	5	5 per cent. War Loan. 1929—1947			
				£14,170	6	7

SAML. GRAHAM, FRANK RICHARDSON } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE

REPORT OF THE COUNCIL

FOR 1918–19.

In the history of the world there has been no such terrible war, or one involving such grave issues and entailing such great suffering and sacrifice of life, as that which began on August 4th, 1914. The forces, human and mechanical, which have been drawn upon were so manifold as to arrest normal activities throughout the British Empire. It was therefore with deep feelings of relief that the news of an armistice was received in November of last year. More than six months elapsed before the full conditions of peace were settled; this has necessarily been a period of anxiety and uncertainty retarding the general resumption of normal conditions of work.

Armstrong College, used as an hospital during the war, is being released by the military authorities, and it is expected that the staff and students of those sections who have been working at the Hancock Museum since 1914 will return to the College during the October term. The arrangement under which the work has been carried on has been in every respect a happy one, and the Museum staff will miss their guests no less for their pleasant association than for their co-operation and ready help in work of kindred nature.

The Council were pleased to welcome the release and return from active service abroad of the Curator, Mr. E. Leonard Gill, in the early part of 1919. While the general work at the Hancock Museum has been carried on so well in his absence by a comparatively inexperienced staff, there is much of a progressive character which will now be pushed forward under his technical direction.

A great loss to natural history—not only locally but in a wider sphere, where his work on marine zoology, and especially crustacea, was well-known and appreciated—was felt in the death of the Rev. Canon Norman. An obituary account of his life and work by Professor Meek will appear in the next volume of Transactions. Another gifted naturalist, Mr. Frederic Raine, who, like Canon Norman, was an honorary member of the Society, has been lost by death during the year. Mr. Raine was hardly known to the present generation of local naturalists, because he was compelled by ill-health to remove many years ago to the south of France. Previously, when he lived at Durham, his zeal as a field naturalist, collector and taxidermist brought him into close association with all the leading members of the Society who shared his tastes. A remarkable perfection of workmanship and finish characterised all that he did; it is strikingly shown in the very valuable collections with which he enriched the Museum. These include collections of British birds' eggs and British butterflies and moths, as well as of the butterflies and flowering plants of the French Riviera. Of other members who have passed away may be mentioned Mrs. Spence Watson, the literary and social work of whose husband brightened Newcastle life; Lord Barnard, whose interest in museum work left its mark; Dr. Clement Stephenson, who devoted much time to the breeding and improvement of cattle; Mr. Richard Welford, local historian; and others, the loss of whom leaves the district poorer.

The roll of members remains almost the same at the end of each year. New members join the Society but death and resignation prevent any permanent increase in numbers. During the year under review 13 valued members have passed away, 6 have resigned, and 24 members and associates have been elected. The membership stands at 396.

Members can materially help the Society by the introduction of new subscribers, and are earnestly asked to co-operate.

On the other hand, the growing popularity of the Museum may be gauged by the increase in the number of day visitors. The turnstile shows that 43,340 entered the building. Of these 1,812 were from the Council and other schools. There are still many soldiers and sailors amongst the visitors, though naturally the number is decreasing. Question papers have been again arranged for boy and girl visitors, and these have been answered with intelligence.

Owing to many of the lecturers, who have in the past so cheerfully and voluntarily given their help, being engaged on important research work, and to the lighting restrictions, it was again impossible to arrange a course of winter lectures. The only exception was an interesting "talk" on "The Birds of France" given by the Curator shortly after his return, which drew a good audience and was much appreciated. Several causes contributed to prevent the "Round Table" meetings held in the winter evenings being well attended. The experiment was therefore tried of holding them on Saturday afternoons, and this has been attended by considerable success, the attendance becoming larger and drawing forth discussion which has been instructive and interesting. A list of subjects dealt with will be found in the Report.

Supplies of fresh wild flowers have been received regularly from Mr. Randle B. Cooke; others have also contributed and thus helped to keep up the exhibit, which assistance has been welcome. That the exhibit continues to fulfil a useful purpose is proved by the frequent and regular visits of those who come to study and identify.

Guided by the experience of the last few years under war time conditions, a programme of Field Meetings within a near and limited area was arranged; these under the able leadership of Mr. Geo. Sisson are shewing by the increased attendance of members that outdoor work is such as should be continued.

Vol. V., part 2 of the Transactions is now in the press, and will be issued in due course. It is hoped now that better conditions are returning, those papers and reports which have necessarily been standing over may be shortly published.

While the competition for the Hancock Prize was distinctly encouraging a couple of years ago both as regards number and quality of essays, there has since been a distinct falling off. Only five essays were received this year, the work of which, with two exceptions, was moderate. The prize was awarded to Mr. F. E. Johnstone of Blackhill for an excellent paper dealing with the bird life of the Upper Derwent district. To the examiners, the Rev. J. E. Hull and Mr. Geo. Bolam, the thanks of the Council are offered for their careful report.

The Endowment Fund has been augmented by a legacy of £1,000 from the late Dr. Clement Stephenson.

Economy has been studied with regard to finance in the face of increasing expense; this expense is chiefly by way of salaries, wages and fuel. Thanks to careful watchfulness the Hon. Treasurer is enabled to present a satisfactory balance sheet. Although the quantity of fuel granted under the Coal Control was limited, the price has been greater. A scheme for improving the heating of the Museum and reducing the quantity of fuel required is under the consideration of the Council.

In view of the great increase in the cost of labour and material the question of the insurance of the buildings against fire has had the careful consideration of the Council, and it was decided to increase the amount to £30,000. From time to time during recent years the collections have been augmented by various accessions; many of these are now unique and could not be replaced, while it is scarcely possible to assess their value. As a precautionary measure, therefore, the insurance on the contents of the Museum has been raised to £40,000.

The Council were fortunate during the last two and a half years in having the help of Mr. Gill, sen., as Deputy Curator, and on the termination of this arrangement they desire to put on record their appreciation of his services, as well as to express their thanks to the other members of the staff, who have, with him, so willingly and efficiently carried out their various duties.

NEW MEMBERS ELECTED

FROM 1ST JULY, 1918, TO 30TH JUNE, 1919.

Alfred Appleby, Stotes Hall, Jesmond.
William Carter, 145, Pilgrim Street.
William Deans Forster, Park House, Morpeth.
F. C. Garrett, D.Sc., F.C S., West Croft, Elvaston Road, Hexham.
Major F. W. Gardner, 59, Meldon Terrace, Heaton.
Stanley S. Haggie, West Jesmond Villa, Osborne Avenue.
B. P. Hill, B.Sc., 37, Holly Avenue, Jesmond.
Miss May Hume, 11, Belle Grove Terrace.
Fred O. Kirkup, The Manor House, Medomsley.
H. B. Lockhart, Arcot Hall, Dudley.
Sir Leonard Milburn, Bart., Guyzance, Acklington.
W. C. Mountain, 8, Sydenham Terrace.
His Grace The Duke of Northumberland, Alnwick Castle.
Percy Parmeter, The Union Club.
H. Pickering, 13, South Parade, Whitley Bay.
R. Morris Richardson, The Union Club.
Benjamin F. Simpson, The Cottage, Bucklebury, Berkshire.
W. E. Stephenson, Throckley House, Newburn.
G. Grey Turner, The Hawthorns, Osborne Road.
W. S. Vaughan, The Poplars, Gosforth.
Frank R. Watts, Wingrove, Clayton Road.
Henry B. Watson, Felton Park, Acklington.
J. R. R. Wilson, M.Inst.C.E., F.G.S , 4, Park Terrace.

ASSOCIATE MEMBERS.

Francis R. Main, 25, Highbury.
G. B. Walsh, B.Sc., Secondary School, Scarborough.
Alastair S. Watson, 31, Osborne Road.

CURATOR'S REPORT ON MUSEUM WORK

1918–1919.

During the past two or three years the work done in the Museum has necessarily been confined for the most part to what may be called maintenance work, as distinct from progressive work; and I should like to say that it is a great satisfaction to me to find on my return that the collections have been kept in such excellent order. A good deal of work of this character has been done during the year under review. The Hancock and Raine collections of British birds' nests and eggs have been examined and put into good order, as have also the large Pallas collection of Russian plants and some other sets of herbarium material. The birds and cases on the gallery of the bird room have likewise been overhauled, to the great improvement of their appearance.

Similar work has been done on some recently acquired collections, for example on the shells presented last year by Miss M. V. Lebour, D.Sc., and on the Finlay collection of local butterflies and moths recently presented by Mrs. Moffatt. (Incidentally it should be stated that the Finlay collection is well worth any work that may be involved in its preservation. The late John Finlay was one of the best of the earlier Northumbrian lepidopterists, and his records are constantly quoted in our catalogue of the local butterflies and moths.) The very numerous minerals and fossils presented by Mr. H. Cooper Abbs (see list of donations) have been worked through and sorted, and the spiders from the Rev. J. E. Hull have been embodied in the reference collection with which he has provided us by instalments in previous years.

A valuable piece of work of a different kind which was carried out by the 'war-time' staff was the preparation of an inventory of the contents of the Museum. This was in part undertaken for purposes of insurance, but in order to serve museum purposes as well the inventory was considerably elaborated. With a view to adequate insurance, dimensions and particulars of all the show-cases were included, while for museum purposes my father has added an alphabetical index to the contents of the store cupboards, and another section which is particularly valuable, an alphabetical list of all the genera represented in the zoology room, with references to their position and nature.

Work of the progressive sort has also been going on during the year. Miss Scott has been getting together from various sources material for the remaining show-cases of insects which we hope shortly to complete, especially those illustrating the Orthoptera and Neuroptera. A large proportion of the specimens have had to be relaxed and re-set. The two chief kinds of work now in hand are labelling, and work on the geology room. Labels of several kinds are being drawn up and printed; large-type heading labels for the cases, smaller labels for individual specimens, and descriptive or explanatory labels for certain groups. These explanatory labels are designed to make the exhibits intelligible to ordinary visitors and to bring out points of special interest. The present work in the geology room has a similar object. I am trying to finish up the series of introductory cases that I began a long time ago in that room, and with Dr. Woolacott's help I have also made a beginning upon the large geological sections which I intend to put up above the wall cases. The geological collections are now very much the most backward section of the Museum. They comprise a wealth of good material, but it is still in the roughed-out state of thirty years ago—far too much stuff on view and none of it so treated as to mean much to the public. Undoubtedly a gradual transformation of the geology room ought to be a main element in our work for some years to come.

A few other portions of the year's work should be briefly referred to. In the library Miss Hepburn has done a good deal of sorting and re-arrangement, chiefly of unbound periodical literature. The tank in which the giant squid is shown has been cleaned out and the glass top refitted on a new system. On the wild-flower counter we have usually had during the summer a good show of the more conspicuous flowers of the season; for supplies we have been indebted principally to Mr. Randle B. Cooke.

The greatly increased attendance of visitors to the Museum, both on public holidays and at ordinary times, is a noticeable and pleasing change as compared with the years before I went away. It gives further encouragement to those parts of our work which are designed especially for the benefit of the public. In this connexion my father's very successful experiment in getting boys and girls to answer papers of questions has been a valuable development and one that should certainly be continued.

Some noteworthy acquisitions have been made during the year by donation or bequest. Col. Adamson has given us de Nicéville's work on the butterflies of India, and also the icterine warbler shot twenty years ago in his garden at North Jesmond the most important bird, from the point of view of local ornithology, in the beautiful collection left by his father, the late Charles Murray Adamson. From the Rev. J. E. Hull we have received 135 fresh tubes of spiders for incorporation in the reference collection with which he has provided us. A gift from Lord Armstrong which has attracted a good deal of attention is a clever reproduction of the dodo made by Messrs. Rowland Ward. Dr. C. T. Trechmann has given us a large number of insects, British and exotic, of various groups; some of them will be particularly useful in fitting up the show-cases that are still to be prepared. The largest and in many ways the most remarkable acquisition of the year has come to us by bequest of the late Miss M. R. Dickinson, of Norham, a lady who retained to an advanced age a boundless energy and unusual versatility. The bequest includes a great series of beautifully executed water-colour drawings of wild flowers, in itself a remarkable life-work; good collections of flowering plants, mosses, fresh-water algae and seaweeds, some shells and other remains of shore life, a small microscope and some useful books. To the geological department Mr. John Jeffrey, B.Sc., has contributed some graptolites from the Skiddaw Slates (a formation in which fossils are hard to find), and some unusually good trilobites from local limestones; a large number of fossils, rock specimens and minerals collected by the late Rev. George C. Abbs, of Cleadon, have been presented by his nephew, Mr. H. Cooper Abbs; and Mr. L. F. Richardson has allowed us to select some specimens from the similar collection formed by the late David Richardson. Among the accessions to the ethnological department are some poisoned arrows from North-Eastern India, together with papers on the poisons, presented by Sir Thomas Oliver; and a fine example of the hand harpoons formerly used in whaling, presented by Mrs. Bewicke Dowell.

Dr. Woolacott and the Rev. Mark Fletcher have kindly given their help in sorting through some of the geological material referred to above, and, as already stated, Dr. Woolacott is also helping with the large sections for the geology room. Another member of the College staff to whom we have been indebted for constant help is Dr. Harrison.

I should like to conclude this report with what I may call some suggestions for benefactions. Much has been done for this and other museums by spontaneous generosity on the part of those who happened to know of special needs. The following list of some of the present needs of the Hancock Museum is given in the hope that, if they are made known, some one or more of them may appeal to those who are willing to help us. Most of them are unlikely to be met in any other way for a very long time :—

Cases and Fittings:

Separate cases, small and large, for special groups of birds and for other objects up to the size of big-game animals.

Book-form sets of frames for drawings and pressed plants.

Photographs and frames for the ethnology gallery - to illustrate the types of mankind whose productions are shown.

Top-cases for the mineral gallery, to complete the series begun some years ago.

Reflectors for the zoology room—to throw light into the new insect cases on the dark side.

New fronts for wall cases in the zoology room—to replace the old-fashioned fronts which unnecessarily obstruct the view.

Specimens:

Injurious insects—cases illustrating life-histories and damage caused.

Fur-bearing animals—contributions towards as nearly complete a set as possible.

Big game animals.

E. LEONARD GILL.

MUSEUM STAFF

CURATOR	E. LEONARD GILL, M.SC.
DEPUTY CURATOR	JOSEPH J. GILL.
ASSISTANT CURATOR	MISS GLADYS SCOTT.
LADY ASSISTANT	MISS I. M. HEPBURN.
ATTENDANT	A. E. BENNETT.
GARDENER	H. STONES.

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.
R. S. Bagnall, F.E.S., F.L.S.
H. Eltringham, M.A., D.Sc., F.Z.S.
Samuel Graham.
Prof. Alex. Meek, M.Sc., F.Z.S.
Prof. M. C. Potter, M.A., Sc.D.
Geo. B. Walsh, B.Sc.

INFORMAL SATURDAY AFTERNOON MEETINGS

1918.

Nov. 9. "Growth and Structure of Fungi"—Mr. W. H. Wheldon.

Dec. 31. "Classification of Fungi"—Mr. W. H. Wheldon.

1919.

Jan. 11. "The Structure of Insects"—Mr. C. E. Robson.

Feb. 8. "Pollination"—Mr. E. Potts.

Mar. 8. "The Life History of an Early Spring Flower"—
Mr. R. Adamson, F.R.H.S.

CURATOR'S "MUSEUM TALK."

1919.

Mar. 26. The Birds of France.

Private Evening Meeting of the Society, 19th March, 1919: Report on Field Meetings of 1917 by Mr. W. E. Beck, Chairman of Committee. Reading of the Hancock Prize Essay by Mr. F. E. Johnstone, Blackhill.

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey.

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Grey.
Lord Ravensworth.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Geo. J. W. Noble, Bart.
Sir Lindsay Wood, Bart.
Sir W. H. Hadow, M.A., Mus. Doc.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Col. C. W. Napier-Clavering.
Lt.-Col. C. H. E. Adamson, C.I.E.
Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
Clive Cookson.
R. Coltman Clephan, F.S.A.
J. L Gracie
Samuel Graham.
Prof. A. Meek, M.Sc.
H. N. Middleton.
Prof. M. C. Potter, M.A., Sc.D.
J. D. Walker, J.P.

COUNCIL

G. A. Atkinson.
W. E. Beck
A. J. Haggie, J.P.
Wilfrid Hall
J. J. Hill, M.S.A.
Hon. J. Arthur Joicey.
Prof. J. A. Menzies, M.A., M.D.
A. M. Oliver.
Ernest Scott.
George Sisson.
Nicholas Temperley, J.P.
Clarence Smith.

HON. SECRETARIES

C. E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
Frank Richardson.

TRUSTEES FOR THE SOCIETY

Elected at the Special General Meeting held on the 13th of December, 1905.

His Grace the Duke of Northumberland, K.G., F.R.S.
The Rt. Hon. Viscount Ridley.
The Rt. Hon. Lord Ravensworth.
The Rt. Hon. Lord Armstrong.
The Rt. Hon. Lord Joicey.
Sir Hugh Bell, Bart.
Sir Andrew Noble, Bart. F.R.S.
Sir John D. Milburn, Bart.
Lt.-Col. C. H. E. Adamson, C.I.E.
E. J. J. Browell.
N. C. Cookson.
Clive Cookson.
G. E. Henderson.
Edward Joicey.
J. H. B. Noble.
T. E. Hodgkin (elected Oct. 1st, 1917).

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1919.

H COOPER ABBS.—Large collection of rocks, minerals and fossils left by the late Rev. Geo. C. Abbs of Cleadon.

LT.-COL. C. H. E. ADAMSON, C.I.E.—De Nicéville's "Butterflies of India," 3 vols. The icterine warbler (*Hypolais icterina*) shot in the donor's garden at North Jesmond, 20th June, 1899.

HUGH P. ANGUS.—Female example of *Andræna fulva* (a bee) from the donor's garden at Low Fell.

COL. W. M. ANGUS, C.B.—Large snake ('mamba') killed by the donor in South Africa.

RIGHT HON. LORD ARMSTRONG.—Reproduction of the dodo (*Didus ineptus*), the work of Messrs. Rowland Ward.

R. S. BAGNALL, F.E.S.—Specimens, mounted for the microscope, of two Collembola added to the British fauna by the donor, viz.—*Tetracanthella pilosa*, Schoett. (Cheviots), and *T. oxoniensis* Bagnall (Oxfordshire, paratype). Also copies of many recent papers by the donor on Protura, Thysanura, Collembola, Homoptera, Thysanoptera, Gall-Midges and Gall-Mites, Myriapods, etc. Rothschild's "British Siphonaptera," South's "Synonymic List of British Lepidoptera," and other papers.

MISS T. M. BAUMGARTNER.—Skin of a platypus, *Ornithorhynchus paradoxus*.

D. BROWN (Shieldfield).—Fox, a large specimen, stuffed and mounted in case.

J. D. BROWN (Consett).—Leaf-cutter bee, *Megachile circumcincta*, from Consett, with nests and larvæ.

R. BURT.—Fine specimen of toothwort, *Lathræa squamaria*, from Shotley Bridge; complete plant with rootstock

F. J. COLLEY. Male giant sawfly, *Sirex gigas*.

W. A. DAVISON.—Some eggs of British birds.

MISS M. R. DICKINSON (the late).—By bequest: fine series of water-colour drawings of flowering plants; herbarium of flowering plants, mosses, freshwater and marine algæ; small microscope, with slides of fishes' scales, algæ etc.; some shells and insects; a number of books, including Muirheads' "Birds of Berwickshire."

Mrs. M. E. Bewicke Dowell.—Hand harpoon as formerly used by whalers, in fine preservation; skull of albatross, sperm whale's teeth, etc.

M. Drake.—Living female poplar hawk moth.

Rev. Mark Fletcher, M.A.—Quarterly Journal of the Geological Society, series from 1895 to date.

Stanley S. Haggie.—Large adder (23 inches) from near Otterburn.

Mrs. Harding.—Shale with fern fronds etc., from Woodhorn Pit, near Newbiggin.

Dr. J. W. Heslop Harrison.—Piece of 'dogger' from the Inferior Oolite, Roseberry Topping, composed of leaves of *Thinnfeldia.*

Rev. J. E. Hull, M.A.—Further batch of spiders, 135 tubes, chiefly local, to add to the reference collection previously received from the same donor.

Charles Janet (Paris).—Paper by the donor on "La Phylogénèse de l'Orthobionte."

John Jeffrey, B.Sc.—Unusually good series of graptolites and a few other fossils from the Skiddaw Slates, collected by the donor; and two unusually well preserved trilobites from local Carboniferous limestones.

Jane Longstaff, F.L.S.—Paper by the donor on "New Lower Carboniferous Gasteropoda," in which specimens from the Hancock Museum are described.

Dan Maddock.—Specimens from Jamaica: a living pair of cockroaches, a fresh centipede and a large Helix.

Henry T. Mennell, F.L.S.—Journal of the Linnean Society: Botany, vol. 44, nos. 296-8; Zoology, vol. 34, nos. 225-6. Proceedings, Oct. 1918, nos. 353-6.

Sir Thomas Oliver.—Three poisoned arrows from North-Eastern India, obtained through Sir Thomas Frazer, of Edinburgh, with papers by Frazer on the poisons.

Lewis F. Richardson, D.Sc.—Selection of fossils and minerals from the collection left by the donor's father, the late David Richardson.

Ernest Scott.—Copy of British Museum "Instructions for Collectors: No. 7—Blood-sucking Flies, Ticks, etc.," by E. E. Austin.

Joseph Scott.—Masked crab, *Corystes cassivelaunus*, alive.

J. W. Thompson.—Perfect cast of interior of wooden pipe, made by calcareous deposit from water at East Holywell Colliery, Shiremoor.

Dr. C. T. Trechmann.—Large number of insects left by the donor" father, the late Dr. C. O. Trechmann ; British and Foreign Lepidoptera, bees, wasps, ants, Neuroptera, Orthoptera, etc.

H. S. Wallace.—Newt with forked end to tail, from near Hexham. Scorpion fly *(Panorpa sp.)* from Galloway. Several exotic insects, including an oleander hawk moth from Egypt.

The publications received by exchange with British and foreign scientific institutions are acknowledged in a separate list which is published later (in the Transactions) as an appendix to the report.

DONATIONS TO THE ENDOWMENT FUND
From July 1st, 1918, to June 30th, 1919.

	£	s.	d.
Dr. Clement Stephenson	1,000	0	0
Thomas Reed	10	0	0
Richard S. Bagnall	3	3	0
	£1,013	3	0

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM JULY 1ST, 1918, TO JUNE 30TH, 1919.

RECEIPTS	£ s. d.	£ s. d.
Balance, 1st July, 1918		25 13 4
Members' Subscriptions		339 16 0
Museum Admission Fees	286 14 0	
Education Committee's Grant	10 0 0	
Grammar School Grant, 2 years'	4 4 0	
		300 18 0
Sale of Guide Books, etc.		15 17 9
Interest on Investments		437 13 0
Sundries		24 3 6
Balance, 30th June, 1919		4 16 11
		£1,148 18 6

PAYMENTS	£ s. d.	£ s. d.
Salaries		725 8 6
Advertising		0 10 10
Fuel, Lighting, and Water		113 15 5
Insurance		109 8 7
Materials and Fittings		21 0 1
Postage and Carriage		14 2 8
Printing		28 5 0
Property Tax		25 16 9
Building Repair Fund		40 0 0
Stationery		3 2 0
Publication Account		28 16 11
Subscriptions: Museums Association	1 1 0	
Ray Society	1 1 0	
Sundries	36 9 9	
		38 11 9
		£1,148 18 6

SAML. GRAHAM, FRANK RICHARDSON, Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer

BUILDING REPAIR FUND

	£	s.	d.		£	s.	d.
Balance, 1st July, 1918	116	17	4	Sundry repairs	7	8	0
Newcastle Gas Co., damage to manhole, etc.	2	18	9	Balance, 30th June, 1919	152	8	1
Transferred from General Account	40	0	0				
	£159	16	1		£159	16	1

PUBLICATION ACCOUNT

	£	s.	d.		£	s.	d.
Sale of Transactions	1	18	9	Line Blocks	3	13	2
Transferred from General Account	28	16	11	Transactions, Vol. V., Part 1 (balance)	27	2	6
	£30	15	8		£30	15	8

SAML. GRAHAM
FRANK RICHARDSON } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

ENDOWMENT ACCOUNT

	£	s.	d.		£	s.	d.
Balance, July 1st, 1918	8	7	1	*Stephenson Bequest*—			
Donations and Subscriptions	1013	3	0	£1050 5% War Stock 1929–1947	989	14	6
Grant from Armstrong College	50	0	0	Balance, June 30th, 1919	83	14	9
Bank Interest	1	19	2				
	£1073	9	3		£1073	9	3

DEPOSIT ACCOUNT

				£	s.	d.			£	s.	d.
Balance, July 1st, 1918—							On deposit with Crown Building Society	Crawhall Bequest	300	0	0
In Bank	470	4	9				,, Crown Permanent Building Society ...		300	0	0
In Building Societies	600	0	0	1070	4	9	£400 5% War Stock 1929–1947		377	1	0
Interest on Investments				24	0	0	Balance, June 30th, 1919		124	14	11
Bank Interest on Account				7	11	2					
				£1,101	15	11			£1,101	15	11

Saml. Graham, Frank Richardson } Hon. Auditors.

A. H. Dickinson, Hon. Treasurer.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1919:—

£	s.	d.		Taken at cost. £	s.	d.
Coppin Bequest—						
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock	2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt	500	0	0
Crawhall Bequest—						
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock			
1,900	0	0	North-Eastern Railway Company's $4\frac{1}{2}$ per cent. Preference Stock	6,000	0	0
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock			
400	0	0	Armstrong, Whitworth & Co., Ld., 4 per cent. Debenture Stock			
485	0	0	Newcastle and Gateshead Water Company's Ordinary Stock	2,000	0	0
80	0	0	Weardale and Consett Water Company's 10 per cent. Maximum Ordinary Stock			
350	0	0	" " 7 " " "			
Stephenson Bequest—						
1,050	0	0	5 per cent. War Loan, 1929—1947	989	14	6
Endowment Fund—						
1,800	0	0	Canadian 4 per cent. Registered Stock			
421	0	0	Newcastle and Gateshead Water Co.'s 5 per cent. Preference Stock	3,670	6	7
500	0	0	" " 5 per cent. Consolidated Preference Stock			
789	9	5	5 per cent. War Loan, 1929—1947			
				£15,160	1	1

SAML. GRAHAM, FRANK RICHARDSON, Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

LIST OF MEMBERS

OF THE

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-ON-TYNE

REVISED TO JUNE 30TH, 1918.

*** Except where otherwise stated, the addresses given are in Newcastle-upon-Tyne.

*** The letters F.C. in place of the date of election indicate that the member joined the Society in 1903 under Rule 3 as a former member of the Tyneside Naturalists' Field Club.

	Elected.
Adamson, Lt.-Col. C. H. E., J.P., C.I.E. *(V.-P.)*, Crag Hall, North Jesmond	1896
Adamson, Miss C. T., Crag Hall, North Jesmond	1903
Adamson, Richard, F.R.H.S., Winlaton, Blaydon-on-Tyne	F.C.
Addison, J. G., The Grange, East Boldon, S.O.	F.C.
Allan, Edward, Osborne Villas	1903
Allden, W. F., Elmfield Road, Gosforth	1906
Allendale, Right Hon. Lord, Bywell Castle, Northumberland	1911
Anderson, Dr. Robt., 4, Gladstone Terrace, Gateshead	1910
Angus, Col. W. M., J.P. C.B. *(V.-P.)*, Benwell Cottage	1884
Angus, Jos. G., Westover, Low Fell	1902
Angus, Hugh P., Eslington Villa, Low Fell	1902
Angus, Geo., 37, Percy Park, Tynemouth	1917
Appleby, Alfred, Stotes Hall, Jesmond	1918
Armstrong, J. H., 5, Windsor Terrace	1890
Armstrong, The Right Hon. Lord, J.P., M.A., D.C.L. *(Patron)*, Bamburgh Castle, Northumberland	1889
Arnott, Spencer L., Woodlands, Killingworth	1904
Atkinson, F. Buddle, J.P., Gallowhill, Morpeth	1911
Atkinson, Geo. A., Williton, Riding Mill-on-Tyne	1899
Atkinson, T. H., Eilans Gate, Hexham	1906

	Elected.
Backhouse, T. W., West Hendon House, Sunderland	F.C.
Bagnall, Richard S., F.E.S., F.L.S., Rydal Mount, Blaydon	1905
Bainbridge, Geo. B., Espley Hall, Morpeth	1912
Baumgartner, Mrs. J. R., Ambleside	1911
Beavan, Frederick, Dene Brow, Jesmond Park West	1912
Beck, W. E., 30, St. Mary's Place	1889
Bedson, Prof. P. P., M.A., D.Sc., F.C.S., Armstrong College	1888
Bell, C. L., J.P., Woolsington, Newcastle	1903
Bell, G. F., 55, Highbury	1913
Bell, Sir Hugh, Bart. *(V.-P.)*, Rounton Grange, Northallerton	1905
Bell, John G., 49, Osborne Road	1899
Bellerby, W. J., 4, Kensington Terrace	1910
Belt, Thomas, Bigg Market	1907
Benson, Harry, Denehurst, Jesmond Park East	1896
Blair, Robert, F.S.A., Harton Lodge, South Shields	F.C.
Blayney, R. O., West Sand Ends, Haydon Bridge	1903
Boocock, J. T., 80, Falmouth Road, Heaton	1913
Bowes-Lyon, Hon. Francis, Ridley Hall, Haydon Bridge	1905
Brackenbury, Hereward I., Seaton Burn House, Dudley, S.O.	1905
Browne, Lady, Westacres, Benwell	1918
Browne, B. C., Fawdon House, Newcastle	1911
Bullerwell, R. G. A., M.Sc., 2 Millbank Crescent, Bedlington	1910
Bulman, H. F., Morwick Hall, Acklington	1905
Burdon, Col. Rowland, J.P., Castle Eden, Co. Durham	1903
Burn, J. H., Dipton House, Riding Mill	1916
Burnup, John, Brantwood, Gosforth	1884
Burnup, Edwin, 2, Wentworth Place	1904
Burnup, Miss Winnifred E., 2, Wentworth Place	1910
Burt, Right Hon. Thos., P.C., D.C.L., M.P., 20, Burdon Terrace	1885
Burton, W. S., 2, Elmfield Villas, Gosforth	1911
Cackett, Jas. T., 113, Osborne Road	1901
Cadman, Chris. C., North of England Fish Hatchery, Barrasford, Northumberland	1906
Carrick, F., The Elms, Elmfield Road, Gosforth	1916
Carr, Wm. Cochran, Lower Condercum, Benwell	1904
Carr-Ellison, H. G., 15, Portland Terrace	1908
Carter, William, 145 Pilgrim Street	1919
Challoner, John D., 15, Framlington Place	1898
Chapman, Abel, Houxty, Wark-on-Tyne	1908
Chapman, Francis, Lynton, Graham Park Road, Gosforth	1916
Charlton, Chas. F., 21, Claremont Place	1912
Chaston, Ed. C., 36, St. George's Terrace	1913

	Elected.
Clark, Isaac, 12, Clayton Road	F.C.
Clay, Mrs. (in memory of the late T. R. Clay), 5, Haldane Ter.	1894
Clayton, Major Ed., Walwick Hall, Humshaugh	1907
Clephan, R. Coltman, F.S.A. *(V.-P.)*, Marine House, Tynemouth	1887
Cochrane, A. H. J., Jesmond Dene House	1911
Cochrane, Mrs. Alfred, Jesmond Dene House	1911
Cochrane, Cecil A., Oakfield House, Gosforth	1903
Cochrane, Henry H., Eshwood Hall, near Durham	1915
Cohen, Charles, 32, Osborne Road	1908
Cooke, Randle B., Kilbryde, Corbridge	1905
Cookson, Clive *(V.-P.)*, Nether Warden, Hexham	1903
Cookson, Kenneth ,, ,,	1904
Cookson, Harold, Birchwood, near Malvern	1906
Cooper, R. W., 2, Sydenham Terrace	1911
Corder, Percy, Collingwood Terrace	1911
Corder, Walter S., J.P., Rosella Place, North Shields	1911
Cowen, Joseph, Stella Hall, Blaydon-on-Tyne	F.C.
Cowper, J., 7, Framlington Place	1914
Coxon, Herbert, St. Mary's Mount, Jesmond Dene Road	1917
Cruddas, Miss Dora, Haughton Castle, Humshaugh	1904
Cruddas, Miss Eleanor ,, ,,	1904
Cutter, C. F., Fountain Cottage, Low Fell	1916
Dalgleish, R. S., 7, Grosvenor Villas	1916
Dendy, F. W., D.C.L., Eldon House, Osborne Road	1905
Devey, Dr. Thos. V., Muker, Richmond, Yorkshire	F.C.
Dickinson, A. H., 52, Dean Street *(Hon. Treasurer)*	1884
Dickinson, Robert, Underwood, Riding Mill-on-Tyne	1910
Dinning, Mrs., 43, Eldon Street	1894
Dixon, J. Askew, Ramshawe, Corbridge-on-Tyne	1905
Dodd, D. Mainland, 3, Fenham Terrace	1902
Dove, Ed. J., J.P., Oaklands, Riding Mill	1912
Drummond, D., M.D., Saville Place	1902
Dunn, N., Sunnybrae, Alnmouth	1902
Durham, The Right Hon., The Earl of, Lambton Castle, Fence Houses, Co. Durham	1903
Eeles, Robt., Jesmond Dene Hall	1914
Elphick, Geo., M.R.C.V.S., 1, Brandling Park	1894
Eltringham, H., M.A., D.Sc., F.Z.S., 8, Museum Road, Oxford	1902
Fenwick, J. C. J., J.P., M.D., Long Framlington, Morpeth	1896
Ferguson, John, South View, Hexham	1885
Ferguson, William, 2, St. Thomas' Place	1905

	ELECTED.
Finlay, Rev. W., Seaton Burn	F.C.
Fletcher, Rev. Mark, M.A., F.G.S., The Vicarage, Benton	1918
Forster, John J., J.P., Oakfield, Ryton-on-Tyne	1884
Forster, Fred. E., 32, Grainger Street	1901
Forster, C. D., Burradon, Rothbury	1906
Forster, J. H. B., Whitworth House, Spennymoor	1917
Forster, W. Deans, Park House, Morpeth	1918
Fowkes, W. H., 32, Marine Avenue, Whitley Bay	F.C.
Fraser-Smith, E. W. F., 2, Jesmond Gardens	1918
Frazer, T. Burdon, Woodside, Lindisfarne Road	1911
Gardner, Major F. W., 59 Meldon Terrace, Heaton	1919
Gardner, John, F.E.S., Laurel Lodge, Hart, West Hartlepool	1911
Garrett, F.C., D.Sc., F.C.S., West Croft, Elvaston Road, Hexham	1918
Gibson, Wm. W., 7, Grey Street	1909
Glendenning, G. H., 13, Eslington Terrace	1913
Goodger, Chas. W. S., 18, Market Street	1898
Gordon, Percy, 64, Osborne Road	1913
Gowans, Dr. T., Lochlibo House, Adderstone Crescent	1911
Gracie, John L. *(V.-P.)*, 11, Sydenham Terrace	1896
Graham, Samuel *(V.-P.)*, 107, High Park Road	1885
Green, Newbey S., 29, Brandling Park	1907
Greenwell, Winship, Bothal, Morpeth	F.C.
Grey, Right Hon. Viscount, Falloden, Northumberland	1905
Gurney, Miss H. M., M.D., The White House, Grainger Park Road	1912
Hadaway, George, 75, Howard Street, North Shields	F.C.
Hadcock, Major A. C., Benton Lodge, Longbenton	1901
Hadow, Principal, Sir W. H., M.A., Mus. Doc. *(V.-P.)*, Armstrong College	1909
Haggie, A. J., J.P., The Manor House, Long Benton	1914
Haggie, Stanley S., West Jesmond Villa, Osborne Avenue	1919
Hale, R. E., The Hermitage, Chester-le-Street	1916
Hall, Wilfrid, Prior's Terrace, Tynemouth	1903
Hand, T. W., Public Library, Leeds	F.C.
Hardie, W. J., Stalheim, Graham Park Road, Gosforth	1912
Harle, W. A., 8, Osborne Avenue	1904
Harrison, The Misses (in Memoriam A. P. H.), 9, Osborne Terrace, Jesmond	1906
Harrison, Thomas, Eastburn, Hexham	1905
Havelock, John, Eastwood, Jesmond Park East	1907
Henderson, G. E., Framlington Place	1886

	Elected.
Henderson, W. F., Moorfield, Claremont	1884
Henderson, J. C., Clifton Mount, Grainger Park Road	1917
Henderson, Mrs. J. C., ,, ,,	1917
Herd, T. S., 11, Grey Street	1912
Heron, J. P. Maxwell, 65, Eldon Street	1912
Heslop, Jas., South Close, Riding Mill	1914
Hick, Rev. J. M., M.A., Springfield, Elphinstone Road, Southsea	F.C.
Higginbottom, A. H., Simmondley, Adderstone Crescent	1914
Hill, B. P., B.Sc., 37, Holly Avenue	1919
Hill, J. J., M.S.A., Runnymede, Ponteland	1909
Hobbs, A. Holmested, M.D., 24, Ellison Place	1903
Hodgkin, T. E., M.A., Old Ridley, Stocksfield	1903
Hodgkin, Mrs. T. E., ,, ,,	1905
Holmes, Stephen, 10, Osborne Villas	1903
Holmes, Ellwood, Wyncote, Jesmond Park East	1911
Holmes, J. H., Wellburn, Jesmond Dene Road	1911
Holmes, Miss, ,, ,, ,,	1911
Holmes, William, Woodhurst, Moor Road, Gosforth	1914
Holzapfel, Max, Kenton Lodge, Gosforth	1905
Horsley, Wm. F., St. Helen's Terrace, Low Fell	1913
Howden, Prof. R., M.A., F.R.S.E., 14, Burdon Terrace	1903
Hull, Rev. J. E., M.A., Ninebanks Vicarage, Whitfield	F.C.
Hume, Miss May, 11, Belle Grove Terrace	1918
Hunter, Edward, Wentworth, Gosforth	1902
Hunter, Sir G. B., D.Sc., J.P., The Willows, Clayton Road	1902
Hunting, Chas. S., Slaley Hall, Riding Mill	1917
Hutchens, Prof. H. J., M.A., M.R.C.S., D.S.O., Corbridge	1907
Irving, J. A., West Fell, Corbridge-on-Tyne	1906
Jackson, Joseph, 10, Leazes Terrace	1888
Jeffreys, Harold, B.A., M.Sc., St. John's College, Cambridge	1917
Jenkins, Geo., Burley Orchard, Chertsey, Surrey	1896
Johnson, Rev. W., Brookfield, Rossett Drive, Harrogate	F.C.
Joicey, The Right Hon. Lord *(President)*, Ford Castle, Ford, Northumberland	1888
Joicey, Hon. Hugh Edward, Ford Castle, Ford, Northumberland	1910
Joicey, Hon. Jas. Arthur, Longhirst, Morpeth	1906
Kirk, William, J.P., Norton Hall, Stockton	1903
Kirkup, Fred O., The Manor House, Medomsley	1918

	Elected.
Kirkup, Austin, Manor House, Penshaw, Fencehouses	1916
Knothe, Rudolph, 3, Haldane Terrace	1884
Knott, Sir James, Close House, Wylam	1907
Knowles, W. H., F.S.A., 25, Collingwood Street	1893
Laidler, G. G., Jun., 38, Northumberland Street	1915
Laidlaw, P. O., Stonecroft, Fourstones, R.S.O.	1892
Lamb, Edmund G., M.A., Borden Wood, Liphook, Hants	1891
Lawson, Wilfrid H., Lindisfarne, Ryton	F.C.
Leach, C. C., Seghill Hall, Northumberland	1903
Leathart, T. H., Low Angerton, Hartburn, Morpeth	1904
Livens, W. M., Ellison Place	1918
Leighton, Miss M., 39, Waverley Avenue, Monkseaton	1916
Lisle, George, Bentham Buildings, Side	1906
Literary and Philosophical Society, Westgate Road	1916
Lockhart, H. B., Arcot Hall, Dudley	1918
Logan, Jas., 10, Eskdale Terrace	1912
Lord, Sir Riley, J.P., Highfield Hall, Gosforth	1887
Louis, Prof. Henry, M.A., D.Sc , A.R.S.M., 4, Osborne Terrace	1902
Lunn, Sir Geo., Moorfield, Gosforth	1912
Macarthy, Leonard, Benwell Park	1918
Maling, E. A., J.P., Blackwell Hall, Darlington	F.C.
Maling, John Ford, 25, Eslington Terrace	1903
Manson, Jas. McD., Hillcroft North, Low Fell	1910
Marshall, Frank, Claremont House	1887
Martin, Dr. W., West Villa, Akenside Terrace	1914
May, A. H., 15, Athole Gardens, Kelvinside, Glasgow	1917
McLean, John S., Rannoch Lodge, Lindisfarne Road	1917
Meek, Prof. Alex., M.Sc., F.Z.S., F.L.S., Armstrong College *(V.-P.)*	1895
Meikle, Jas. Ed., Beauclere, Riding Mill-on-Tyne	1907
Mein, M. M., 49, Percy Gardens, Tynemouth	1902
Mein, N., Beechwood, Clayton Road	1917
Menzies, Prof., J. A., M.A., M.D., 3, Fenwick Terrace	1915
Merz, Chas. H., The Ems, Gosforth	1910
Middleton, Sir Arthur E., Bart., J.P. *(V.-P.)*, Belsay Castle, Northumberland	1884
Middleton, H. N., J.P. *(V.-P.)*, Lowood, Melrose (N.B.)	1884
Milburn, Sir Leonard, Bart., Guyzance, Acklington	1918
Mitcalfe, J. Stanley, 60, Percy Park, Tynemouth	F.C.
Mitchell, Mrs. E. H., Jesmond Towers	1904
Mountain, W. C., 8 Sydenham Terrace	1918

	Elected.
Morris, F. W., Wantage, Beltingham, Bardon Mill-on-Tyne	1915
Napier-Clavering, Col. C. W., *(V.-P.)*, Axwell Park	1908
Newall, F. S., J.P., Castle Hill, Wylam-on-Tyne	1896
Newcastle, Lord Bishop of *(V.-P.)*, Benwell Tower	1908
Newbigin, E. R., 4, Tankerville Terrace	1916
Newton, Edward, Thirston House, Felton	1889
Nicholson, Geo., 26, Lancaster Street	1917
Nisbet, E. T., Birnie Knowes, Cullercoats	1918
Noble, Lady, Jesmond Dene House	1911
Noble, Miss, Jesmond Dene House	1887
Noble, Major Sir Geo. J. W., Hornton Lodge, Camden Hill, London, W. 8.	1877
Noble, S. W. A., Kent House, Knightsbridge, London, W.	1887
Noble, J. H. B., Ardkinglas, Inverary	1904
Noble, Philip E., Manor House, Whalton, Morpeth	1903
Northbourne, The Right Hon. Lord, Betteshanger, Dover	
Northumberland, His Grace the Duke of, *(V.-P.)*, Alnwick Castle	
Oliver, Arthur Moule, Thorney Close, Fenham Hall Drive	1910
Oliver, Prof. Sir Thos., M.D., F.R.C.P., Ellison Place	1889
Ormond, John G., Bywell, Stocksfield	1909
Park, A. B., Holly Lodge, Gosforth	F.C.
Parmeter, Percy, The Union Club	1919
Parrington, M. W., Hill House, Monkwearmouth	1915
Parsons, Hon. C. A., J.P., F.R.S., M. Inst. C.E., Holeyn Hall, Wylam-on-Tyne, (and 6, Windsor Terrace)	1903
Pattinson, Hugh Lee, 13, Mosley Street	1892
Pease, Howard, J.P., Otterburn Tower, Northumberland	1905
Pease, J. Beaumont, J.P., Pendower, Benwell	1903
Pease, Mrs., Pendower, Benwell	1905
Peile, Henry, Duke's House, Hexham	1910
Peverley, R. B., Bellear, Stocksfield	F.C.
Philipps, Mrs. Bertram, 34, Hyde Park Gardens, London, W. 2	1904
Pickering, H., 13, South Parade, Whitley Bay	1919
Potter, Prof. M. C., M.A., Sc.D. *(V.-P.)*, Armstrong College	1889
Potts, Edward, Whitburn Road, Cleadon, Sunderland	F.C.
Priestman, Francis, Shotley Park, Shotley Bridge	1910
Proctor, J H., Ravenswood, Westgate Road	1910
Pumphrey, Mrs. T., Summerhill Grove	1912
Pumphrey, Bernard, 115, Osborne Road	1902
Pumphrey, Joseph, Hindley Hall, Stocksfield	1911

	ELECTED.
Punshon, Mrs., Ingleby House, Northallerton	1906
Pybus, Major F. C., F.R.C.S., Windsor House, Jesmond Road	1913
Pybus, W. Mark, Milburn House, Dean Street	1884
Ramsay, N. F., 131, Osborne Road	1912
Ravensworth, The Right Hon. Lord *(V.-P.)*, Ravensworth Castle, Co. Durham	1904
Reed, Col. Joseph, Horton Grange, Dudley	1916
Reed, Thomas, C.A., 1, High West Street, Gateshead	1917
Reid, Sidney, 26, Claremont Place	1911
Renwick, George, J.P., Springhill, Morpeth	1902
Rich, F. W., 6, Jesmond Gardens	1886
Richardson, Edmund R., Monkton Lodge, Jarrow	1911
Richardson, Frank, Clifton Cottage, Clifton Road	1911
Richardson, George B., M.A., Lindum, Jesmond Park	1903
Richardson, Miss Laura, Sandysike, near Brampton	1911
Richardson, J. Alaric *(Hon. Secretary)*, Anster, Grainger Park Road	1897
Richardson, John H., J.P., Kensington Terrace	1881
Richardson, Lawrence, Stoneham, Beechgrove Road	1903
Richardson, R. Morris, The Union Club	1918
Richardson, Miss S. A., Ashfield House, Elswick Road	1881
Richardson, W. G., M.D., 10, Claremont Place	1903
Ridley, C. A., 6, Ellison Place	1915
Ridley, Viscountess, Blagdon, Cramlington, Northumberland	1917
Ritson, U. A., J.P., Jesmond Gardens	1887
Ritson, W. H., J.P., Springwell Hall, Durham	1902
Robson, C. E. *(Hon. Secretary)*, Priorsdale, Clayton Road	1903
Robson, John S., Sunnilaw, Claremont Gardens	1887
Robson, Jos. T., Beetholme, Osborne Gardens, Monkseaton	1917
Robson, Mrs. M. A., 6, Collingwood Terrace	1905
Robson, Robt., 13, Framlington Place	1884
Rodgers, Major R. M., 21, Oaklands, Gosforth	1908
Rogerson, John E., J.P., Mount Oswald, Durham	1880
Rollin, Charles, Bilton Hall, East Jarrow	1917
Ross, Charles, Fairfield, Westoe, South Shields	1915
Runciman, Rt. Hon. Walter, M.P., Doxford Hall, Chathill	1912
Ryott, W. H., 8, Windsor Terrace	1884
Sanderson, Thos., Woodhill, Ponteland	1913
Sanderson, W. J., J.P., Eastfield, Warkworth	1889
Scott, Ernest, 5, Colbeck Terrace, Tynemouth	1901

	Elected.
Sharp-Naters, John G., Stelling Hall, Stocksfield-on-Tyne	1883
Sharp, Wm., Blythswood South, Osborne Road	1883
Simpson, J. B., J.P., Bradley Hall, Wylam-on-Tyne	1903
Simpson, Thos., The Crofts, Hepscott, Morpeth	1888
Simpson, Benjamin F., The Cottage, Bucklebury, Berkshire	1919
Sisson, George, West Oakwood, Westgate Road,	1899
Sisson, J. Arnott, 4, Fenham Terrace	1902
Smart, G. S., Corchester, Corbridge-on-Tyne	1902
Smith, Clarence D., Lough Brow, Hexham	1909
Smith, John, 128, Rye Hill	1908
Smith, Lancelot, Piper Close, Corbridge-on-Tyne	1909
Smith, Mrs., Hencotes House, Hexham	1907
Smythe, Dr. J. A , 10, Queen's Gardens, Benton	1913
Spain, Col. Geo. R. B., C.M.G., 7, Tankerville Place	1907
Spence, R. F., Backworth	F.C.
Spence, Philip, Mellbreak, Elmfield Park, Gosforth	1912
Spencer, Ralph, Netherwitton Hall, Morpeth	1911
Squance, H. S , South Hill The Cedars, Sunderland	1917
Stephens, Rev. T., Horsley Vicarage, Otterburn	F.C.
Stephenson, W. E., Throckley House, Newburn	1918
Storey, Samuel, J.P., Southill	F.C.
Strachen, R. A., 16, Ivy Road, Gosforth	F.C.
Straker, F., J.P., Angerton Hall, Morpeth	1888
Straker, John C., J.P., The Leazes, Hexham	1903
Straker, Jos. H., Howden Dene, Corbridge	1885
Straker, Chas. E., High Warden, Hexham	1912
Sutherland, A. Munro, Thurso House, Fernwood Road	1904
Sutherland, James, Summerhill, Alnwick	1884
Swan, C. V., Singleton House, Jesmond	1909
Swan, E. W., The Pele Tower, Corbridge	1912
Swan, Mrs. A. S., Daneswood, North Avenue, Gosforth	1913
Swanston, William, 7, Sydenham Terrace	1902
Talbot, John, M.A., B.Sc., 10, Eslington Terrace	1912
Taylor, Thomas, J.P., Chipchase Castle, Wark-on-Tyne	1903
Temperley, Henry, 1, Fenham Terrace	1909
Temperley, W. A., 1, Osborne Avenue	1904
Temperley, Nicholas, J.P., 4, Carlton Terrace, Low Fell	1914
Thompson, Miss Jessica, The Cottage, Whickham	1889
Thompson, J. W., Holywell Grange, Shiremoor	1917
Thompson, T. W., 117, Pilgrim Street	1906
Thompson, R. J., 38, Eldon Street	1913

	Elected.
Thomson, Miss M. H., 22, Wentworth Place	1906
Thomson, James, M.A., 22, Wentworth Place	1911
Trevelyan, F. B. T., 11, Windsor Crescent	1908
Turner, G. Grey, The Hawthorns, Osborne Road	1919
Turner, G.B., 74, Warrington Road	1909
Turner, W. Leonard, Heatherlea, Stocksfield	1914
Vaughan, W. S., The Poplars, Gosforth	1918
Waddilove, Geo. H., J.P., Brunton, Hexham	1904
Waggot, Jas. B., 19, Percy Park Road, Tynemouth	1911
Wallace, Thos., 42, Mosley Street	1912
Wallace, H. S., F.E.S., 6, Kayll Road Villas, Sunderland	1913
Walker, John D., J.P. *(V.-P.)*, 21, Pilgrim Street	1888
Walther, P., International Comp. Co., Ltd., Factory Union, Union Co., New Jersey	1906
Walther, W., Eastfield House, 15, Granville Road	1912
Ward, Percy F., 27, Mosley Street	1907
Ward, Miss I. V., 44, Jesmond Road	1915
Watson, Henry B., Felton Park, Acklington	1918
Watson-Armstrong, Hon. W., Cragside, Rothbury	1912
Watts, Rev. Arthur, F.G.S., The Rectory, Witton Gilbert	1903
Watts, John, Wingrove, Clayton Road	1917
Watts, Frank R., Wingrove, Clayton Road	1918
Welch, Geo., 4, Devonshire Terrace	1912
White, Mrs. W. H., Knaresdale, Slaggyford	F.C.
Wilson, Henry B., 11, Osborne Avenue	1907
Wilson, W. N. C., National Provincial Bank	1918
Wilson, John, 12, Pilgrim Street	1887
Wilson, J. R. R., M. Inst. C. E., F.G.S., 4 Park Terrace	1918
Wilson Cuthbert B., 49, Grey Street	1908
Winstanley, R. H., 18, Oaklands, Gosforth	1917
Wise, Frederick, Heddon Hall, Wylam	1914
Wood, J., J.P., Coxhoe Hall, Coxhoe, Durham	1903
Wood, James Scott, 90, Falmouth Road, Heaton	F.C.
Wood, Sir Lindsay, Bart. *(V.-P.)*, The Hermitage, Chester-le-Street	1875
Woodcock, Alfred, M.Sc., 23, Lesbury Road, Heaton	1907
Woods, Jas. E., J.P., Swarland Park, Felton	1896
Woolacott, D., D.Sc., 3, The Oaks West, Sunderland	F.C.
Wright, Jos., 7, St. Mary's Place	1911
Young, W. H., F.Z.S., F.L.S., 10, Marden Road, Whitley Bay	1901
Zöllner, Louis, 6, Osborne Terrace	1904

HONORARY MEMBERS.

Brady, Prof. G. S., M.D., LL.D., D.Sc., F.R.S. *(V.-P.)* ...	... Park Hurst, Endcliffe, Sheffield.
Baker, J. G., F.L.S., F.R.S. ...	.. Kew Gardens, London.
Bidwell, Edward, M.B.O.U. ...	... 1, Trigg Lane, London.
Garwood, Prof. E. J., M.A., F.G.S....	University College, London.
Jackson, A. Randell, M.D., D.Sc.	... 67, Hoole Road, Chester.
Mennell, Henry T., F.L.S. ...	... Park Hill Rise, Croydon.
Perkins, V. R.	... Wotton-under-Edge, Gloucester.
Wright, Rev. R. Stewart, F.R.G.S, F.R.S.G.S.	... Haydon Bridge.

ASSOCIATES.

Bulman, Thomas, 40, Wingrove Avenue	1907
Clague. Chas. Ernest, White House, High Heworth, Felling	1909
Clague, Wm. Douglas, ,, ,, ,, ,, ,,	1909
Edmunds, Miss Annie, The High School	1909
Egglishaw, Herbert, 6, Stanley Street, Houghton-le-Spring	1918
Harrison, J. W. H., D.Sc., The Avenue, Birtley	1915
Heslop, Miss Mary K., M.Sc., 20, Framlington Place	1907
Jeffrey, John, B.Sc., 59, Grove Street	1912
Main, Francis R., 25, Highbury	1919
Patterson, J. E., 2, East Avenue, Benton	1906
Peacock, A. D., M.Sc., F.E.S., Armstrong College	1911
Richardson, Wm., 35, Newlands Road, High West Jesmond	1914
Rosie, David, 224, Ellesmere Road	1898
Stephenson, J. W., 98, Biddlestone Road, Heaton	1907
Walsh, G. B., B.Sc., 166, Bede Burn Road, Jarrow	1918
Watson, Alastair S., 31 Osborne Road	1919

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