

TRANSACTIONS
OF THE
EDINBURGH FIELD NATURALISTS'
AND
MICROSCOPICAL SOCIETY

§. 61.

TRANSACTIONS
OF THE
EDINBURGH FIELD NATURALISTS'
AND
MICROSCOPICAL SOCIETY

INSTITUTED AS THE
EDINBURGH NATURALISTS' FIELD CLUB

VOL. II.
(SESSIONS 1886-91)



Printed for the Society by
WILLIAM BLACKWOOD AND SONS
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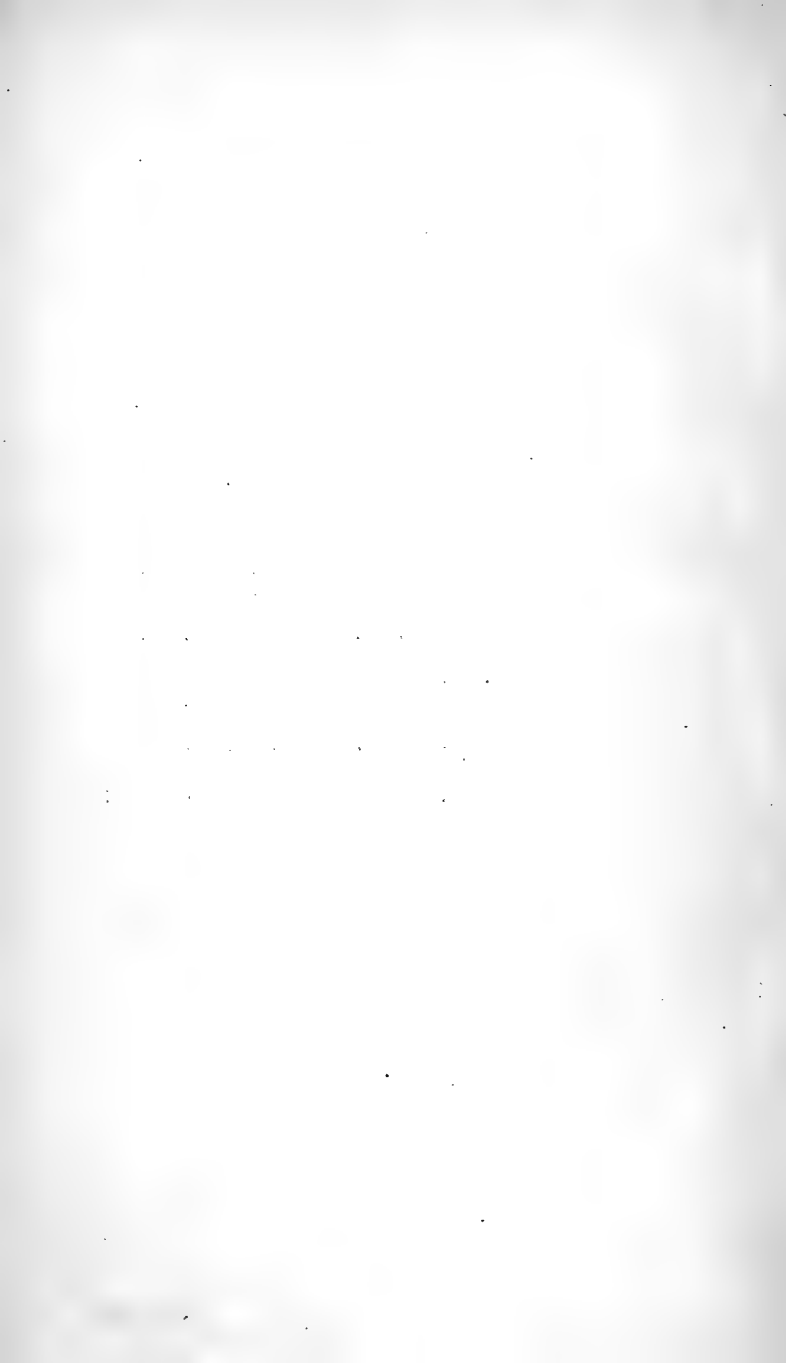
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OF

The Edinburgh Field Naturalists' and
Microscopical Society

SESSION 1886-87



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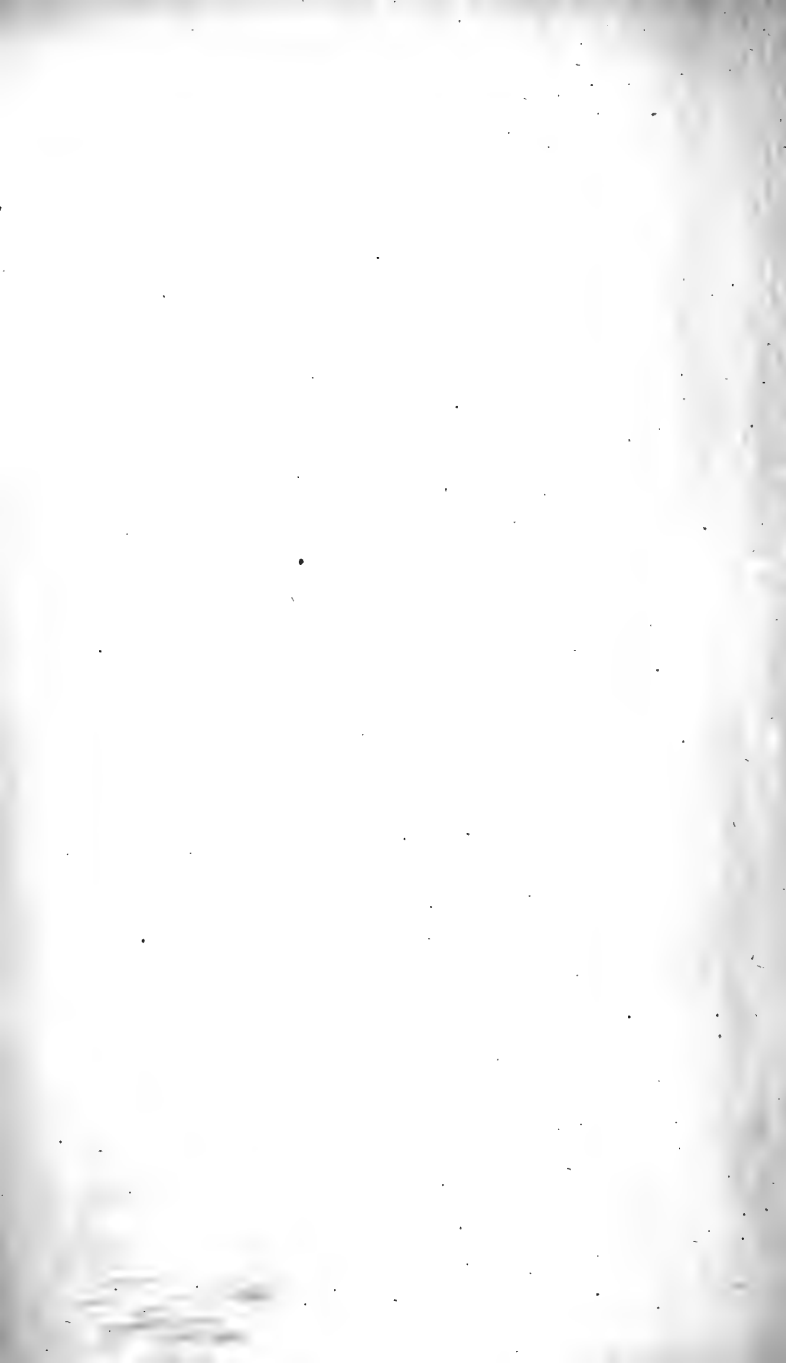
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MDCCCLXXXVII



TRANSACTIONS.

SESSION 1886-87.

I.—*OPENING ADDRESS.*

BY MR SYMINGTON GRIEVE, PRESIDENT.

(Read Nov. 24, 1886.)

ALLOW me to express my thanks for the honour you have been pleased to confer upon me by electing me as your President for another year. As you are aware, we have this year made some important alterations not only in the name but in the constitution of the Club, and we trust that these reforms may tend to make it more popular, and also supply the necessary funds to make its microscopic section increasingly successful. Instead of having fortnightly meetings for the reading of papers during the winter months, we are now to have a larger number of monthly meetings—these being continued till June. We trust this arrangement may prove advantageous in every way, as it is intended to introduce some variety into the meetings by having each evening not only papers on Natural History subjects, but also others on Microscopy, as well as demonstrations. At those meetings to be held after the field excursions begin, we hope to have the results of the observations of our members at those excursions brought before us in the form of contributions for our 'Transactions.' The Microscopic Section intend also to have regular evening

meetings in the room of the Society up-stairs. The Council hope that the great majority of our members will join this section, as if they do, they may hope to obtain much information that is invaluable to every naturalist.

When I had the honour to read to you last year my opening address, I had occasion to refer to the advantage that would accrue to our members if we had committees appointed to devote special attention to each of the following subjects—viz., Flora, Fauna, Geology, Archæology, and Microscopy. I am sorry to say we are still without any of these committees, except that for Microscopy. I hope the matter may not be lost sight of, as I feel sure the subjects above enumerated are not likely to get the full attention they deserve until we appoint some properly constituted authority to give them special attention, and at the same time direct the efforts of our younger members in whatever line of study they may desire to take up.

It is with great satisfaction that I see the printed 'Transactions' of the Society for last year now ready, as it completes our first volume, which records the labours of five years, and represents a large amount of creditable and useful work on the part of some of our members. I wish every one connected with our Society would give us contributions; and I can assure them that it will give us the greatest pleasure to print any special scientific information they may possess. I am sure you will all join with me in expressing thanks to our joint editors, Mr Andrew Moffat and Mr John Lindsay, for the able and careful way in which they have seen our publications through the press.

There is only one other matter to which I need refer before proceeding to the subject proper of my address, and that is the summer excursions of next year. We are all most anxious to make these interesting and successful; and with the object of attaining this end, a committee has been appointed to consider the matter, and make suggestions. If any members can give information regarding places not previously visited by the Society, or have any suggestions as to the way in which our field meetings may be made more useful and interesting, they might kindly write the Secretary, who will lay their suggestions before the committee.

A FEW SUGGESTIONS TO OUR YOUNGER MEMBERS ON HOW TO
EQUIP THEMSELVES FOR USEFUL BOTANICAL WORK IN
THE FIELD.

In addressing you to-night, I must claim your indulgence, as I am about to venture to offer our younger members a few suggestions on how to equip themselves for useful botanical work in the field. I have been led to make this attempt for several reasons—the principal of them being, that I fancy my remarks may perhaps induce some to undertake studies that may lead to investigations full of results; whereas if I confined myself simply to narrating the results of some investigations of my own, as I at one time intended, it would have been quite beyond my subject to narrate the studies undertaken before even a partial understanding of the things observed could be obtained. I cannot pretend to be a very capable teacher, but I may plead a little practical experience. I cannot treat the subject exhaustively, as time will not permit of my doing so, but I will endeavour to throw out a few hints, and illustrate my subject by the experiences of others as well as myself.

In the first place, let me say I have invariably found that one of the first questions young naturalists ask themselves when they join a Society such as ours, is—What subject should I take up so as to do useful work? Perhaps they feel a little shy, and do not care to push themselves forward until invited; but all the same, they are most anxious to become active workers, and nothing would give them more encouragement than to be taken in hand by some of our more experienced members. Can any of you doubt that if we had such committees as I have just told you of, they would prove most helpful to our new members, whether young or old, by indicating useful fields of research, and by associating them in more intimate relations with kindred spirits in our Society? But however valuable the friendship and association with brother naturalists may prove, all students of science will remember that they must have an independent equipment of their own, unless they court failure. Natural inclinations and abilities may go a long way, but having chosen a theme they must have it thoroughly mastered before they can expect to obtain information or results beyond what is already

known. I do not mean by this, that before they can hope to make some new discovery they must have a thorough knowledge of every branch of a great subject. If they have little leisure, they will find it possible, with an ordinary amount of general knowledge of a subject, to take up one branch of it, and excel in their knowledge of this branch in a way quite surprising to their fellow-men, and this without such great effort as may be supposed requisite. While in a general sense we may take it as an axiom that men with a university training are much more capable of undertaking original research than those who have not had similar advantages, or are only self-taught, still there are so many striking exceptions to this rule in every field of study, that one is almost led to doubt if such great advantages accrue from this special training after all, unless it is combined with an earnest determination to make life a success in some particular department of study or work. In far too many instances parents lavish great expense upon a training that is quite unsuitable for the development of the energies, mental or otherwise, of sons or daughters. Young people who have had a good education to begin with, would, in most instances, be much better to be encouraged in the particular line of study to which their inclinations point, instead of being forced to cram with knowledge of a kind they do not like or appreciate, only to suit the eager desires or ambitions of a parent.

Life is too short and too earnest with most of us, to warrant that even a single hour should be misspent. It is therefore necessary that each of us should form, as early as possible in our career, some definite ideas of what we are best adapted for, and direct our studies accordingly. Now, while what I have said applies to every course in life, to-night you must look upon yourselves as strictly Field Naturalists. May I ask you to try and apply what I have said to your daily life, whether in the field, or in your homes studying the results of your field work. For my own part, I believe that if a man makes up his mind to succeed in life, with God's help he will; but he must be patient, and have a strong and fixed determination. This, properly exercised, will carry him through every difficulty. He will be stepping out when other men are resting: once give him a start, and he will

keep it. Now I say this for the encouragement of every one who has the feeling that he can make no new discovery, and cannot even help us, as a Society, in our investigations. The sooner that all who have these feelings disabuse their minds of their supposed inability the better. In fact, until you try you cannot tell how great an amount of success you will attain, and I promise each of you that if you strive properly, you will surprise yourselves as well as others. My own experience is, that a man who studies any particular subject for a short time, soon knows much more about it than most of his fellow-men, and he will probably get credit from them of being a great deal wiser than he really is. Even that is something to aspire to, and should give us encouragement. Besides this, you will find that you cannot strive to improve yourself in one branch of study without imperceptibly gaining a large amount of general knowledge. Ask those who contribute papers to our own and other Societies, and they will tell you how much they have felt benefited by even reading up for the preparation of a short note.

“Whatever is worth doing, is worth doing well;” but it not unfrequently happens that in endeavouring to do well, the student of science strives to do too much, and when this occurs, it generally follows that the work done is unsatisfactory. It is well to be careful to avoid this mistake, as it is one into which I am convinced most of us fall, and we have not far to seek for examples of how earnest workers of previous generations have committed the same error. Let me give you a simple illustration of what may probably happen with some of you when collecting plants for your herbarium, unless you are careful. We will suppose you are having your holidays, and start for a botanical excursion that will occupy some days. As you wish to travel with as little *impedimenta* as possible, you take only absolute necessaries, and none of the appliances for drying your plants, in the hope that when you get home they will still be in a fit state for preservation. The first day is warm, but wet: however, you get on very well; your vasculum is half filled, and you think you can remember where you got each plant. By the end of the second day your vasculum is very full, and you rejoice over the specimens of rare plants you have met with. The third day you

start for home, collecting more plants on the way, and press down your plants in the vasculum to make room for fresh treasures you may never have an opportunity of collecting again. At night you get home so tired after your travels that you cannot think of starting to arrange and press your plants, so allow the vasculum to remain untouched until next morning, when you think you will have plenty of leisure, and feel more inclined to bestow time upon the careful arrangement of the foliage and flower of each plant. The morning arrives, and you turn out the contents of your vasculum before some interested friend. To your dismay, you find that you pressed the plants far too tightly into the tin box, crushing the flowers, leaves, and stems, and rendering them useless for specimens. When you come to your collections of the first day, which was wet, you discover that all the plants are mouldy, and most have to be thrown out. But what is even perhaps more vexatious, you find that, through having gone over so much ground during the three days you were from home, you have forgotten the exact locality where you got each plant. However, you think this of secondary importance, and it does not trouble you much so long as you can get the plants named. On further examination of your mutilated specimens a few days after your return, you find that some of them are quite unfamiliar to you, and that even with the aid of an illustrated Flora you cannot identify them. So you ask some botanical authority to help you with their identification. Having got the promise of his assistance, you send him a plant of each variety collected. He has no sooner looked over the specimens than he notices one to be a plant of the greatest rarity in Britain, and never previously recorded from the locality you have visited. He at once communicates with you, congratulating you on your find, and asking for full particulars, with, if possible, one or two specimens. To your dismay you discover that, beyond telling him where you visited, you cannot state any particular locality, and have only the one specimen which he has identified. I need not try to picture to you the sorrow and regret that fill the young botanist's heart, all through endeavouring to do too much in a limited time.

Permit me to remind you that when a rare plant is found, the knowledge of its discovery should not remain concealed

from the scientific world. The discovery should at once be made known through the recognised mediums of publicity; but how much of its value is taken away when the precise locality, surroundings, and soil in which the plant grew are unknown even to the collector himself? I am not one of those who believe in publishing the precise spots on which rare plants grow, as it has too often led to their eradication. However, it can do no harm to name the mountain or glen where the rarity is to be found, as it will place on record the locality, and prevent future botanists, if they come across the station, claiming a record. Beyond this, a very accurate note of the spot where the plant grew should be preserved in the herbarium in which the specimen is placed. It is extraordinary how much doubt has been thrown upon the work of some botanists through their want of keeping a proper record of stations. Perhaps no man suffered more in his reputation at one time from this than the greatest of our Scotch field botanists, George Don. He was a man that each of us may well aspire to take as an example in his zeal to add to the existing knowledge of the Scottish flora. His solitary wanderings among our Highland mountains for weeks at a time may well astonish us — at night generally making some mossy hollow his bed and a stone his pillow, with no roof over him except the arch of heaven. But even with all his enthusiasm and devotion to science, George Don sometimes did too much. Long after his death acrimonious disputes took place among botanists regarding Don's work, as there were numbers of plants which he alone had recorded in Scotland, and for which he gave either vague localities or none at all. As time rolled on and Scotch stations for these plants were not found, the botanists of fifty or sixty years ago began naturally enough to cast doubts on the reality of Don's work. Some even hinted that he had got specimens of certain plants from abroad and noted them as Scotch; while others, who thoroughly believed and trusted him, did their best to defend his memory. The war of differing opinions was waged for years, and was carried on till recent times. However, one by one the plants noted and recorded by him have been rediscovered where he found them about ninety years ago, and now we hold his memory sacred as that of a noble and honest man. It was only last

year that Mr Brebner of Dundee, along with the President of our Microscopic Section, Dr J. M. Macfarlane, and Mr P. Neill Fraser, Treasurer of the Botanical Society, rediscovered on Ben Heasgarnich, *Carex ustulata* *Wahl.*, one of Don's long-lost plants. It had been deleted from the list of the British flora, as it appears in the second edition of 'Topographical Botany.' But how came all this doubt regarding the great botanist's work? Such a question is easily answered. He lived at a time when the methods of conducting scientific studies were less accurate than they are now; and when he went on his long excursions, he did not think it of such importance as we do at present to note localities with particular care. He therefore appears to have made his collections from day to day without keeping each day's work separate, with the result that when he got home, and in arranging his specimens came across some rare plant that was new to him, he sometimes could only tell the name of the district which he had brought it from, but not the exact spot at which it had been found. If he knew, as some suppose, the exact places where such plants grew, it is at least remarkable that he did not keep some record of these stations.

I have said sufficient about trying to do too much, so let me now direct your thoughts for a moment to what I may define as doing too little. It frequently happens that field botanists quite forget what should be their aim in conducting their researches. It is not merely to make collections for their herbariums, or only to search for rare plants. If this were all that had to be done, it would take away half the charm of field work. No; the botanist must note everything botanical, and take time to do so too. I can never forget the earnestness with which the late Rev. W. W. Newbould repeatedly enforced upon me the feeling that seemed to be the message of his life to botanists, and a great topographical botanist he was himself. He used to say, "Never mind rarities, and tell all your botanical friends the same. Note all plants, and the conditions under which they grow, and you will be sure to come across the rare ones." He also told me that in his long experience he always found that those who made the greatest discoveries, and were the best field botanists, were those that did not forget to look for common plants. I feel sure the Rev. Mr Newbould was right, and would advise every young

botanist to keep in mind that common plants, owing to their wider distribution, are much more useful to the topographical botanist to draw inferences from than rare plants that are found sparsely scattered over isolated areas widely separated from each other.

Of the older field botanists who worked in Scotland, perhaps no one, according to the standard of his time, was more accurate in his observations than Dr John Lightfoot, author of the 'Flora Scotica,' published in 1777. He sometimes visited a locality and noted very few plants, but he made a record of those that were common as well as rare. He had the faculty of taking in, as it were, at a glance, what were the most striking botanical features of a locality, and recorded them. I have more than once had most surprising instances of his faculty of coming across uncommon forms that would have been overlooked by most botanists, had they been such a short time as he was at some of the places he visited. The season I began to record the flora of the island of Colonsay I found *Orchis pyramidalis*, and when I returned home was told that it was the first record of that plant in the west of Scotland. One day I was looking over the 'Flora Scotica,' when I observed, to my surprise, that Dr Lightfoot had found the plant growing more than a hundred years before at or near the same place where I had rediscovered it. Later I found another station for the same plant on the island of Oronsay; and I believe that these are, up to the present time, the only two stations known for *Orchis pyramidalis* in the extreme west of Scotland. At both stations the plant grows on sandy soil in the midst of a rabbit-warren, and these animals seem to have a great liking for the succulent leaves and stem of the orchis, which they generally eat down close to the ground, so that it is easily overlooked. Two years ago I had further evidence, at the island of Rum, of the persistence of plants at stations where undisturbed, and also additional proof of the accuracy of Lightfoot's work. With the aid of the information given in the 'Flora Scotica' and the routes mentioned by Pennant ('Voyages and Travels,' vol. iii. pp. 312-315), I was able to go over most of the ground visited by Lightfoot. As I came upon the plants where he noted them, one after another, I gazed upon the descendants of the flora of 1772 with most peculiar feelings. Perhaps no botanist

had visited these places and looked upon the wild-flowers I found, or their predecessors, for more than a century. Yet they had flowered on year after year, unknown and neglected, and it almost seemed as if they had been growing on through all the decades of a hundred and twelve years for me alone. I cannot express to you how overwhelming was to my mind the feeling that the Creator of all things had preserved such beautiful forms to flower far from the beaten track in the bleak wilds of Rum, for all these years unnoticed and forgotten, but in me once more to gladden a human heart.

But time will not permit me to go further into an investigation as to the merits of Dr Lightfoot, and I must endeavour to point out to you one or two fields in which, as botanists, you can work with success, and confer at the same time a benefit on science. I have no doubt you have all heard of the late Mr Hewett Cottrell Watson, the author of 'Topographical Botany.' He was a man of whom it may be said that in some respects he lived before his time, and I am afraid that some of his fellow botanists of fifty years ago were hardly able to appreciate his genius. It is to Mr Watson that we owe the present position of British Topographical Botany. It has been through his labours that such a correct record of the plants discovered in each district has been obtained. His researches revealed those parts of our country that were neglected, and set botanists to work to record the flora of these districts. The outcome has been, that willing workers have laboured steadily during recent years with splendid results. Still the work goes on with earnestness, and some of you might join in it. I had a large amount of correspondence with the late Mr Watson, and in one of his last letters to me he said that Wigton and Wester Ross-shire were the two districts in Scotland that needed most attention. Both districts have now been pretty well worked up, but that there is still work to do is evidenced by the new records for Wester Ross-shire obtained by the parties forming the camp of the Botanical Society this summer. Remember, common plants as well as rare, if discovered in a district for the first time, are records, and at times it is much more valuable to have the evidence obtained from observing common plants than from those that are seldom met with. In collecting plants, as far as possible take a

note of the climate, soil, and the elevation at which the plant grows.

There is another department of British Field Botany that is attracting much attention, and that is, its Scandinavian flora. I think it is to Mr Arthur Bennett of Croydon, Surrey, we are most indebted for drawing attention to this interesting feature, which is most likely to be studied with success at those parts of the British coast nearest to Scandinavia. We may therefore expect new discoveries to be made on the east and north-east of Scotland, and I trust some of our members may be fortunate enough to help on this work by obtaining new records for our metropolitan district. You are doubtless all aware that the flora of our country is not endemic, or peculiar to our insular position, but has been nearly all derived from the European continent. In a paper read before you in 1884, I had occasion to refer to the introduction of the Continental flora to these islands, but at that time I was not fully appreciative of the number of Scandinavian plants we have representatives of in Scotland. While it is principally in the north-eastern counties and the Orkney and Shetland islands that we may expect the best results, we may perhaps find plants that will surprise us much further south. This knowledge should inspire each botanist who has time and health with a new energy. Month after month new discoveries are being made that quite surprise us, as it is no new ground that is being gone over, but the old beaten tracks. Now it is Caithness, then Sutherland, and so on, until it seems doubtful what other well-known field is next to add new plants to our Scottish flora. I might continue this subject much further, but I feel I have said enough to let each of you see there is work for you to do, and that old Scotland is still a mine of botanical wealth. How this work can best be done, is well worth the consideration of every botanist. I wish we had a good herbarium in connection with our Society, so that members could always have a series of good type-specimens within their reach, and critical specimens could thus be determined with some certainty. It might be well to begin a collection as soon as possible; and if the gentlemen do the hardest part of the outdoor work, perhaps the ladies might assist by drying and mounting the plants on paper.

In conclusion, let me ask you to be enthusiastic. Equip

yourselves as best you can with advice and aid from your fellow botanists who wait to help you. In the field or in your study, be determined to succeed, and be sure you will.

II.—NOTES ON BIRD-LIFE.

BY MR ROBERT STEWART, S.S.C.

(*Read Nov. 24, 1886.*)

WHEN it was arranged that I was to observe and report on Bird-Life in the Royal Botanic Garden, I was in hopes that some interesting facts would be brought to light in this connection; but so far I have only been able to ascertain generally, that although the numbers of birds which frequent the Garden are considerable, still the varieties are comparatively few.

During the spring and early summer—and the season at that time promised well—I paid a good many visits to the Garden, thoroughly exploring every bush or shrub where a bird might build. Thrushes' and blackbirds' nests were abundant. It has often occurred to me to inquire why the nest of the thrush should be plastered inside, and the only reason I can think of is, that as this bird builds in the early spring, the cold winds are kept from the eggs and young by this mud interior. This appears probable, for the blackbird, which, next to the thrush, brings in the nesting season, also uses mud or decayed wood in the manufacture of its nest, only the layer in this case is in the centre and not in the inside of the nest, as with the thrush.

Next in order of numbers came the hedge-sparrow, and it was amazing the number of nests of this quiet and retiring bird that was this year in the Garden. These birds are always more plentiful than one would suppose, as they are given to frequenting the quietest corners, and appear quite content to spend the greater part of their existence in an uneventful popping out and in at the foot of hedges or among the shrubs. The hedge-sparrow's nest is usually easily found, as it is built for the most part in hedges while they are yet bare; and a well-built

and comfortable habitation it is, while the contents, in the shape of its complement of blue eggs, usually figure as the first contribution to all amateur collections. Of all birds, one would expect the hedge-sparrow to follow the beaten track, and not to introduce any questionable innovation; but this year there was to be seen in Warriston Cemetery a hedge-sparrow's nest built upon the ground, and covered to a certain extent by one of those "in memoriam" circular glass-shades which are placed at the head of graves, one end of which was propped up by wires at the back. In this same cemetery last year there flew past me and alighted close at hand a bird which, to all appearance, was a great titmouse or ox-eye, but of such a peculiar colour that I was fairly at a loss to name it. On watching it for a minute or two, it suddenly disappeared, and on examination I found it had gone into a hole in one of the iron pillars surrounding some private ground, where its nest was built, and that in the passage out and in it had got so impregnated with rust that, as the saying goes, "its own mother would not have known it." This year, in the Botanic Garden, the Curator, Mr Lindsay, showed me a nest of one of these birds inside an iron pump, where the birds had to go up the spout every time they wished to visit their young. The nest and contents were readily examined by lifting off the iron top; but the parent birds had so easily accustomed themselves to their being taken notice of, that at the time I paid them a visit the lady who was in charge disdained to desert her post, and "fuffed" defiance at the intruders. A most interesting paper could be written on the subject of birds' nests, dealing particularly with the curious freaks which possess almost all varieties at times to build in out-of-the-way and unnatural places. For instance, I found a blackbird's nest a short time ago in one of the nurseries on the top of a large stone which had fallen out of the dyke, in quite an exposed position, while all around were hedges and shrubs where one would imagine the most fastidious bird could find a place where she "safe her young ones forth might bring." I remember also a robin-redbreast which chose for itself so peculiar a nesting-place, that it was only when the young ones by their cries gave up the secret that we could find the nest. We were sure the nest was somewhere near the foot of some bushes at the bottom of a garden,

but the minutest search failed to discover it until at last, as we said, the young ones came to our assistance, and we found it in an old tin coffee-pot, which had been the most noticeable object during all our repeated searches.

To return, however, to the titmice, I find it noticed in almost all books on the subject that they disarrange the thatch of out-houses in quest of torpid insects. Gilbert White says: "The great titmouse, driven by stress of weather, much frequents houses; and in deep snows I have seen this bird, while it hung with its back downwards, to my no small delight and admiration, draw straws lengthwise from the eaves of thatched houses in order to pull out the flies that were concealed between them, and that in such numbers that they quite defaced the thatch and gave it a ragged appearance." Now, while I don't dispute that the titmice may do this in search of food, still it is the fact that they shelter themselves during the night in the holes they so make under the thatched eaves; and I have taken dozens of them in a night by going round the old-fashioned farm-offices and searching all such holes by thrusting the hand into them. To do this, one does not require to be of a nervous temperament, as the titmice are of a bold nature, and bite the hand in quite a savage manner when they feel themselves taken hold of. They make first-rate pets, and thrive well in captivity, provided they can be kept in the cage, but they have such a faculty for getting outside that it is a difficult matter to confine them. They delight greatly in nuts, and manage in a very clever way to scoop out the contents of a nut suspended in the air by a string from the top of the cage, grasping the nut with their feet in the process.

In addition to blackbirds, mavises, and hedge-sparrows, we found the nests of greenfinches, chaffinches, and robins: but it would be difficult to give any idea of the numbers of nests in the Garden, because very often one found that, since the previous visit, the eggs had been taken from a particular nest, while near at hand a pair of the same species, evidently the owners of the harried nest, were engaged in nidification. The Garden is not well suited for birds nesting, as the greater number of otherwise suitable trees or shrubs are of the ever-green species, and as a general rule birds, with perhaps the

exception of the very birds whose nests are most common—blackbirds and thrushes—do not care to build in these. I noticed, when visiting the Garden the other day, a sparrowhawk darting hither and thither in search of a victim; while earlier in the season, from the road adjoining Fettes College, we had a splendid opportunity of watching the kestrel at work. Nothing is prettier in its way than the sight of this hawk on the wing in search of a meal, as every short time it poises itself in the air, and is quite motionless—for all the world like a paper kite. I have seen also in the Warriston district the missel-thrush, the long-tailed tit, and the fallow-finch; while in Warriston Cemetery a pair of flycatchers regularly build. During the month of August last I was residing at Glendevon, near Rumbling Bridge, which is a perfect paradise for birds. There you get the sparrow fresh and clean-looking, and with nothing of the dragged and rakish air of his town brother. The golden-crested wren was there in great numbers; while we also saw upon more than one occasion the redstart. On the Devon, which, as most of you know, is an exceptionally clear stream, there were several families of the water-ousel, and we could see how they worked their way on the ground under water looking for grubs, &c. They were very tame—in fact, perhaps a little too much so, as it was annoying to have two or three of them come plump down into the pool you were fishing. It was very interesting to watch them at play. One would sit on a stone in the middle of the stream, dip, dip, dipping away at his companion who was up to the neck in the water at the side. Suddenly the latter would, with a brisk chirrup, make for his friend, who then plunged out of sight into the pool, closely followed by the other, when, after a minute or so, they both suddenly appeared a little further up the stream, shot up as it were from the bottom, and then bobbed about with all the seeming buoyancy of corks. That they walk on the bottom is not, I think, correct, as it must require some considerable force to enable them to breast the stream, at the same time keeping under water, as the mere ceasing of exertion appeared to have the effect of sending them to the top like an air-bubble. Occasionally the game was varied by the players keeping their heads alone above the water; and in this way they chased one another in and out of

the shallows until, a sudden thought striking them, away they flew to some other pool.

Here, too, at night owls were plentiful, and it was rather eerie to feel them flying past in the gloaming without seeing them. One missed such old friends as the bullfinch and siskin; but bird-fanciers seem to have almost exterminated these once very plentiful favourites. Some of you may have noticed a letter in the 'Scotsman' a month or so ago regarding a crow which came regularly to a gentleman's house for food. One day, while in the village of Muckhart, and standing at a shop-door speaking to the owner—a very old man—we were rather mystified by his calling out to the inmates, "There's the crow!" On looking across the road, we saw sitting on the dyke, and eyeing us curiously, a very patriarch of the crow species; and when my old friend, who, in answer to his summons, had been supplied with bread-crusts, threw a piece on the road, the veteran hopped down and leisurely consumed it. We learned that she came daily for her meals for years, and when the supply at any time exceeded the demand, the crow carefully collected all scraps and buried them at the bottom of the dyke for future consumpt. I was also informed that before the sacramental raid on the young crows, our friend put in an appearance with her family, and to the number of half a dozen would sit in a row on the dyke waiting to be fed. This coincides exactly with the facts narrated in the case I refer to, and proves, I think, that crows will be crows.

A point on which a good deal of curiosity is always expressed is as to the powers of the corn-crake as a ventriloquist, and how it is that it is so difficult to make this bird take wing, even with the assistance of a dog. I could ere now have supplied the needed information, as I have heard the matter solemnly discussed on many occasions at our meetings, and indeed have often been tempted to do so; but there was a reason for my silence, which, being in a confidential mood to-night, I will now explain. Know then, when you get a little accustomed to the sound, that you can pick out the exact spot in the field where the bird is; and if you have sharp eyes you will see, after every "craik," his head appearing to make sure that you are still where you ought to be. Should you make the least movement, down goes our friend's head, and no greyhound could cover the distance

from one end of the field to the other quicker than he can, so that when you get to the place where you thought you heard him, and where indeed he really was, you hear him uttering his peculiar cry at the other end of the field. Knowing this, when, as boys, there were a number of us together, and we heard the corn-crake in a field, we spread ourselves out in a line, a short distance being between each, and when we found we had our friend in the centre of the line, the signal was given, when away we went as fast as we could run across the field, and invariably succeeded in sighting him. But you may say, "Why did you not give this information before?" The reason is, that the corn-crake is indelibly associated with a certain episode in my life, where I certainly did not figure to advantage. It arose thus. Many years ago, it used to be the case that every Saturday afternoon saw a party of boys, as soon as school was over, make for the country, intent on scientific discoveries. But I am sorry to say that these researches were carried out utterly regardless of the sacred rights of property; and anything in the way of game which unfortunately fell into the hands of the expedition was ruthlessly confiscated. On one of these excursions, a corn-crake was heard to give tongue in a neighbouring field: the usual tactics were gone through; the bird was flushed, only to fall a victim to the unerring aim of the leader of the gang. The expedition speedily came to the conclusion that the bird was not good to eat, so a council of war was held as to how the body was to be disposed of. Finally, it was resolved on to try and dispose of it to the game-dealer in the village; and as a corn-crake was not a marketable commodity, it was thought, with the elastic conscience of youth, that we were in these circumstances entitled to represent it in the light of a partridge. The game-dealer, who was known in the place as "the laird," on account of his being a large holder of house property, in addition to dealing in game, dealt in confectionery, tallow, hides, and other miscellaneous articles, to which he added the duties of money-lender and bill-discounter. He was always in a chronic state of drunkenness, but notwithstanding this he seldom made bad debts, and usually had the best of a bargain. It was therefore a matter of moment who was to dispose of the game, but ultimately one of the party was fixed upon as being of good character, and a favourite with the laird. It was found, on in-

spection, that the gentleman was in fine form for being operated upon, seeing that he was lying in a helpless condition, with outspread arms, upon the counter. Enter first conspirator, followed by an admiring but select few as assistants. "Fine day, laird." One eye opens partially, but never a word spake he. "We thought you might like to buy a partridge," and the corn-crake is thrust invitingly before his view. The eye gradually closes, while a quiet humorous voice gently says, "Ou ay, Robbie, get awa' wi' your sparra."

III.—*POLYPORUS GIGANTEUS*, FR. (*GIANT SAP-BALL*).

EXHIBITED BY MR A. B. STEELE.

(*Nov. 24, 1886.*)

THE specimen exhibited was gathered from a splendid group growing in the policies of the Marquis of Lothian at Mount Teviot, near the entrance-gate at Penielheugh. The enormous size and beauty of the plants attracted the notice of the Marquis, who takes an interest in Natural History, and orders were issued that they were not to be removed. Application being made to his lordship personally for a specimen, permission was at once courteously granted. The specimen was unfortunately gathered during the wet weather in September last, and was not in a favourable condition to be permanently preserved. When fresh it weighed nearly 20 lb., and measured 2 feet across.

The species is not common. It grows in tufts on underground roots and stumps of trees. It is formed of imbricated, dimidiate pilei, covered with a rigid velvet pile, and springs from a common root. The surface is irregularly zoned, and the colour various. In the Mount Teviot group the colour varied from a pale yellow to a date-brown. The flesh, when torn longitudinally, comes away in white cotton-like fibres, terminating in tubes which are sometimes half an inch in depth. The spores are pale yellow, and may be seen lying on the ground under the ripe plant like a mass of gold-dust.

IV.—EXHIBITION OF A WHITE SPARROW.

BY THE SECRETARY.

(Read Dec. 22, 1886.)

THE sparrow now exhibited was sent me by Mr John Cruickshank, Aberdeen, that I might bring it under the notice of the Society. In his accompanying letter he says, "He has been in my possession since June 1878, eight years and a half. He fell out of a nest, and could neither eat nor fly. I fed him till he could do both, and let him out to fly away; but he did not do so, and was taken into the house again. I had several canaries, and he seemed to prefer their company to being free: indeed he was free enough, for he was allowed to fly about, but he never would leave the canaries. He ate nothing but canary-seed and anything the canaries got to eat. He was quite of the colours of a common sparrow till the first moulting of his feathers, which was in 1879, and they then came in as you see them, and have always come in the same year by year till the present, when he has not had strength to cast them, and death has been the result. I thought last year he would hardly have come through the casting; but he did, and got as lively as before. I attribute the white feathers to the domestication and the food he lived on. He was clean and tidy in all his ways, bathing every day like the canaries. In his earlier years he picked up some turns of their song, and performed very agreeably. He was gentle, even timid in his ways, and if any difference arose the canaries easily mastered him. If any thing or person that was strange appeared, he made for his cage at once; indeed he never lost sight of it, and when it was removed to be cleaned he invariably followed it: no open window presented any inducement to him to lose sight of it." The sparrow is not a very pure *albino*, being not nearly so white as some which are occasionally seen in the neighbourhood of Edinburgh, but is interesting from the fact of its changing the colour of its plumage after the first moult.

Mr A. Frazer, M.A., Secretary of the Microscopical Section, exhibited at this meeting the following pieces of apparatus, some of which had been forwarded to him for exhibition by Mr H. Crouch, of London:—

(1.) *Crouch's Large Premier Microscope of the Binocular Pattern.*—It was explained that this instrument did not differ in any marked manner from other large instruments of its class, and that it was exhibited chiefly for the purpose of enabling members to examine a large modern microscope of the best construction.

(2.) *Crouch's Photo-Micrographic Camera.*—This camera is similar to an ordinary photographic camera of small size, but is provided, at the part to which the lens is usually fixed, with a flange carrying a tube of the same dimension as an eye-piece tube. By this device the eye-piece can be withdrawn, and the camera put in its place, thus affording a ready means of preparing photo-micrographs.

(3.) *An Improved Tripod Knife-Carrier for Freezing and other Microtomes:* by A. Frazer.—This knife-carrier is so arranged that an ordinary razor occupies the place of the specially prepared knife in a Williams' microtome knife-carrier. It was explained that special knives are not, in many cases, readily to be procured, and are always more difficult to sharpen than an ordinary razor; hence the need of this new knife-holder. The method of holding the knife now adopted (that of grasping it by the handle end) avoids the inconvenience, sometimes found in the Williams' instrument, of the knife-clamp rubbing against the tissue at the time of cutting.

(4.) *Crouch's Petrologist's Microscope.*—It was explained that this instrument had been made at the suggestion of Prof. Geikie and others, and was intended to meet the wants of those desiring a good petrological microscope at a moderate price.

(5.) *The Syracuse Solid Watch-Glasses.*—These are glass dishes with a concavity similar to an ordinary watch-glass, but are made of glass about half an inch thick, so that they may not readily be overturned. The glasses are intended for staining sections and similar purposes.

V.—*APOCHROMATIC OBJECT-GLASSES.*

BY MR WM. FORGAN.

(Read Dec. 22, 1886.)

WHAT is an apochromatic object-glass, and in what respects is it better than an ordinary achromatic one? The term apochromatic means "free from colour." Now we have hitherto always regarded an achromatic lens as essentially possessing this property of freedom from colour. To enable one to understand the matter properly, it is necessary to begin with an illustration of what takes place when light is transmitted through and refracted by an ordinary convex lens. Light so refracted is bent or brought to a focus behind the lens at a point nearer to or farther away from it, depending upon the extent of its curvature. But from the fact that the separate rays of light have not all the same refractive power—those at the violet end of the spectrum having the greatest and those at the red end the least—the coloured rays into which the light is broken up by the lens do not form the focal point at one and the same distance, but each ray has a focus of its own, the consequence being that the focal point of the violet ray is nearest to the lens, and the focal point of the red ray farthest away. It may be readily seen from this that every ordinary lens has as many focal points as there are rays in the spectrum. When the principle of achromatism was discovered, it was found to be possible, by using glass of different densities, to combine two of these rays, and so render the images produced by such a lens what was termed achromatic—the two rays selected for combination being those which gave, by means of the glass, the whitest and purest image. In this case all the other colours were left necessarily out of view, and, so to speak, to shift for themselves. These outstanding or uncorrected rays are what is called the "secondary spectrum." The combination of the two primary rays by the lens rendered the others so little conspicuous, except in certain cases, that they had to be, and were, necessarily disregarded.

Another point in regard to this so-called achromatic combination, and a very important one, is this, that as every ray

has its own focal point, depending upon its refractive power, so each one must of necessity have a separate magnifying power with the same lens. This, it will be seen, introduces a very strong element of confusion in the image rendered by an achromatic lens of the very best construction. In the construction of an achromatic lens any two of the rays might be taken for combination. The lens might be, as many are, corrected for the red end, or give a very red image; or they might be corrected for the violet end, as is done in photographic lenses. But the point to be kept prominently in view is, that whatever two were taken, there could only two be taken, and the others left.

Now, taking that as the principle of construction of the ordinary achromatic lens, we shall see why so much has been done to get rid of the "secondary spectrum," and the effect it has always had in the deterioration of the image in the best constructed lenses. We have heard of it specially in the construction of object-glasses for telescopes, in the best of which it has usually made itself apparent, declining to be left out of view. The object in view in the construction of the new apochromatic lenses has been, to get rid of this secondary spectrum, and to combine at least four of the refracted rays, so as to produce a still further perfected image, and render the other outstanding and uncombined rays, termed the "tertiary spectrum," of little, or at least of much less, account in the formation of the image. This object has been sought to be attained by two means—*first*, by the formation of certain kinds of very dense glass containing other substances than lead, which has been used for density, in the construction of the object-glasses; and *second*, by the use of specially constructed eye-pieces to correct still further the effects inherent in the flint-glass. It is unnecessary here to detail the nature and kinds of glass used. These may be found in detail in the printed pamphlet issued by the makers of the glass. They have been able to construct glass having a density very much greater than that of the diamond. The makers of the new apochromatics have of course kept their methods of construction a secret, and we know nothing as to the formulæ upon which they are constructed, and can judge them only by the results they give us with known tests.

These results are certainly very wonderful, and the glasses deserve the highest praise. The images they give of these tests are undoubtedly clearer and brighter and freer from colour than other glasses of the same magnifying power, and their resolving power is consequently very much increased. The price put upon them, however, by the makers is so excessively high, that they may not become popular except with those who can afford the luxury of buying them. There are very few, if any, tests resolvable by them which cannot be as easily seen by means of a homogeneous oil-immersion. To see, however, the striæ upon *Amphipleura pellucida* by means of diffused daylight from a north window at 5 P.M. in the month of April with a Zeiss condenser, is certainly what no ordinary oil-immersion would readily do.

These notes have been written at the request of the editors of our 'Transactions,' although it is feared they may not be of much service to the members of the Society, none of whom may possess apochromatic lenses. The above short detail of the principles involved in their construction, and of defects in previous glasses to which we are indebted for apochromatic lenses, may, however, be interesting to those members of the Society who take a genuine pleasure in the microscope, and everything which tends to improve it.

VI.—*JOTTINGS ON A RAMBLE IN WESTER ROSS.*

BY MR JOHN ALLAN.

(Read Jan. 26, 1887.)

IN the end of July and beginning of August last, I had the pleasure of forming one of a party who, under the auspices of the Botanical Society of Edinburgh, passed a fortnight in investigating the flora of the parish of Applecross, more particularly of that part of it lying on the southern shore of Loch Torridon. Our headquarters were the schoolhouse in the small crofter and fishing hamlet of Arrin-a-chruinach. We met with but a moderate degree of success in our search for plants, not many rare ones being found. Our report on this head,

however, will be laid before the Botanical Society; and the object of this paper is mainly to give you a short account of the place, and of some of the incidents which came under our observation while in that locality.

We left Edinburgh about 5 o'clock on a July morning, travelling by the Highland railway to Inverness, and thence, by the Dingwall and Skye section, to Strathcarron station, where we arrived about 5 P.M. Having dined at Strathcarron Station Hotel, we drove to Shieldaig, a distance of twenty miles, where we found a sailing-boat waiting to take us to Arrin-achruinach, the last stage of our journey, and at a distance of nearly seven miles, where we arrived about 11 P.M.

The route as far as Inverness is too well known to need description. On leaving that place, the railway skirted the flat shores of the Moray Firth to Beaully, and thence through a fertile and well-cultivated country to Dingwall, a neat, well-to-do county town at the head of the Cromarty Firth. The town seemed to be well stocked with churches, judging from the number of steeples visible from the railway. The branch to Skye diverges here, and this was our route. We soon commenced a long ascent by the base of Ben Wyvis, which was some distance off on our right hand, obtaining a very fine view of the neat little watering-place of Strathpeffer, situated in a fine fertile strath about two miles to our left, and to which a branch railway was lately made. The picturesque old mansion of Castle Leod, a seat of the Duchess of Sutherland, who is the owner of Strathpeffer, lies between the town and the railway. Continuing our ascent, we got into the valley of the Blackwater, along which we went in a westerly direction through a chain of straths interspersed with lochs, the largest of which is Loch Luichart. We reached the summit about Achnasheen, where the road to Loch Maree diverges on our right. The country is here very bleak and bare, but the scenery improves as we reach Strathcarron station, which is at the head of the sea-loch of the same name. The post-office village of Janetown, through which we passed, is on the north-west shore of the loch, three miles distant; and after passing it we crossed over a high neck of land till we reached the head of Loch Kishorn, a branch of Loch Carron. After passing Courthill, a gentleman's seat at the head of the loch, the road to Applecross diverges,

and is seen winding up between high and precipitous hills to the Bialloch pass, a height of about 2000 feet, said to be the highest road in Scotland. The scenery now becomes very grand, and soon the colossal and almost perpendicular precipices of Beinn Bhan, 2936 feet high, tower up on our left. From this on to Shildaig the view of the surrounding mountains is as grand as can be obtained in any part of Scotland. The village of Shildaig stretches in a straggling way along the shore of Loch Shildaig, which is an arm of Loch Torridon, and divides the outer from the inner loch. There is a precipitous hill behind the village called Ben Shildaig, and an island in the loch immediately in front of it well clothed with fir-trees. On arriving at Shildaig, we found two of our party who had preceded us by a week; and we embarked in the sailing-boat by which they had come that evening from Arrin-a-chruinach. The wind being against us, we had to take many a tack to get round the peninsula of Ardheslaig, and it was quite dark before we reached Camas-an-eilein, the residence of Lord Middleton's gamekeeper, where we landed; and we had great difficulty in picking our way through the wood in the dark to Arrin-a-chruinach. The track was most uneven; and having our *impedimenta* to carry, we were very glad indeed to see the light which shone from the window of the schoolmaster's house, which was to be our home for the next fortnight.

The situation of Arrin-a-chruinach is rather pretty. The few houses, not more than a dozen, are situated almost in a row on the western bank of a small stream which takes its rise in Loch-na-Creige, a fresh-water loch about half a mile distant, and flows into Loch Torridon at the top of a small sheltered bay. Behind the houses is a desolate track of moorland stretching away to the Atlantic, a distance of three or four miles, while to the front rises a high rocky ridge clothed with wood, chiefly birch and hazel. The view from the village across the loch to Ben Alligin and the high picturesque range of hills bordering upper Loch Torridon, was very grand. There are no roads in the district, but only tracks, which are barely distinguishable in many parts. This desolate moorland consists chiefly of mosses, with occasional low hills and many inland lochs, both large and small. From some of the heights fine views are got of the Atlantic, with the island of Rona in

the foreground and the island of Skye beyond, showing a high and picturesque outline, and on clear days the island of Lewis is distinctly seen. The cattle and sheep of the crofters pasture in common on this moorland, while they have small patches of corn and potatoes on land reclaimed by their own exertions in the more sheltered places in the vicinity of their houses. These houses are mostly very small, built of rough unhewn stones gathered from the adjacent shore, and thatched with heather, but can be made very comfortable within. The accommodation for their cows is of a still more primitive description. They each possess two or three cows, with followers, and a few sheep. There are no horses about the district, and indeed they could not be used for want of roads. The cows are of the small, shaggy, Highland breed, and their milk is very rich. The crofters dig their crofts with an implement called a *caschrom*, which has more the appearance of a tool used by drainers to clear and level the bottom of their drains than of a spade. It consists of a piece of wood about $1\frac{1}{2}$ foot long and 4 inches broad, shod with iron at one end, and having a handle at the other end projecting at an angle, and about 4 or 5 feet long. It is shoved into the ground with the aid of the foot, and pushed along, the furrow being turned over as it goes by regularly canting the handle to one side. It goes over the ground a great deal quicker than a spade, but to my mind not nearly so good a job is made, as the furrows it makes are very shallow. The land is manured with sea-weed. It is quite evident that these primitive modes of cultivation can never yield anything but poor and barren results in such a region as this. And when the scanty harvest of both sea and land fails, the condition of the poor inhabitants must be sad indeed.

The crofters themselves seem decent, honest, and industrious, and I do not think the characteristics recently manifested by the crofters on the opposite coast of Skye belong to them. They are mostly engaged in fishing in the summer season, but their fishing last season was not successful. They have small fishing-yawls of two or three tons burden, which carry a crew of from three to five. They are generally part owners of a boat, and the earnings are divided among the crew. They are a very religious people, and very strict in their observance of the Sabbath, going frequently long distances to church. They are

almost to a man Free Churchmen, the local F.C. minister exercising a very great influence over them. The whole population, especially the young women and children, have very sallow complexions, caused, I suppose, by a want of iron in the blood, their diet being too exclusively fish, without the addition of butcher's-meat. Exposure to the weather gradually causes this sallow hue to disappear. The Gaelic language is universally spoken, the bulk of the women and the older men being unable to speak English: the children are taught only English at school, but use the Gaelic almost exclusively as soon as they are outside the school. They go about without any head-covering, and are very scantily clothed, the boys' dress consisting generally only of a shirt, jacket, and short ragged kilt. Those children we conversed with were very intelligent, and their manners were very much superior to those of the children of a corresponding age and class in the Lowlands. One very pleasing feature of their character was their non-molestation of the birds; and I was much struck with the utter want of fear in many of the smaller birds, such as the yellow-hammer, which hopped about almost among our feet.

The inland lochs, before referred to, are nearly all full of trout, and in most of them the white water-lily (*Nymphaea alba*) grows in great beauty and profusion. *Lobelia Dortmannii* is another plant found very plentifully in them; while round their banks *Drosera anglica* and *D. rotundifolia* grow in great luxuriance. On a warm sunny day large numbers of dragonflies skim along their surface. In the small streams issuing from these lochs *Chara* and *Myriophyllum* grow plentifully; while *Batrachospermum* and fresh-water sponges are less commonly found. In the wood, before referred to, in front of the village, we found *Hymenophyllum unilaterale* growing plentifully on the northern sides of large stones and on the trunks of decayed trees. Mosses and lichens were plentiful everywhere. I searched in Loch-na-Creige one afternoon for diatoms, and on going over them carefully after getting back to town, I found I had collected specimens of the following: *Tabellaria*, *Epithemia*, *Nitzschia*, *Navicula*, *Cocconema*, and *Gomphonema*. I also found a good many Desmids, chiefly forms of *Closterium* and *Cosmarium*.

There was a small island, just beyond the corner of the bay,

called Eilan Mor, which we often visited, and which was the resort of large numbers of gulls and terns. They built their nests among the heather on the top of the island—or, more strictly speaking, they laid their eggs there, for their nests hardly deserved the name. We found nests with eggs, two or more in each, in all stages of development, the young chick being occasionally seen with only its bill protruding, and busy picking a hole large enough for its emergence. Young gulls unable to fly were sitting about on projecting rocks: our approach always caused a great commotion among them, and much screaming. Cormorants, puffins, and oyster-catchers were seen in smaller numbers, but they did not frequent or breed on the island. The cormorants seemed to have their home on a small rocky islet close by Ardheslaig Point, which is known as the Cormorant Island. The crowberry was plentiful among the heather on the top of the island, and the fruit, which was quite ripe, was in great plenty. There was abundance of crowberry on the mainland also, but no fruit. I suppose these had been plucked by the grouse, while on the island there was nothing but sea-birds, and they apparently did not take the berries. I picked up the cast skin of an adder, which shows they frequent the island, but I saw none.

The shores are very rocky, and there are numerous caves. We penetrated one at Fearnimore to the distance of 140 yards, by the aid of candles. It divided into two at that distance, one part ending in a round chamber of considerable height, and the other, after rising considerably, was closed by a pool of water. The cave-moss (*Eurhynchium pumilum*) grew here for some distance inwards, depending from the roof and sides. There was another cave between Arrin-a-chruinach and Eilan Mor, where, when approaching it, I was struck with a singular projection of the rock from one of the sides in the shape of the profile of a man's head with a pipe in the mouth. We found a few plants of lovage (*Ligusticum scoticum*) on the rocks over this cave, while on the roof inside the sea-spleenwort (*Asplenium marinum*) grew in tufts. These caves must be very convenient for the operations of the illicit distiller, who still carries on his operations in the Alligin district, on the opposite shore of Loch Torridon. The Excise have made several seizures in this

neighbourhood lately; and that the natives appear to live in constant wholesome dread of these "gentry" is pretty evident, for we were at once taken for Revenue officers when we visited that district one day. We crossed over to Diabaig, which is a most picturesquely situated crofter village in a small bay, surrounded by high, rugged, and almost perpendicular rocks. A burn comes down a tremendous fissure in the rocks behind the village, and at the lower bottom of this gorge the royal fern grows in large patches, and in splendid condition. We dug up several specimens, and then commenced the steep ascent of the gorge. A small cottage was perched a short distance up, and on our approach to it a comely middle-aged woman, the mistress of the house, came out with a tumblerful of milk for each of us. This we received very thankfully, as we were hot and tired climbing up the steep ascent after our exertions in digging up the ferns, and we were much pleased with the kindness she showed us, total strangers as we were. On reaching the top of the ravine we found the burn to issue from a large loch lying between us and Ben Alligin, which was about three miles distant. We were anxious to ascend this mountain, which is the highest in that neighbourhood, being over 3000 feet, but were unfortunately prevented.

We observed enormous numbers of jelly-fish in the sea, chiefly between Eilan Mor and Arrin-a-chruinach Bay. They were of various kinds and sizes, and were sometimes so numerous, especially in the evenings, when they seemed to rise to the surface of the water, that it was impossible to row without bringing the oars in contact with them. We were careful not to handle any of them, on account of their stinging propensities. The fishermen told us they often got their hands badly pricked while taking the long threads off their hooks. We used to go out in the evenings to fish for lythe, which seemed to be the most plentiful fish in the loch, and sometimes we were very successful. We caught them with an artificial bait, made of india-rubber, resembling a lob-worm of two colours, red and white; and it is curious to note that some evenings the fish indicated a decided liking for the red, seizing it only, while on other evenings it was the white that had the preference. We also found many large and fine specimens of *Echinus sphaera* adhering to the rocks at low water. A very beautiful zoophyte, *Coryne pusilla*, and a *Botryllus*, were also found.

Red-deer were very plentiful in Lord Middleton's forest in the neighbourhood. On one occasion, while two of our number ascended Beinn Bhan, they saw a herd of over 200 at one time. We noticed few wild animals, but Mr M'Rae, Lord Middleton's gamekeeper, informed us that he occasionally trapped wild cats, large and splendid specimens, and that he sent the skins to Inverness, where he got five shillings each for them.

Though we met with nothing very rare, as I have already said, in our rambles, still we enjoyed a most delightful holiday trip, not altogether without profit, amid the wild and picturesque scenery of this Ross-shire village, overlooking the Western Isles; while, last but not least, we laid up a store of health and had our energies renewed for the labours of the winter.

VII.—*ORMISTON HALL: ITS YEW-TREE AND
OTHER ANTIQUITIES.*

BY MR JOHN LINDSAY.

(*Read Jan. 26, 1887.*)

A VISITOR to the quiet little village of Ormiston is at once struck by its peculiar aspect, it being so unlike all other Scottish villages with which he is acquainted, and so remarkably similar in appearance to some English villages which he may have seen. It is situated on the north bank of the Tyne, in the centre of a fertile district, and is noteworthy for its acres of strawberries and other fruits. Sitting down beside the monument lately erected to the memory of Dr Moffat, the African missionary, in this place of his birth, on a still, warm June day like that on which the Club visited it last summer, we may rest a while to take in the scene before us. The silence is almost oppressive as we look away west, up the long line of village street, with its tall and fine trees set at regular intervals on each side, and casting dark shadows athwart the wide intervening space. Not a living thing is to be seen moving out-of-doors, suggesting the fancy that some enchanter's wand has been waved over the scene; while the only sound is a dull clang which reaches us lazily through the heavy noontide air from the

village forge. Right in front is the ancient village cross, generally supposed to be a remnant of an old Roman Catholic foundation which at one time occupied the same site,—though Chalmers, in his 'Caledonia,' affects to make merry over this suggestion, and says "it is obviously the market-place of a prosperous town, in the midst of an agricultural country."¹ Letting the eye wander on beyond this point, there may be discerned in the distance a sign-board thrust out a little into the roadway on the right, which we afterwards find marks the village inn or Hopetoun Arms, and represents the crest of that noble family, with the punning motto, "At Spes non fracta." The vista is closed by a background of foliage, so that altogether the scene is a very pleasant one; and we almost envy the lot of these villagers in this quiet rural retreat. Here is a picture which is still much the same, in all its details, after the lapse of fully half a century. The minister of the parish, writing in 1835, avers that "the great bulk of the people are contented and comfortable in their circumstances;" yet he has perforce to complain of some "who disturb, by their irregularities, the peace of a place which, from its beautiful and retired situation, seems peculiarly fitted to be the abode of tranquillity and happiness."

The sign-board of the village inn reminds us that the Hopetoun family is now dominant in the parish, and we naturally inquire how and when they thus came into possession. Ormiston derives its name from a half-mythical Saxon settler called Orme, who dates as far back as the twelfth century, and whose descendants continued to hold "Orme's toun," or Orme's dwelling, down through the thirteenth century. Orme, it has been remarked, was a common name during the eleventh and twelfth centuries, as we know from the chartularies still in existence. From the Ormes the lands passed into the possession of the Lindsays, until, in 1368, the only daughter of Sir Alexander Lindsay, Joan, married John, the second son of Sir Alexander Cockburn of Cockburn, and this historical family was then vested in the lands and barony of Ormiston, with several other lands contiguous. The Cockburns continued in possession until 1747, when John, second Earl of Hopetoun, acquired the whole by purchase from the last member of the family, and became the sole proprietor of the parish.

¹ Chalmers's 'Caledonia,' vol. ii. p. 552.

I have spoken of the family of Cockburn as a "historical family"; and it was, in truth, bound up intimately with the history of Scotland during centuries "big with fate" to our native country. For many years the office of Lord Justice-Clerk was retained in the family; other members of it were Lords of Session; while John Cockburn, best known as "the agriculturist," sat in the old Scots Parliament, took his share in the negotiations regarding the Treaty of Union, and again represented his native county in the British Parliament, after the Union had been effected. One of the family who held the office of Justice-Clerk, Adam Cockburn, appointed to that honour in 1692, was rather a notable character in his day. In a profusely illustrated work, published a few years ago in two quarto volumes, entitled 'The Castles and Mansions of the Lothians,' the late Mr John Small, Librarian of Edinburgh University, who wrote the descriptive letterpress for the work, tells us, when dealing with Ormiston Hall, that Adam Cockburn was very unpopular from his zeal in suppressing the Rebellion of 1715. And he adds the curious fact that when, at that time, "ladies at cards were playing the nine of diamonds, commonly known as the curse of Scotland, they called it the Justice-Clerk." But it is John Cockburn, son of this Whig Lord Justice-Clerk, whom I would more particularly speak of at present. This Laird of Ormiston, born about 1685, was long resident in England, which circumstance explains the distinctively English character of the village of Ormiston. From the 'New Statistical Account' we gather that about 1732 he "made great improvements in the village, and laid out the fields contiguous to it upon a plan furnished by Mr Lewis Gordon, a land-surveyor, whom he brought from England for that purpose. They were all divided into small portions, and enclosed with thorn-hedges and hedgerow trees. This plan was extended over the whole barony of Ormiston, by which it was, and still is, distinguished from all other parishes in the neighbourhood." He also endeavoured, we are told, to promote the growth of flax, founded a school for teaching the spinning of linen yarn, and established a bleachfield—said to have been at that time the second in Scotland—for the bleaching and dressing of fine linens, which formerly had to be sent to Haarlem for this purpose. (The first bleachfield in Scotland was that of the British Linen Co., in the neighbouring parish

of Salton; and in the same antiquated little village the first barley-mill in Scotland was erected, by William Adam, the architect, who carried the plan in his memory from Holland.) But it is as an enterprising agriculturist and landlord that John Cockburn's chief renown rests. The system of long leases which he introduced is said to have ruined himself, the leases being on too easy terms, and to have compelled Capt. George Cockburn, on his father's death, to sell the estates to the Earl of Hopetoun, as already mentioned. Whether this be so or not, these long leases certainly did much for the ultimate improvement of the agriculture of Scotland. Formerly lands were usually held on a five years' lease; but John Cockburn fixed a thirty-eight years' lease, as an inducement to tenants to improve their farms, with a renewal every nineteen years, "for all time coming," on payment of a *grassum*, or stipulated extra sum, as rent, at the expiry of each period of nineteen years—a system which has now, in its turn, given place to still better and fairer methods. He was, in truth, far ahead of his time as an agriculturist, and the various improvements he began were taken up and continued by the noble family who came next into possession. In an interesting newspaper article which appeared lately, entitled "Reductions of Rent in East Lothian,"¹ it is stated that "in 1743 the estate of Ormiston was regarded as a model for imitation by landlords and tenants." And to show that its *prestige* still continues, the writer proceeds: "Ormiston has bravely sustained its early reputation. The reduction of rents indicated by the Valuation Roll for the period from 1872-73 to 1883-84" (the latest then available) "is only £59 on a previous rent of £7154;" and this although, as we are informed, "from 1872 rents have been reduced in some cases more than 40 per cent"—the adjoining parish of Pencaitland being cited as one in which there has been a large deduction during that period.

Our subject, however, is more particularly Ormiston Hall, and not the parish of Ormiston, though the two are closely related. And here behind us is one link of connection with the old Hall: let us turn round and look on the bronze medallion, by Mr D. W. Stevenson, of the veteran missionary—pronounced by his son to be "one of the best portraits that I

¹ 'Scotsman,' Jan. 12, 1887.

know," of the many that have been executed. The face recalls vividly to my own mind a rather memorable occasion, when Dr Moffat gave an address in a village church not far from Ormiston, on a summer Sabbath evening some years ago. "The old man eloquent" became so engrossed with his memories of African scenes, that he forgot the flight of time, continuing his discourse until the shades of night had fallen, and the congregation had at length to be summarily dismissed. In 'The Lives of Robert and Mary Moffat,' lately written by their son, the Rev. John S. Moffat, the following sentence will be found in the preface: "At the entrance of the grounds" of Ormiston Hall "stands the gardener's house, a substantial stone building, in which Robert Moffat's mother spent her youth a hundred years ago; and in the churchyard stands a stone to the memory of her parents, William Gardiner and his wife, erected by the Earl of Hopetoun of that date, in whose service they had lived and died." Let us therefore suppose that we have now passed over the mile of road between the village and the entrance to the Hall, and that we are proceeding down the avenue to the mansion-house. This avenue consists of stately trees—beech and elm and oak—mostly planted by the John Cockburn, Laird of Ormiston, of whom I have already spoken. The modern house, too, which by-and-by comes in sight, was built originally by the same laird in his later years—in 1745—though various additions have been made by the Hopetoun family since then. John, fourth Earl of Hopetoun, on succeeding to the title in 1816, lived at Ormiston Hall for a year and a half while Hopetoun House was being enlarged, and made numerous improvements at that time not only on the house but on the whole estate. After his death at Paris, in 1823, his widow, the Dowager Countess of Hopetoun, took up her residence at Ormiston Hall, when further extensive alterations were made both on the house and grounds. It was then that the yew-tree, to be afterwards specially mentioned, was left outside the orchard-wall by the contraction of the orchard—though this is to the advantage of the tree, giving it a more prominent position. Sir Thomas Dick Lauder has described the mansion-house as being "in the tea-canister style of architecture, with three additions to correspond, one canister being added to another till the accommo-

dation wanted was completed." He admitted, however, that the interior arrangements for comfort were well planned. Ormiston Hall is at present leased to George Dempster, Esq., LL.D.,—who, it should be here mentioned, at once consented to permit the Society to inspect the grounds, and paid our party much kindness on their visit to this most interesting place last summer. The benign influence exerted by this gentleman and his like-minded lady over the surrounding district is worthy of all honour and praise.

The old fortalice, or rather what remains of it, stands about 200 yards west of the present mansion-house, and one cannot look upon the ancient buildings without being stirred in thought. Though now in great part dismantled, enough remains to suggest what once had been. Here was the principal entrance, through this low archway, with pieces of the old iron stanchions still embedded in the masonry at the sides. This gave entrance from the outside to the courtyard round which the buildings were ranged. Part of the principal staircase, close to this gateway, still remains, and at the top we come on the room whence Wishart is said to have been taken, before his martyrdom, at the end of the year 1545. The whole story is picturesquely told in Book I. of Knox's 'History of the Reformation,' but is too long for quotation here. There is first the sermon at Haddington; then the travelling on foot to Ormiston, accompanied by the Laird of Ormiston and several of his friends (Knox adds the graphic touch, "it was a vehement frost"); then supper, and the singing of the 51st Psalm; when Wishart passes to his chamber, to be aroused at midnight by the tramp of armed men, and angry voices demanding admittance—for the Earl of Bothwell has just left Cardinal Beaton at Elphingstone Tower, a mile distant, and is come to demand that Wishart should be delivered over to him. After many solemn promises on the part of Bothwell that Wishart would be kept in safety, he was at length given up, and the party then marched off in triumph, their tread ringing out sharp in the clear frosty air of that December night, as they returned to Elphingstone. We all know the sequel: though not directly and at once handed over to the tender mercies of the Cardinal, that wily prelate at last succeeded in getting Wishart into his power, and on the 1st of March following he suffered martyrdom

before the Castle of St Andrews, in presence of Beaton and his friends. Knox was greatly influenced by Wishart's preaching; and several of the landed gentry, including the Laird of Ormiston, were also much attached to him. Thus it is related that "when, in 1545, George Wishart courageously ventured to preach in Leith, among his auditors were the Lairds of Brunstane, Longniddry, and Ormiston, at whose houses he afterwards took up his residence in turns, accompanied at times by Knox, his devoted scholar, and the bearer of his two-handed sword."¹ The mention of Knox recalls the circumstance that Alexander, son of Sir Alexander Cockburn, was a favourite pupil of the Reformer, and is spoken of in affectionate terms in his 'History of the Reformation.' A monumental brass to the memory of this talented young man, who died in Aug. 1564, in his twenty-eighth year, is on the north wall of the only part left standing of the old church, within the grounds of Ormiston Hall—viz., what was probably the chancel. The classic elegiac verses of George Buchanan, in praise of his linguistic attainments and regret at his early death, are still perfectly legible;² but the building itself is dark, half choked up with rubbish, and has been roughly roofed over at some late period. It is said that a number of stone coffins, the last resting-places of several Cockburns of Ormiston, are here at no great depth below the surface. A brief notice of this old church, where both Knox and Wishart are believed to have officiated oftener than once, is found in a volume printed by the Maitland Club, in 1835, from a manuscript discovered accidentally about that time in the Register House. It is there stated that "the Kirk of Ormistoun of old wes ane of the Kirkis of the Trinitie College of Edinburgh, consisting of 4

¹ 'Old and New Edinburgh,' vol. iii. p. 150.

² This monumental brass forms the subject of a short paper by the Rev. Dr Struthers of Prestonpans, in the 'Proceedings of the Society of Antiquaries of Scotland,' vol. iv. p. 225. The late Dr David Laing adds the remark to Dr Struthers's paper, that the tablet "is of peculiar interest; and as few specimens of the kind exist in Scotland, it was thought desirable to give a reduced facsimile of the 'rubbing'" which Dr Struthers had made. This facsimile has been executed in a very artistic manner, and will be found in the Society's 'Proceedings.' Dr Laing was of opinion that the tablet in St Giles's, in memory of the Regent Earl of Morton, was of the same period, perhaps executed by the same hand; while the inscription upon it, by a curious coincidence, is also by George Buchanan.

prebendaries, a parochie priest, and a vicar. Bot sen reformation it is a laik patronage, according to the new erectioun, quhais patron is the Laird of Ormiston."¹ The only entrance to this old parish church was through the laird's garden-gate; and as this was felt to be rather inconvenient for all parties, another church was erected on a different site in 1696, which in turn gave place to the present edifice.

Surrounding the old church, from pre-Reformation times, was the ancient churchyard, both situated a little to the west of the mansion-house of Ormiston Hall; and probably in or near this churchyard stood originally the venerable tree now known far and wide as "the Ormiston yew." The age of this tree is unknown, though there is evidence to prove that it was of considerable size in 1474, when a lease of a piece of ground, granted by the superior of the religious house in the village, was signed beneath it. The uniform tradition is that Wishart occasionally preached under its branches to congregations composed of the Ormiston family with their friends and retainers; and there is every reason to believe the accuracy of the report. Strange to think that we now look upon, not a crumbling ruin, but a living object which has existed all through these centuries, from the beginning almost of authentic history in our own country, and yet lives and thrives, green and flourishing. How many generations of men have passed away during its existence; and how many stirring events, ecclesiastical and civil, have taken place! And it may continue to grow for as many centuries still, so far as any one can predict. The tree is very graceful and well-proportioned; and standing in the midst of a clear space, as it now does, it is seen to the full advantage. It has frequently been measured by visitors and others, amongst the more recent of these measurements being one carefully made by the late Professor Balfour and Mr Isaac Anderson Henry, in August 1879. Mr John Hamilton, forester at Ormiston Hall, kindly measured the tree, by request, on the 6th of December last, and wrote as follows: "Its circumference, at 3 ft. 9 in. from the ground (where the branches begin to spring), is 16 ft. 2 in. The outside circumference, where the branches lie on the ground, is 227 ft.; and the inner circumference, 147 ft. I am sorry

¹ 'Reports on the State of Certain Parishes in Scotland, 1627,' p. 125.

I can tell nothing about its age. I am glad to say it is in good health: in seven years the bole has increased in circumference 2 inches, and the outside branches 8 ft." As there was no mention here of the height of the tree, I asked Mr Hamilton for this measurement, and received the reply, dated Jan. 7, 1887, that it was at that date 35 ft. 3 in. high. I have drawn up in tabular form authentic measurements of the tree for periods stretching over nearly a century. The first is from Sir John Sinclair's Statistical Account, of date 1792; the second, from the 'New Statistical Account,' 1824; the third from Croal's 'Sketches of East Lothian,' in 1864; and the fourth, Mr Hamilton's measurements of December last. The only uncertainty is regarding the girth, which is not in every case at exactly the same distance from the ground; but the variation is slight, and the height may be taken in each instance as 3 ft. 9 in. The following are the figures:—

—	1792.	1824.	1864.	1886.	Average growth in five years.
Girth, . . .	11 ft.	13 ft. 10 in.	(No record.)	16 ft. 2 in.	3½ in.
Height, . . .	25 ft.	29 ft.	34 ft.	35 ft. 3 in.	6½ in.
Outside diameter of branches, }	53 ft.	59 ft.	69 ft.	72 ft.	1 ft.

It will be seen from this comparative statement that the Ormiston yew is still enjoying the vigour of youth; and with the careful attention which for long has been, and still is, paid to it, the tree may yet reach a "green old age," which, in the case of a yew-tree, is very much of an unknown quantity.

Any one who has had frequent occasion to consult the Old or the New Statistical Account of Scotland, cannot but have noticed the meagre references to the flora and fauna of some parishes, as contrasted with others. This, indeed, is just what we might expect, when we consider the different tastes or predilections of the various writers; and especially when we remember that Natural History was not then the popular study which it is now. Yet there are instances where the geology, botany, and zoology of a district are all very fully described, either by the minister of the parish or by some scientific

friend; and in one case—that of the parish of Prestonpans—the writer bewails the difficulties in the way of his study of Natural History, especially the domain of ocean-life. The Rev. W. B. Cunningham thus writes, half in anger, half in sorrow: “It is to be regretted that, in some of those districts in which the most ample fields of Natural History are presented to the inquirer, the means of exploring them are unfortunately denied to him. Notwithstanding the writer’s most anxious exertions to procure the rare specimens (which the sea occasionally yields up to dredge, net, and line) from the fishermen under his own pastoral superintendence, he has almost entirely failed in attaining his purpose, through their utter apathy to everything like a love of the ‘unsaleable’ creatures that ‘swim the ocean’s stream.’” I have no doubt that the experience of several amongst ourselves has been much the same as that of this clergyman half a century ago—though his case had its own peculiar aggravations. But to return to the Ormiston yew. In both Statistical Accounts this tree is noticed at some length, while the yew at Whittinghame, which is often looked upon as a rival to the Ormiston tree, is mentioned in neither Account. Nor does Loudon include the Whittinghame yew in his long list of remarkable trees, though the Ormiston yew has a paragraph devoted to it. A stranger omission still is that of the late Sir Thomas Dick Lauder, who edited in 1834 ‘Gilpin’s Forest Scenery,’ making many curious and useful additions to that well-known work. Among other remarkable trees, he gives an interesting notice of the Ormiston yew, with detailed measurements of its circumference. Yet the Whittinghame yew is not once referred to by him, though it was only a few miles distant from his own estate of Fountainhall. Some days after inspecting the Ormiston tree, I accompanied a friend to Whittinghame to see the eucalyptus there growing. This tree was planted as a seedling in 1846, and though cut down nearly to the ground at one time by frost, is now 60 feet high. When at Whittinghame, I made a careful survey of the yew-tree there, while the appearance of the other East Lothian specimen was still fresh in the memory. Although the Whittinghame yew is certainly a very fine old tree, and has also its own historic associations, it did not appear to me to be so stately or so well-proportioned as the Ormiston yew. When the Berwickshire

Naturalists' Club visited this fine estate in July 1884, the yew-tree was found to have an inside diameter of 40 feet 6 inches, which is not very far behind that of the Ormiston yew—viz., 47 feet. But the girth of the Whittinghame yew at 5 feet from the ground is only 11 feet, while that of the Ormiston yew at the same distance is nearly double, which would go to prove that it is much the older of the two. At 5 feet up, the Whittinghame yew separates into a great number of interlacing shoots, thus shortening the stem, though making it more dense in appearance—so much so, that from the inside the branches seem like an impenetrable wall. It is to be hoped that our Society, having visited Ormiston Hall, with its ancient yew and other interesting sights, may yet include Whittinghame, with its historic tree, its old tower, and other notable features, in some future list of excursions.

It may be mentioned here that to the north of the mansion-house of Ormiston Hall there is a narrow glen through which the Belsis burn flows, containing a mass of vegetation, and where are several large and fine trees—oaks, beeches, and sycamores. It may also be of interest to some of the members of the Society to know that there is growing near the flower-garden the parent of a very distinct form of the Portugal laurel (*Laurus* or *Cerasus lusitanica*). This form is popularly known as the "Ormiston laurel," and has dark leaves of a thick, leathery texture—therefore the varietal name which has been given to it of *coriacea*. There are several specimens of this laurel in the Royal Botanic Garden, some of them assuming the dimensions of trees. I am informed that it was a particular favourite of a respected "past president" of this Society, the late Mr Wm. Gorrie, and that he did much to spread it, sending cuttings to several places throughout the country which were thought suitable for its growth. I can find no mention of this variety of the Portugal laurel in any of the numerous works on the subject which I have consulted. The forester at Ormiston Hall is of opinion that it was in all likelihood brought by Sir John Cockburn from Portugal in the early part of last century.

In concluding these remarks, the fig-trees growing on the south wall of the orchard at Ormiston Hall deserve notice. These, too, were planted by Sir John Cockburn, and are said

to have produced at one time figs of peculiarly fine quality. Though cut down to the ground by frost during the inclement winter of 1880-81, they are again throwing out fresh shoots, in some instances over 3 feet in length,¹ and form no unfitting memorial of the far-sighted, enterprising cultivator who originally planted them, and whose memory will always be so intimately bound up, not only with the lands of Ormiston, but with the whole fertile county of East Lothian.

VIII.—*THE PARIDÆ, OR TITMICE.*

BY MR ARCH. CRAIG, JUN.

(*Read Feb. 23, 1887.*)

THE *Paridæ*, or titmice, are a small group of birds that present great attractions to the student of Natural History, in consequence, so far, of their possessing the dual advantages of not only being very numerous, but from their constant residence in this country throughout the year. Opportunities of observation are not, therefore, confined to the narrower limits afforded us in the case of migrants. Strictly speaking, partial migration does take place among some of the species; but as they never actually leave our land in a body like the swallow tribe, and are more or less to be met with in suitable localities at every season, for all practical purposes they may be designated non-migratory. They form a distinct and select little clan by themselves, both as regards their habits, plumage, and song; and although frequently accompanied in their wanderings by other birds of kindred tastes, they seem notwithstanding to be so intent upon their own affairs as to furnish ground for the belief that they fill the more honourable *rôle* of leaders, while the others again enact the character of the escort. Be that as it may, they are essentially a unique and highly interesting fraternity, and I shall endeavour to bring under your notice a

¹ On a visit to Ormiston Hall during the present summer (Aug. 1887), the fig-trees were found in good health and vigour, and would probably have borne fruit this season had they not in 1880-81 been so severely damaged by frost.

few of the more prominent features of what all naturalists unite in considering an order of birds most worthy of attention.

One of their leading characteristics, even to the inexperienced eye, is their constant restlessness and activity, carried to an extent which has almost no parallel save in the well-known instance of the Hirundines, or swallows; and if proof of this assertion were wanting, a few hours spent in following the track of a flock in autumn would be sufficient of itself to bring conviction to the most incredulous mind. Another peculiarity is their intense inquisitiveness. This latter trait when developed in the human animal is not always to be considered commendable, but in the case of the titmice it is much to be admired, and, besides, is most beneficial to the growth of trees and plants directly, and indirectly of course to the owners of these. Just take the trouble to watch a titmouse hanging on the trunk or branches of a tree, and see how eagerly he reconnoitres every little crevice or crack in the bark, hammering away with his hard little bill, or poking the same into some small recess barely visible to the naked eye. The uninitiated in many cases imagine he is doing harm, whereas he is a decided benefactor, being busily engaged destroying insect-life in the shape of eggs, larvæ, or the creatures themselves, which ultimately would injure the growth of the tree. Yet, nevertheless, the day was, and unhappily in some parts of Great Britain still is, where a premium was paid for the destruction of the whole race of titmice, probably the best friends that gardeners or tree-growers have. It has been advanced as an argument on the opposite side that they eat grain, destroy plants for the sake of the seed, and tear open buds in early spring. This is true, but to a certain extent only, as the grain devoured is trifling, and the buds burst usually contain insects in one form or other; so that, even painting them in as black a hue as perversity is capable of, their bad qualities are a mere bagatelle in comparison with the good services they render. Their fearless nature, and trusting disposition in the presence of man, made them an easy prey; but it is pleasant to record that this prejudice is fast dying out, in common with many other equally mistaken ideas that our forefathers, from want of knowledge, indulged in at the expense of the feathered fauna of our country, and it is perhaps not too much to hope that, with the

rapid march of education, in a few years they may exist in the minds of people as obsolete traditions only. As a whole they are insectivorous, except when pressed by scarcity of their natural food to eat seeds and other viands—even flesh at a pinch is not despised. For this reason they are rather difficult to keep in confinement, although with care as to diet they may to a certain extent be successfully caged. The practice, nevertheless, savours of cruelty, as they are of such a roving, active disposition as to rouse in us a feeling of sorrow when we look at the little captives cooped up into such narrow prison-houses, when they would otherwise be so happy in the enjoyment of their liberty. The same may be said likewise of all insectivorous species, who cannot be so readily inured to captivity as the granivoræ, owing to the difficulty of procuring the proper food to maintain them in a state of good health. One and all are accomplished acrobats, it apparently making no difference to them whether they hang with their backs up or down, or whether, figuratively speaking, they stand on their heads or their tails. Sometimes you see them diligently working on the upper surface of a branch, to shift instantaneously to the under; next minute they are clinging to the trunk like a creeper, fluttering in the air like a butterfly, or dangling like a cork at the end of a swinging twig, and all the time never for a moment losing sight of the main object of their quest, calling to each other in shrill clear notes that penetrate to a considerable distance, especially when uttered amidst the solemn silence of dark and lonely pine woods. It is chiefly at these times when foraging in bands that they are joined by other species, such as the goldcrests, siskins, redpoles, creepers, &c.; but concerning this companionship more may be said at some future time. Their plumage is striking, being characterised in most examples by clearly defined colours and decided contrasts—yellow, slaty blue, black, white, and combinations again of all these, being the chief factors in forming the sum total of their outward covering; and in the cases of the great and blue tits their garb is really handsome. In some the feathers are of a soft, fluffy nature, and as a natural sequence specimens are difficult to shoot clean, and decidedly more difficult to stuff after they are secured; therefore really good and satisfactory skins are seldom to be seen. Although by no means formidable as

regards bulk, they possess daring that would put to shame birds six times their size. Just attempt to rob the nest, or put your hand into the hole where the same is concealed, and you will soon have painful evidence of their dislike to your interference. The sitting bird will hiss like a small snake and salute your fingers with no gentle bite, particularly the great tit, to whose natural disinclination to be meddled with is to be added a longer, and correspondingly stronger, mandible, capable of inflicting considerable pain on the assailant. One cannot help admiring the pluck displayed by these mites of creatures when guarding their eggs or young,—a bravery, when we take their size into account, far exceeding that of most birds whose powers of defence are infinitely greater. Why titmice should be gifted with larger powers of resistance than other small birds is not easy to understand. It can hardly be that Nature, taking into account their usefulness, endows them with courage disproportionate to their size, in order to allow of their increase,—as in the case of many other equally useful species, notably the Warblers, the reverse is the rule, the mere accidental finding of the nest or touching the eggs being sufficient to make the birds desert. There can be no doubt, however, that Providence, who has ordered everything so wisely, must have bestowed the quality for some rational end, and with the knowledge of that we are fain to be content.

Enough, perhaps, has been said by way of introduction, so we will now turn to look at the species in detail. Of the true titmice, six exist in Scotland, and one other, known as the bearded tit, forming a separate genus, has been found in England; but of this latter no mention need be made, as it is quite unknown in our more northerly part of the island. The names of the six are as follows:—

Great tit, . . .	<i>Parus major.</i>	Marsh tit, . . .	<i>Parus palustris.</i>
Blue tit, . . .	" <i>cæruleus.</i>	Long-tailed tit, . . .	" <i>caudatus.</i>
Cole tit, . . .	" <i>ater.</i>	Crested tit, . . .	" <i>cristatus.</i>

The great tit, or ox-eye, is the largest of the genus, and can be readily distinguished from the broad black band down its breast and lower parts. The cognomen ox-eye is occasionally applied to the blue and cole tits, but erroneously so. How the name originated is not clear, and in reality is of little im-

portance. Some writers aver that its call-note in spring has a resemblance to the syllables "ox" "eye," but if that be so, the believers in this theory must be gifted with livelier imaginations than have fallen to the lot of most folks, as by no possibility can its notes be contorted into a sound resembling these words. While upon the subject of names, it may be as well to mention that "tom-tit" is a favourite synonym for the genus, but as it is rather a weak and puerile designation it would not be much loss to ornithology if it fell into disuse. Many popular names have a real significance, and are of great value, but the same can scarcely be said of this one. For example, take a few of the more absurd epithets by which the *Paridæ* are known in different parts of England: "Sit-ye-down," "Tom Collier," "Billy Biter," "Joe Bent," "Long Tom," "Mum Ruffin," "Bottle Tom," and "Poke-pudding." I think it will be confessed that these do not add much dignity or weight to ornithological nomenclature. It is of great importance, therefore, to adhere as far as possible to one recognised denomination, and this, combined with the scientific name most in vogue, will prevent dubiety. The plurality of scientific names in ornithology is most puzzling at times, but this may be overcome by taking up one well-known system and holding to it.

The great tit haunts woods, gardens, hedges, and brushwood, but is often to be seen about the vicinity of houses and farmyards. In spring the note of the male is peculiar and pretty constantly repeated, and although not attaining to the distinction of a song, is cheerful and lively. Some of his efforts, however, are the reverse of musical, being grating and discordant, and not unlike the sound made by a saw when it encounters a nail in a piece of wood. As a rule, this species does not travel about in such large numbers as the cole or long-tailed tits, and is decidedly more vicious in disposition when captured. Like the robin, they often alight upon the limed twigs set round the call-bird's cage, and I have frequently made their acquaintance under these circumstances, but, to speak truth, never with any great desire to renew it, as while endeavouring to release them from their self-imposed position they bit so persistently as in many instances to draw blood. The nest is fabricated of moss, hair, feathers, &c., and is most commonly placed in the hole of a tree or wall. A decayed and

hollowed-out stump is a favourite site, especially where there is a narrow hole deep enough to prevent access by the human hand; but occasionally other and more singular situations are adapted to the purpose, such as the disused nests of magpies, or even a squirrel's drey. It is amazing how agilely they wriggle in and out of a small space. Last summer I watched one at Temple Bridge flying in and out of a long narrow aperture in the masonry, apparently one of those outlets for the escape of the water after rain. It alighted on a tree within five or six yards of the bridge, and then flew like a flash straight for the slit. The latter, however, was too small for it to pass into direct; so as quick as thought it grasped the sharp edge of the stone, turned itself sideways, and disappeared into the recess, to emerge again in a few seconds with equal rapidity. This performance was repeated every few minutes; so taking into account the length of a summer day, one can gather an idea of the indefatigability of the parents while feeding the young, and of the incalculable benefit they confer on sylvan life by destroying countless insects. Some authors accuse it of cannibalistic tendencies, in so far that it now and then kills and eats other small species; but upon this point I should not care to hazard an opinion, never having come across a case of the kind. That it does so when confined has been indubitably established by Dr Bechstein in his valuable work on 'Chamber Birds'; but one is loath to credit such evil of this little ornament of the woods in its native state, although, from the evidence adduced in support of the statement, it seems likely to be too true. A friend who possessed a number of marsh tits, informed me that on one occasion, when by some blunder food was omitted to be put into the cage, they fell upon each other, and, like the far-famed Kilkenny cats, in the morning none were left to tell the tale, the last survivor having evidently succumbed through exhaustion. Any one who has kept an aviary must have observed how intensely cruel birds are to any of their number who fall sick. In nine cases out of ten the healthy set upon the weak and peck them to death. It is hard to comprehend the motive of this seemingly relentless nature, unless it be with the object of putting the sufferers out of pain, or from some inherent desire to extirpate all who cannot "fend" for themselves; but this is all the more difficult to reconcile when

we take into account the loving care that they bestow upon their young broods. The great tit is no favourite with apiarists, as, if all tales are true, it manages to destroy a good many bees as they issue from the hive, by perching on the little shelf outside the entrance-hole and dabbing the unsuspecting insect as it emerges.¹ The female is very like the male, but hardly so bright in colour.

It would be useless to take up time describing the plumage of the various species, as the accompanying specimens speak for themselves, so we will pass on to the next in order—viz., the blue tit. This is the prettiest and at the same time the most impudent of all the *Paridæ*. It seems to be regardless of the presence of human beings, and is not easily frightened, coming close to houses, farmyards, and gardens at certain times of the year, particularly autumn and winter. If a person remains still in a wood where these tits are feeding, they will often alight on trees within a few feet, and hammer away at the bark close to your elbow, with as much nonchalance as if you were a hundred miles distant. In general habits they resemble the great species, but, if anything, utter their shrill notes oftener, and have a knack of dropping down to the ground when least expected, in this respect being very like the robin. When upon the nest they show a marked reluctance to leave, and display even greater intrepidity in defending their young than their larger relation. They build in cavities of trees, rocks, or walls, and sometimes the entrance is so small as to make one wonder how they get in or out so readily. Many extraordinary breeding-sites are recorded, such as inside bottles, old pipes, pumps, &c., for full descriptions of which I would refer any curious upon the subject to well-known works on ornithology, such as Yarrell, Morris, or Jardine. A very good method of observing this bird's powers of clinging and curious attitudes, is to hang an old bone with meat upon it by a string to the branch of a tree, and in winter especially it won't be very long ere the dainty morsel is discovered by one or more tits, who, notwithstanding the swaying motion, manage to retain their foothold and satiate their appetite at the same time. The popular name of this beautiful bird in Scotland is "blue bonnet,"—an appellation that calls to the recollection of enthusiastic Scotsmen the "bonnets" of quite a different nature,

¹ This is disputed, and apparently with some show of reason.

whose wearers played such a prominent part in the days of Border warfare.

Next on the list is the cole tit. This word is spelt alternatively *cole* or *coal*. The latter is perhaps the more correct form, and has been adopted in the latest edition of Yarrell by Professor Newton, who adduces as proof that the French name "petite charbonnière" clearly points to the fact that it has connection with the fuel burnt in our fires, and not with a plant known as *cole*. This bird is usually found to be more plentiful in high-lying plantations than any of its brethren; but it is by no means confined to these, as thick woods in the low grounds often abound with them. It can never be mistaken for the blue tit save by a novice, as its note is different, and as a rule it travels in bands, a constant calling to each other going on all the time. Whether owing to its greater sociability or from a similarity of tastes, you mostly find it consorting with other small species, notably goldcrests and creepers; and while the former are chiefly busy among the leafy branches, the latter devote their attention to the trunk. In autumn in suitable districts of the Highlands there is a constant succession of the aforementioned hunting the woods in concert; but, besides these, siskins and redpoles often join in the campaign. Where crossbills are numerous this is very noticeable, the smaller fry taking advantage of the greater powers possessed by the larger birds, to extract the seeds from the half-opened cones left by the former. It is amusing to see the pertness with which the minuter species mix with the crossbills and perch within a few inches of them, evidently with the assurance of perfect safety and immunity from assault, which says a great deal for the good-nature of the crossbills, who, all the same, have probably very little intention of reversing the order of things and becoming jackal to their lion. At a distance this species is apt to be confounded with the marsh tit; but when near enough to admit of scrutiny, the white patch on the nape of the neck is a sure distinction, the latter never having that at any time of life. The whitish spots on the wings also occur in the cole tit alone.

The marsh tit is not nearly so common in Scotland, and must be considered very local in its distribution. In England, again, it is much more plentiful, and during last May it was my good fortune to make its acquaintance in Warwickshire, in suffi-

cient numbers to become familiarised with its note and general appearance. The name "marsh" implies a fondness for swampy localities, but in the district of Snitterfield it was frequenting a thick forest of small trees (ash principally) known as "The Bushes," and miles away from any marsh. The nest of one which I found accidentally was in the hollow stump of an ash-tree, rising about a foot from the ground. The bird alighted on the edge of the stump, and dropped into the hole, which appeared to be about eighteen inches deep. The aperture was much too narrow to admit the hand, so, gently inserting a thin twig, the hissing noise began at once. Being very anxious to identify the species, and be satisfied that it was not the coletit, I rattled the twig against the edge of the hole; but the little creature was not to be dislodged so easily, and it was only after several louder applications of the twig that it evidently lost patience, and flew up the narrow space like a shot, perching on a tree close by, and chirping in a very angry tone indeed. Having now a good opportunity of observing both it and its partner, who was attracted by the noise of its mate, I was much pleased to distinguish the marsh-tit, previously almost unknown to me. Further investigations in the same district proved them to be very numerous. It has been found nesting in various parts of Scotland, and was seen by a friend of mine inhabiting a wood a few miles south of Inverness.

Before calling attention to the long-tailed tit, it may be as well, in a few words, to advert to its crested congener. It has fallen to the lot of few ornithologists to recognise this species in the flesh, and it must on all accounts be considered a rare bird. The only district where it is really known to frequent regularly is Strathspey, among the pine and fir forests that skirt the base of the Grampians east of Grantown, in that lovely locality Rothiemurchus and Glenmore. The extent of wood is so great on the Gordon and Seafeld estates, that one might go specially a dozen times to look for it, and never have the felicity to come across a single specimen; but it is beyond doubt that it makes its home in the neighbourhood mentioned. The fact of its being so difficult of discovery is in reality the only safeguard against its extermination—for to speak truth, and *entre nous*, ornithologists are in many cases little better than hypocrites, in so far that they do not always

practise what they preach ; and although inveighing against the slaughter of rare birds, I am just afraid, if temptation in the shape of a crested tit were put in some of our own ways, we might be apt to eat our principles for the time being in order to possess the skin. A stuffed example may be seen in the Museum of Science and Art, and judging from it and the coloured plates in several ornithological works, it must be a very pretty bird to watch in life.

We come now to the last, the long-tailed tit. This is the creature that rejoices in the names of Bottle Tom and Poke-pudding. The peculiarity about this species is the disproportionate length of tail to the size of the bird, and in many respects it is different from other tits, in none more so than in its plumage, which is fluffier, more muddled in its colours, and not so decided in its contrasts. To watch the old birds and the newly-flown young herding together among the woods is a never-tiring treat. The fledglings look no larger than humblebees, and the long thin tail attached gives them somewhat the appearance of a comet as they flit from branch to branch. To add two other similes, the one ornithological and the other reptilian, they may be said to resemble a magpie in shape, though not in colour, and a powet or tadpole, though not in size. The body is exceedingly small, and is the most diminutive of British species, save the gold and fire crests: the bill also is shorter than that in any of the other tits, and is nearly obscured by the soft downy feathers at the base. It is not an uncommon bird by any means, and may be seen during late autumn, and winter even, in the suburbs of Edinburgh where there are belts of high trees ; but perhaps it may only resort to those localities when driven in by stress of weather. The scientific name adopted by most modern writers is *Acredula caudata*, it having been made the type of a sub-genus from its dissimilarity in many points to the other Paridæ ; and certainly, when you examine a specimen, there is sufficient evidence to warrant the change. With a slight description of its nest I shall conclude this paper. Unlike other tits, this species does not hide its nest in holes, but forms an elaborate structure, which is placed between the branches of bushes or in the fork of a tree. It is composed of moss, coated with lichens, after the manner of the chaffinch, and lined with soft feathers. In

shape it is oval rather than round, and the means of entrance and exit is a small hole near the top. How the sitting birds dispose of their long tails is more than I can tell. It has been stated, and probably with truth, that they turn them backwards over their heads, after the manner of those contortionists we occasionally see in the theatre, who, by doubling back their bodies, manage to gaze at the audience through their legs. They may, perhaps, put them straight up against the side of the nest; but it is really of very little use hazarding theories, as they would be extremely difficult to prove, especially when the smallness of the entrance-hole is taken into consideration, and the fact that the bird is not likely to remain long enough in the nest to permit of close investigation.

In conclusion, let me urge upon every member of this Society who may have it in his or her power, to do what they can to protect the little subjects of this paper, and by their influence and good example endeavour to uproot those silly and cruel prejudices which in the past have done so much to deprive our woods and gardens of the presence of that most interesting and useful race, the titmice.

[Stuffed specimens were shown in illustration of the above paper.]

IX.—*THE FOSSILS OF THE RED CRAG AND CHALK PITS, SUFFOLK.*

By MISS MINNIE M'KEAN.

(*Read Feb. 23, 1887.*)

LAST November, being in Suffolk, I visited, with some friends, one of the red crag cuttings and one of the chalk pits in the neighbourhood of Ipswich. I had heard a great deal about the crag formation, but it was all so new to me that I wished much to see it, and to make a collection of its fossils for myself. This desire was strengthened after inspecting the interesting collection in the Museum at Ipswich,—a building which I would advise any lover of Nature in most of her departments to visit as soon as possible.

We had a beautiful day, and after driving four miles or so through lanes bordered with hedgerows on either side, over

which the briony-berries were clustering in scarlet masses, while the tufts of wild clematis-seed (*Clematis vitalba*) clothed everything in a mantle of snow, we arrived at Foxhall Crag Pit. This pit is leased at present by the farmer on whose ground it is situated, and he accompanied us to the place where the men had just left off working.

A few words as to the nature of the crag formation will explain it at once. In the Pliocene period in geology, Britain, after a long time of exposure as a land-surface, when it underwent great denudation by weathering, began gently to subside. Nothing definite can be said as to the extent of this subsidence, but it is well known that that part which forms now the south-east counties of England was gradually submerged, when sand-banks and shelly deposits were laid down in the shallow waters of the North Sea, and it is these accumulations that are termed "crag." Many of the "crag" shells still live in arctic seas. Geikie, in his 'Text-book of Geology,' says:—

It is evident that in these fragmentary accumulations of the "crag" series we have merely the remnants of some thin sheets of shelly sands and gravels, laid down in the waters of the North Sea, while that great lowering of the European climate was beginning which culminated in the glacial period.

The "crag" series is subdivided into five groups, of which the "red" is the second oldest, and it is principally in Norfolk and Suffolk that all of these groups are exposed. The cutting which we visited seemed to be about 6 or 8 feet thick. Its natural colour is a deep red, and in some parts it is stained deeper still by a mixture of iron. The section here is very good, and shows the "red crag" resting on the "London clay."

The crag shells are 230 in number, and there are five different species exhibited to-night—viz., *Trophon antiquum*, *Pectunculus glyceris*, *Cardita senilis* (extinct), *Astarte Omallii*, and *Nucula Cobboldiæ*. The Foxhall Crag Pit is worked for the purpose of obtaining those valuable phosphatic nodules called "coprolites." These are gathered by the ton, after being extracted from the "crag," and are then conveyed to the crushing and chemical works and converted into manure. As there are various opinions regarding the nature of these nodules, I shall quote an extract from Dr J. E. Taylor's book, 'Nature's Bye-Paths,' which gives his verdict on the subject:—

The well-known red crag phosphates of Suffolk are scarcely less interesting to geologists than those of the south of France. They occur as *nodules*, often enclosing fossils; but, singularly enough, these fossils are never those of the red crag itself, but always those of the much older "London clay" formation. These crag phosphatic nodules still go by the name of "coprolites," from an antiquated but erroneous opinion that they are the fossil excrement of animals. Instead of this being their origin, however, we know that they represent that portion of phosphorus which has entered into the structures of the soft bodies of those very animals whose hard parts, as bones, shells, &c., also occur in the fossil state; in fact, they are phosphuretted hydrogen set free from the decomposing bodies of the animals which died in the sea along whose floor the "London clay" was deposited. Phosphoric acid, so forming, combined with lime, and in this manner the nodules of phosphate of lime were formed by segregation.

Here is another short extract bearing on the same topic, from Dr Taylor's 'Geology of Ipswich':—

There is every reason to believe that the so-called coprolites or phosphatic nodules were in reality accumulated on an old exposed *land*-surface of the "London clay," before the area was submerged to form the bed of the red crag sea. Teeth of "mastodon," rhinoceros, and deer are not unfrequently met with, associated with bones of older date.

Fossil wood, as well as bones, teeth, &c., of animals, chiefly cetaceans, are met with in the "crag," these having been re-deposited in the crag beds after having been washed out of the London clay in which they were originally embedded. I am indebted to Dr J. E. Taylor for several specimens of *Otodus obliquus* (shark's teeth) which are shown to-night, as well as for the beautiful "box-stone" containing *Pectunculus glycymeris*. The nature of these box-stones will be best described in Dr Taylor's own words:—

Very singular are the roundish masses of coarse sandstone which are met with at the Foxhall Crag Pit. From Foxhall, the bed containing them, which usually lies directly on the "London clay," extends to Felixstowe, and heaps of them may be seen by the roadside, waiting to be broken up for road-mending. They are very curious as representing a lost formation, older than the "coralline crag," for they are also found under it, which is probably of late Miocene age. It is the quarrymen who have termed them "box-stones." You strike them with a sharp blow of the hammer, and about one in every ten will break in halves, revealing the cast of a fossil shell within. These "box-stones" are the broken-up and rolled remains of a bed of sandstone which once covered this part of Suffolk, and which still underlies Antwerp, Brussels, and other places in Belgium.

Let us now turn from the fossils of the crag to those of the chalk. The chalk pit we next visited was a very large one, near the village of Bramford, about three miles from Ipswich. It was a very deep cutting, the walls of pure chalk towering up like lofty hills above our heads. The men were busy burning the chalk for lime. We were not so fortunate as to chalk fossils, but secured a pretty specimen of *Ananchytes ovata*, an Echinoid of the Cretaceous period, locally termed "Fairy loaves." We found them difficult to dig out of the close, compact mass of chalk, the outside shell being so delicate. At the same place I picked up a completely round ball of flint, and on splitting it in two halves, I came upon a ball of pure white chalk, which, Dr Taylor informed me, when carefully washed, would be found to be full of sponge-spicules. Flint, indeed, is closely connected with sponge-organisms, and there are various theories as to what flint itself really is.

Thus ended our excursion to the red crag and chalk pits of Suffolk—very pleasant in the carrying out, and no less pleasant in the retrospect. A systematic search would of course bring many more fossils to light, and such a search I hope soon to undertake. What was accomplished on that November day was just enough to whet the appetite for more. In addition to the shells found, and now exhibited, I have brought for your inspection a small quantity of the ferruginous shelly sand of the red crag. This sand has for centuries been used for enriching poor clayey soils, on the surface of which it is spread. I am indebted to two gentlemen, members of the Society, for the preparations shown—viz., to Mr Johnston, for the section of a coprolite which he has made, and which is now exhibited under the microscope; and to Mr Pearcey, of the Challenger Commission, who has kindly prepared slides of some of the chalk which I brought with me from Suffolk. These slides show a very considerable number of Foraminifera of various forms, some of them being new species.

The lessons to be learned from the Suffolk crag and chalk pits are extremely interesting, and reveal to us much of the later geological history of this island of ours. Perhaps some of our members have not yet turned their attention to the subject; and if I have succeeded in bespeaking their interest for it, then something has been gained by these remarks.

X.—NOTES ON SOME NEW AND RARE
BRITISH PLANTS.

BY MR SYMINGTON GRIEVE, PRESIDENT.

(Read Feb. 23, 1887.)

I AM indebted to Arthur Bennett, Esq., F.L.S., Croydon, for kindly sending me some of the following plants from his herbarium, and also for identifying one or two which were collected by myself during a visit to the island of Rum in July 1884. As all the plants are exceedingly interesting, it is my intention to hand them over to the keeper of the herbarium at the Royal Botanic Garden of this city for preservation.

Potamogeton prælongus Wulf, from the island of Rum. This plant has been recorded in most of the eastern counties of England and Scotland, from Essex to Caithness. On the western seaboard it appears to be a rare plant, and has hitherto only been recorded from Westmoreland and Kirkeudbright.

Carex flava *var. Gauda* of Gay, from the island of Rum. Although Mr Bennett is not quite certain about the identification of this plant, owing to the immature state of the fruit, still he has little doubt regarding it, after comparing it with specimens in the herbarium at Kew. If this plant is correctly named, it is the first record of it in Scotland, and it has only been once recorded in South Britain, where it was many years ago collected upon Snowdon. In any case, the plant in question is a remarkable form of *Carex flava*, and as none of its varieties have previously been recorded in the North Ebrides, it is at least a new record for Watsonian County 104.

Cerastium arcticum Lange, *var. Edmonstonii* Beeby, grows on Serpentine Hills, Unst, Shetland. This seems to be a variety of *Cerastium latifolium* L., *var. nigrescens*, of our Floras, and which appears as yet to have been only found in Britain in the Shetland Islands. From a paper contributed about a year ago to the 'Scottish Naturalist' by Mr A. Bennett, it would appear that the *Cerastium arcticum* of Dr Lange was not thought to be the same as *Cerastium latifolium* L., *var. nigrescens*. It appears to have been supposed that *Cerastium arcticum* Lange, which was found in Greenland and Iceland, might be found as far south as the Faroes. It is exceedingly

interesting to find such a near variety to the true *Cerastium arcticum* Lange as the specimen upon the table, from a station much farther south.

Alsine hirta var. *foliosa*, Hartm., from Serpentine Hills, Unst, is very close to *Alsine rubella*. Dr Lange, in his 'Flora Grœnlandica,' p. 24, places *A. hirta* and *A. rubella* as mere varieties of *A. verna*, which grows so plentifully on Arthur's Seat, and which some of you may know better as *Arenaria verna*.

Luzula maxima D.C., var. *gracilis* Rostrup, was gathered by Mr W. H. Beeby on Saxa Vord Hill, Unst, on the 28th July 1886, and appears to be an entirely new British plant. It is found abundant on the upper slopes of the hill, but flowers on the small plateau which forms the summit.

Psamma baltica R. & S. This plant has been previously recorded from only one locality in Britain—namely, the Holy Isle and adjoining coast of Northumberland. The specimen before you is from a second British station—Caistor, in East Norfolk.

Festuca sciuroides var. *intermedia* Hächel med. This is a new variety, recorded July 1886, from Mitcham Common Surrey. Mr Bennett remarks, "It appears to be a connecting form between *Festuca sciuroides* and *F. myurus* L."

XI.—ON DARK-GROUND ILLUMINATION, AS SHOWING PECULIARITIES OF CERTAIN DIATOMS.

BY MR WILLIAM PENMAN, Assoc. M.Inst.C.E.

(Read March 23, 1887.)

DARK-GROUND illumination must not be confounded with opaque illumination. The latter takes its name from the manner in which the object viewed is mounted—that is to say, the object is mounted upon an opaque ground, and treated with *super-stage* illumination. Dark-ground illumination, on the other hand, deals with mounts through which light can be transmitted from beneath in the usual way. Besides this, however, there are a few distinctions that must be attended to in the selection of suitable objects for this treatment. Briefly, they

may be condensed into two necessary conditions: *first*, that the object is iridescent; and *second*, that it is mounted in a reasonably thin medium.

There are several kinds of micro-accessories in general use for the production of dark-ground illumination, but I shall confine myself to a description of those that I have tried:—

I. *By Means of an ordinary Stand-Condenser.*—The lamp is placed so that the flame is about the same height as the stage, and the edge of the wick turned towards the microscope. All sub-stage arrangements are removed, so as to allow the light greater range, and the mirror turned aside or taken off altogether. The condenser is now placed, and the microscope tilted to allow the rays to strike the object upon the slide, and then the condenser is moved until the rays are brought to a focus upon the object. After the rays pass the conjugate focus at the stage, they diverge, and do not enter the objective at all. For, provided they fall upon the under side of the glass slip at a reasonable angle, they will pass onwards in their original course; but should they impinge at an angle exceeding, say, 70° , they will, if properly focussed, be almost totally reflected downwards,—so that in the first case they strike the object as they pass, although not entering the objective; while in the other case they do not properly illuminate the object. It is, therefore, manifestly important that the slope of the microscope should not be such as to cause a loss of light by reflection. Granted, therefore, that the object under examination is an iridescent one, the observer will see it by reflected light, which passes up from it into the objective. The object will thus stand upon a dark ground, illuminated and examined according to the same optical principles as the moon or the stars. It is important that the focal length of the objective be taken into account, in order to procure the best results from this kind of illumination. Suppose the objective to be a high power with short working distance, it will be found practically impossible to exclude the direct rays from entering the objective; but I have found that even with a high-angled $\frac{1}{4}$ -inch it is quite possible to get dark-ground illumination from the stand-condenser.

II. *By Means of a Spot-Lens.*—This instrument may be generally described as a plano-convex lens with a slice taken off the convexity, and the flat face thus formed rendered

perfectly opaque by a coating of dead-black varnish. On throwing parallel rays upon the under side of this lens, the central ones strike the opaque surface and do not reach the object; but the marginal ones that fall outside the stopped centre or spot are transmitted, refracted, converge, and come to a focus, which focus may be made to rest upon the object by moving the lens up or down. Now these marginal rays diverge, after passing the focal point, in the same way as those we have already considered, but with this difference, that they pass onwards on each side of the objective. They, however, do not enter the tube, consequently the reflected rays only are seen on looking through the microscope, so that the object thus illuminated appears upon a dark ground. This method is better than the first, because both of the transmitted beams pass at equal angles to the axis of the microscope tube—or in other words, the axes of the objective and the spot-lens are coincident. On account of this the spherical corrections of the lenses are not so severely taxed; and the diffraction, or fringe of light in the object, is not rendered eccentric, but is better distributed round the edges.

III. *By Means of the Abbe Condenser.*—Most of you will know that this is the form of condenser almost exclusively used in Continental microscopes. It is a non-achromatic combination; and whether or not the want of achromatism is against its usefulness as a sub-stage condenser, certain it is that, as a dark-ground illuminator for diatoms, its performance is not thereby impaired. Like the spot-lens, it is lit up by rays from the mirror underneath the stage, the central rays being cut off by an opaque surface. There is, however, a decided difference in the way the exclusion is effected. Underneath the Abbe combination a circular central stop is inserted, so that the cutting off takes place in the centre of the entrant rays, whereas in the case of the spot lens the stop takes effect upon the emergent rays. Owing to the peculiar construction of the apparatus, the rays are brought to a focus almost at their emergence from the upper lens, and thus a much closer working distance is available; or in other words, a higher power may be used without admitting transmitted rays into the objective. By this instrument the size of the stop can be regulated, and the more intense beam gives brighter illumination. The

peculiar feature of the Abbe condenser is its non-achromatism, on account of which there is dispersion of the emergent rays into coloured pencils, and through the different refrangibility of the chromatic rays the focus is lengthened out along the axial line, and consists of a series of points forming a complete spectrum. Thus the red rays, being least refrangible, come to a focus at a point on the axial line farthest from the condenser, and would illuminate an object placed at that point with a monochromatic red light. Similarly the blue rays come to a focus nearest to the condenser, and would affect an object in their focus. In practice these changes are effected by moving the condenser up or down.

The appearance of diatoms upon dark-ground illumination is very striking; for, not only do we see them projected upon a dark ground in the same way that we can see foraminifera, but for the most part they present themselves either in monochromatic light or in variegated colours—that is, some stand out in one colour only, others are lit up by several spectral colours. Now, as the light which falls upon the diatom by transmission through the condenser consists of decomposed light by virtue of the aberrations of the combination, it follows that, upon whatever horizontal plane of the spectral focus the diatom is placed, a monochromatic light will fall. Thus, as we have already seen, if the diatom is placed at the focus farthest from the light, it will be illuminated by the least refrangible ray—namely red. Placed at the focus nearest to the light, the illumination will be blue—the other end of the spectrum. Or, practically speaking, by racking up the condenser you get blue light, by racking down you get red. This is the actual effect presented to the eye in the case of a great many diatoms, but with others it is not so; consequently it must be concluded that, because the reflected light does not conform to the colour of the incident ray, and that it is impossible to disperse or alter the colour of a homogeneous ray by interference, there must be something in the composition or form of the frustule itself to produce this effect.

In the first place, we know that diatoms are siliceous, and this accounts for their iridescent and reflective power. Foraminifera, on the other hand, are also iridescent, but because

they are calcareous their reflective power is impaired, and no colour is detected in their illumination by this process. The optical difference between diatoms and foraminifera is somewhat the same as between ice and snow. Reflection from ice enters the eye from one extended surface at a time; when this reflection is lost you have transparency: so you have with many diatoms in certain positions of the illuminator. In snow, on the other hand, you have the same iridescent medium; but each particle throws its reflection upon its neighbour, and the appearance of opacity is created. The only theory, therefore, that I can give for the appearance of more than one colour upon certain diatoms, is that they must be possessed of an irregularity of surface sufficient to intercept two or more rays of the spectral focus at the same time, and that the minute planes of reflection upon that surface are not turned towards each other, but reflect the particular ray they impinge upon straight upwards to the objective, and thence to the eye.

I have recently examined upwards of 150 different diatoms by dark-ground illumination, under powers ranging from 50 to 600 diameters, and in doing so discovered that, when using high powers, a better result is got by placing a drop of water or glycerine between the top of the condenser and the slide. Those of you who are familiar with the theory of immersion objectives, or the principles of refraction generally, will readily understand in what way the benefit arises. Curiously enough, a few days after I had noted this effect I stumbled upon a short communication to the American 'Micro Journal,' 1884, in which Mr Grunow of New York points out the very same thing. From my cursory examinations I find there are many diatoms unaffected by chromatic light, and appear perfectly transparent. Of these, *Navicula rhomboides* may be taken as an example. Another class take on from a bluish-white to a deep blue, as, for instance, the *Pleurosigmæ*. Others appear in orange, yellow, or green; while a select few are radiant in variegated colours. Selecting some of the most conspicuous, I find that *Aulacodiscus pruinus* shows its flowery markings in bluish-white; *Gomphonema geminatum* in the same colour, with black dotting very distinct. The spokes and rings of *Arachnoidiscus* are made to stand out in relief, the black dots are well seen, and the differences between *A. ornatus*, *A. japon-*

icus, and *A. Ehrenbergii* can easily be detected. *Pleurosigma angulatum* is perhaps the most beautiful diatom for this light. It varies from a milky to a deep blue; and I consider that unless where resolution is desired, this diatom should always be shown by dark-ground illumination. *Pleurosigma balticum*, *Navicula major*, *Pinnularia*, &c., take on the yellow, orange, or red rays. Amongst diatoms capable of reflecting variegated colours there is *Podosira maxima*, which is seen to consist of flat radiations (Maltese-cross fashion); and while the body of the diatom is of greenish blue, these radiations are tinted with purple, sienna, and yellow. On examining this frustule with ordinary means, it appears flat and uninteresting. *Heliopelta* is also seen to much advantage: the fine colours form a most gorgeous object.

I think it a pity that there is no published account of diatoms giving a classification with respect to their appearance under this illumination; but I feel confident that our skilled diatomists will some day be induced to take the matter up. Certain it is that any one engaged in this will have matter in hand for profound speculation as to the causes of these exquisite diffraction spectra, and will perceive for himself that his preconceived notions of the structure and forms of many diatoms were erroneous and misleading.

[On the table were placed three microscopes giving dark-ground illumination in the three different methods above explained—viz., by the ordinary stand-condenser, the spot-lens, and the Abbe condenser.]

XII.—*HUME'S PROJECTION MICROSCOPE.*

BY MR WM. HUME.

(Communicated March 23, 1887.)

I SHALL do my best to first describe the general mechanical and optical arrangements of this micro-lantern, and then will, I hope, be able to show you, what will be more interesting, a number of micro objects thrown on the screen from it. By means of this its actual performance will be made visible, and you will be provided with a test for judging its capabilities.

Until a comparatively recent date, the demonstration of

micro objects on large screens was in a very primitive state, and it is only lately that any real progress has been made. One of the great difficulties in the way of successful projection is the want of a very high illuminating power which is capable of easy manipulation. Even the lime-light, as used in the mixing burner, is insufficient for the higher objectives. In the earlier forms of lantern-microscopes, very little attempt was made to collect all the rays of light emitted from the radiant; and, as a rule, no other condenser except the ordinary double-lantern condenser was used. Since then, however, more lenses have been introduced in this and other forms of micro-lanterns for the purpose of, as nearly as possible, concentrating the whole of the effective rays on the object. For this purpose some provision has also to be made so as to adapt to higher and lower objectives of varying aperture. Another difficulty lies in the want of objectives specially suited to this work. The objectives which are used to-night have been picked out of a large number which, however suitable for ordinary microscopic work, are useless for projection. Many objectives which yield excellent results in the microscope, produce only a very small-defined circle in the centre of the screen, while the greater part of the field is very blurred. It is very difficult, indeed, to find one which gives sharp definition all over. This defect for lantern-work is fully recognised by micro-objective makers, and several are experimenting with the view of bringing out glasses suitable for projection. Among these are Zeiss and Wray, the former having a place fitted up, and under the direction of his son, for this special purpose. In general, the objectives used are of low power. Those which I have found best are a 2-inch Zeiss; a 1-inch Zeiss; a $\frac{2}{3}$ -inch Crouch; and a $\frac{1}{4}$ -inch Wray. This is about the limit possible, as even in the case of a $\frac{1}{4}$ -inch some objectives touch the cover-glass before the object is in focus. With low-power objectives and a moderately large screen the best results are obtained. In the matter of slides suitable for projection, those are, as a rule, best which present any good contrast or decided markings or features. They do not necessarily require to be thin sections, since in the case of some very thin objects the light may be so bright that all detail will be lost, and only a white glare appear to the observer. In the mechanical arrangements of the apparatus,

the two great essentials are steadiness of the whole, so that any adjusting or focussing does not produce a visible movement on the screen; and also, it must be capable of easy and rapid adjustment, and of picking out on the slide any part desired to be brought to the centre. In the lighting arrangements, also, steadiness and freedom from flickering, as well as easy manipulation, are essentials. In the apparatus before you these requirements are obtained in a very high degree, as I shall show you afterwards. These being the general principles essential to successful projection, it remains for me to describe to you Mr Hume's apparatus for obtaining them. In it the lime-light is used by means of the mixing burner, having a power of about 500 candles. This is fitted with an ordinary lime-turning arrangement, and has adjustments for bringing the light to the optical centre. This is contained in a mahogany body, iron-lined, with air-passages to keep it cool. In front of this burner is a 4-inch double condenser, consisting of a meniscus with the concave side towards the light, and a plano-convex with the convex side to the light. This combination has a back focus of about 2 inches, and has the light set about $2\frac{1}{4}$ inches from it, giving slightly convergent rays. Another single $3\frac{1}{2}$ -inch condenser, double convex, of $4\frac{3}{4}$ -inch focus, which is capable of adjustment, slips in a tube before this. All the rays emitted from the first condenser are taken up by this, and are brought to a focussing-point at 4 inches from the lens, where the disc of light is about $\frac{1}{2}$ -inch diameter. At this point the slide is introduced, where it has all the rays of light converged on it. This arrangement of condensers is used for low powers, stops being introduced for special objects to sharpen the disc. For the higher powers a third condenser is introduced, plano-convex, $1\frac{3}{8}$ -inch diameter and 1-inch focus. This possesses the function of an Abbe's illuminator, bringing the rays to a very bright spot about $\frac{1}{4}$ inch from the front of it. The object is held by means of clips in front of this lens, or the stops, on a steady mechanical stage, with vertical and horizontal movements. This is mounted on a tube, within which is carried the objective, which is held in a fitting capable of being pulled out for the insertion of other objectives. The whole is fitted with rack-and-pinion for quick focussing, and micrometer adjusting-screw, one complete turn of which moves

the objective $\frac{1}{200}$ inch. For the purpose of absorbing the heat rays, an alum-bath is introduced before the first condenser, which effectually prevents any heat being communicated to the object during the transmission of the light. The whole apparatus is, for rigidity and compactness, mounted on a cast-iron base, having at one end an upright which holds the mechanical stage and objective tubes.

[Mr Dixon, who read the above paper, then showed a large number of slides, including both animal and vegetable preparations, on the screen, and the clear definition and illumination of these were much appreciated by the members present.]

XIII.—*T H E H A R E.*

BY MR TOM SPEEDY.

(*Read April 27, 1887.*)

IN writing a paper such as the present upon any of the fauna of our country, one is apt to take for his subject the badger, the otter, the wild cat, or some other of those animals which are exceptionally rare. I have, however, chosen one of the most common of our wild animals, though modern legislation has put it in a fair way of becoming very soon as extinct as the great auk. A few years ago, several of our statesmen were clamorous for the protection of sea-gulls, which are of comparatively little use to man, while they, in fact, by feeding to a large extent upon young fish, tend to destroy the food-supplies of the nation. That the feathered tribe should be protected during the breeding season is only justice, in the interests of humanity; but the animal from which that most enjoyable repast, hare-soup, is made, is surely entitled to a like protection. That the hare is now in many parts subjected to slaughter during the entire year is beyond dispute; and if steps are not forthwith taken, and a law passed to protect them during the breeding season, genuine hare-soup, like that of the turtle, will only be indulged in by our wealthy gourmards, or vile imitations will be palmed off upon the unwary. Notwithstanding that the hare is so well known in all parts of the country, it is undoubted that there is a deal of popular ignorance regarding

many of its habits and peculiarities. I shall therefore, in the first place, direct attention to a few particulars on these points; and as I do not profess to lay claim to infallibility, nor have any desire to indulge in dogmatism, I shall be glad to hear the criticisms of any whose opinions may not coincide with my own.

There are several questions of interest to the naturalist affecting the hare, which I shall here put in consecutive order:—

First, Do hares necessarily pair during the breeding season?

Second, How long is their period of gestation?

Third, How many do they produce at a litter?

Fourth, How often do they breed in a year?

Fifth, Do young hares born in March breed the same year?

As regards the first question, I am of opinion that by natural law hares pair, and I shall very briefly give my reasons for making this statement. In districts where hares are limited in numbers, they are, as a rule, in the month of February to be found in pairs lying in proximity to each other on ploughed fields or on rough sheltered grounds. I do not mean to assert that this is their invariable habit, but in places where they are undisturbed, when one is started in the conditions indicated, another at no great distance may be expected. That they pair must therefore appear manifest, but whether they keep faithful to conjugal laws is a controverted question. Rabbits, as is well known, pair, being found in holes together in the early spring; and I have seen a male rendering assistance in carrying into the hole the material for making the nest in which the female deposits her young. At the same time, I have proved, in a locality where I knew only one pair of wild rabbits existed, that by turning out at night a black and white female tame rabbit she very soon produced a litter which generally took after the wild progenitor in colour. All such cases, however, are exceptions to the general rule, though confined to no single class of animals.

Secondly, regarding the period of gestation in the hare, in my opinion it is one month, or more probably nearer five weeks. I have no correct data to guide me, but have often dissected hares in the spring and found them rarely with young till the end of January. As I have noticed young hares in the end of February, and as they are quite common in March, it will thus

be seen that the period of gestation does not, as already indicated, exceed five weeks. I have never kept adult hares in confinement with the view of observing their habits, which, I think, would be the only way of testing the matter under consideration with any degree of certainty. At the same time, I think it dangerous to rest any theory, or argue in support of any experiment, founded on the artificial conditions produced by dissociating animals from their natural environments and placing them in confinement. Nature resents all such interference.

Thirdly, as to the number hares produce at a litter. This is generally two, though very frequently only one. I have, however, seen three and have heard of four; but, though I have skinned and dissected very many gravid hares, I have never, with only some two or three exceptions, found more than two young ones, and certainly never more than three.

The fourth point, as to how often hares breed in a season, is a much-controverted question—gamekeepers and others, who have spent their lives in the country, holding a wide diversity of opinion. There are, I am persuaded, no certain data to warrant the general application of any definite theory, many circumstances and conditions falling to be considered which necessarily preclude the operation of any uniform law. There are, for instance, the nature of the climate and the abundance or scarcity of food-supplies to be taken into account. Then there is the circumstance of "puss" being allowed to luxuriate in conscious security from her enemies, or that of her being subjected to daily disturbance by farmers' collies or miners' lurchers, each and all of which exercise an influence in determining the extent to which hares are prolific. It may safely be assumed that the natural time for hares dropping their young is in the month of March—some, of course, earlier, and others later. Still, this may be regarded as a fact which few will care to dispute. There are, I am satisfied, very many—I would be disposed to say the greater proportion—which do not again breed that season; but there is still a considerable number, certainly not young hares, which have a second litter late in August or in the earlier part of September. I have shot hares in milk in October, although in rare instances. This, however, is no unusual thing in September—a fact which leads me to suggest that, in so far as the sportsman is concerned, hares

should not be shot till the commencement of the partridge season. This remark, it will be understood, does not apply to the protection of leverets.

On the fifth and last point, as to how early young hares breed, it would be rash to affirm that hares dropped late in February or early in March *never* breed during the same year: still such cases, if any, are, I am certain, exceedingly rare. There are several points of resemblance between the hare and the rabbit, but in this respect there is an essential difference.

Having thus disposed of these physiological questions, I would now briefly advert to a few characteristic traits which I have observed in the hare. Though somewhat unusual, it sometimes happens that in the early spring hares are seen engaged in furious combat, like the red deer which have been immortalised by the genius of Landseer. I was once fortunate enough to witness such an encounter, which lasted about half an hour. The two rivals stood on their hind legs, and, with wonderful dexterity, hammered each other on the head and breast, tearing off the down with their fore feet; and so deeply engrossed were they in their engagement, that I managed to get within thirty yards of them unobserved. How long they had already fought I, of course, had no means of ascertaining; but, as they seemed equally matched, I lay down and watched the result with interest. For a considerable time neither yielded an inch to the other, but they stood, like the "Saxon and the Gael," in deadly strife. Besides their loud and rapid breathing, which I distinctly heard, they emitted a peculiar defiant noise, which I am afraid I am unable adequately to describe. Still the fight continued, but I could see their sides heaving and their blows becoming feebler and less desperate. At last one of them, evidently worsted, turned and galloped off, hotly pursued by his antagonist. Within fifty yards, however, they again closed, and the battle was waged as before. But it was this time of short duration, as unfortunately the barking of a shepherd's dog, gathering the sheep in the field, caused them to scamper off into a young wood, where I have no doubt the battle would be decided. I hurried to the place where they disappeared, got up into a tree, but was disappointed in not seeing the end of this most interesting incident in Natural History.

Instances are recorded of deer, and even of the fox with all his wariness, being caught napping; and it is perhaps worthy of note that I have seen a hare sound asleep. Forming one of a shooting-party some years ago in Berwickshire, we were beating a grass field, when I spied a hare in her form. Telling the sportsman next me to be ready, I walked close up to "puss," when, to my surprise, I observed that her eyes were closed, and that she was evidently in an unconscious snooze. Calling out to the others, "Here is a hare sleeping!" the sound of my voice in such close proximity caused her to awake, and, giving a wild stare, she bounded off. This does not comport with the general opinion that hares sleep with their eyes open. Though hares feeding is a common sight to those who live in the country, few have had opportunities of seeing them drinking. Once I was fortunate enough to see this, when fishing at dusk in Loch Garry. Casting down the side of the lake, I struck the heather on the bank behind me and lost the fly. Sitting down to put another on the cast, I was interested in observing two hares, one behind the other, coming down the hill towards where I sat. Keeping perfectly still, I watched their movements, and was not a little surprised to see them go close to the edge of the lake—one of them on to a large flat stone bleached white by the sun and the action of the water—and drink for a considerable time. After assuaging their thirst, they cantered up hill again and commenced to feed.

Through the hare being subjected to daily danger from numerous enemies, Nature has extended to her the means of self-preservation by her senses of seeing, hearing, and smelling being all extremely acute in an equal degree. In this hares are unlike most other animals, which are dependent chiefly for protection upon one or other of the senses, as illustrated in the case of the red deer, with its marvellous power of detecting the presence of an enemy, sometimes nearly a mile distant, by its sense of smell alone. I do not mean to assert that deer do not quickly both see and hear, especially the latter; but, as is well known, they trust much more to their sense of smell for protection. Hares are also, though in a more limited sense, dependent on their nasal organ. I have been interested, when sitting quietly under a hedge on a moonlight night, to see them feeding, and directly one got leeward of where I was, she

would immediately sit up for a second, then scamper off. None know this better than poachers, who, when hanging nets on gates, always take care to keep to the lee-side. I have frequently noticed the keen scent of hares by observing one following the track of another, sometimes after an hour had intervened.

That hares are quick-sighted may be inferred from the fact that when one is discovered lying on a field—it may be hundreds of yards off—directly any person goes over the fence, or even stops opposite it on the road, she will at once squat closer. The quick sense of hearing in the hare is noticeable when being driven out of a wood where they had shortly before been disturbed, and where they may be seen stealing away at the other end, sometimes half a mile ahead.

Hares trust a great deal to being passed unnoticed, and will sometimes allow people almost to trample on them before making off. When one is squatted in a field, and the sportsman goes straight towards where she is concealed, she will very frequently rise out of shot. Human intelligence, however, is superior to animal instinct, and when one is seen in its form, the sportsman, by circling round as if going to pass her, will get within easy range.

Another peculiarity by which the hare very frequently makes good her escape is by doubling back on her tracks, and thus throwing dogs off the scent. In my boyhood I was frequently surprised at seeing harriers and beagles “full cry” on a burning scent, when, all at once, the “music” would cease, and the sport was brought to an abrupt termination. I was, however, fortunate one day in having the mystery unexpectedly solved. The harriers were out, and hares being plentiful, they were very soon “full cry.” I climbed a tree in order to have a good view of the sport. It was not long before I descried the hare, a long distance in advance of the hounds, coming near to where I was concealed. “Puss” galloped up the centre of a field, then suddenly stopped, sat up, and for a second, with pricked ears listened to the distant full cry of the hounds. Instantly she wheeled round and galloped back for a couple of hundred yards exactly where she had come up, then struck off at right angles down wind, and speedily disappeared from view. I then turned my attention to the hounds and riders, who were fast approach-

ing, and wondered if they would discover the manœuvre, or follow up to where the hare had doubled. I was not long kept in suspense, for, on the hounds getting through the hedge, they took up the double scent, giving tongue as if vying with each other which would be the loudest. A number of ladies and gentlemen came galloping up, evidently enjoying the sport. In an instant the music of the hounds had ceased, horses were suddenly pulled up, and disorder and disappointment ensued. I am almost ashamed to confess that I betrayed the secret of poor "puss," which conscience told me should have been kept sacred. Again the hounds were "full cry" on the trail, and, taking advantage of some elevated ground, I watched the remainder of the hunt. Several checks were made, and the hounds seemed baffled; but, unfortunately for the hare, some of the "field" or an onlooker would yell out a "tally-ho," and the chase continued. The instinct and cunning displayed by "puss" were therefore of no avail, and now, struggling up the furrow of a ploughed field, the hounds "from scent to view" speedily terminate the chase, and tear their victim to pieces, making a savoury meal of her remains as the reward of their persistent pursuit.

The hare almost invariably doubles back on her track for fifty or a hundred yards, then makes a spring of six or eight feet down wind, and goes a short distance before settling for the day in an open field. So strongly are hares endowed with this instinct that, as I have observed after a snow shower in April, it is practised by leverets a few weeks old.

One word on the cruelty of greyhound coursing in the months of February and March. The trusty shepherd is ever jealously on the watch to prevent any strange dog from crossing the field among his flock during the lambing season, as causing sheep to run at this time is known to have a prejudicial effect. Coursing hares, therefore, in similar circumstances is cruel in the extreme. Should any Bill be introduced into Parliament providing close-time for hares, care should be taken to protect them from being coursed by greyhounds during the months referred to, so that there would thus be an end put to a species of cruelty which must be deprecated by all humane and thoughtful persons.

XIV.—*SWALLOWS AND STARLINGS FEEDING
IN CONCERT.*

BY MR A. B. HERBERT.

(Read April 27, 1887.)

A RATHER curious coincidence came under my notice on the 14th of August last, while on a visit at a country-house in Warwickshire. I had observed that the "Daddy long-legs" or crane-flies (*Tipula oleracea*) were most abundant just at that time—indeed it was impossible to walk in the pastures without arousing these insects at almost every step—and on one of my customary walks about the grounds before breakfast, I saw over the garden hedge a large flock of starlings sitting and stretching out in a long line across a meadow, and working against the wind in a very methodical manner, as is their usual custom, those in the rear flying over the others and settling again in front, and in this manner beating over the whole length of the field. Immediately the starlings settled, a vast concourse of swallows appeared on the scene, and these kept flitting about in a long line just over the heads of the starlings, and feeding on the crane-flies which the starlings disturbed from the grass. Thus the flocks of birds of two very diverse species and habits kept in parallel lines over the whole pasture, feeding in concert; and when the starlings, on approaching the hedge, rose up in a body and wheeled round for another beat, the swallows followed them, and commenced again flitting just over their heads in a similar manner as before. I watched these peculiar proceedings with much interest till the breakfast-bell summoned me indoors. Whether the starlings were eating the "daddies," or searching for grubs, &c., in the grass, I could not distinctly ascertain, but as to the food of the swallows there could be no doubt, and it appeared to me an intelligent act on their part to avail themselves of the services of the starlings in procuring what we well know is a favourite article of swallow diet; and when we consider how destructive to the crops of farmers and gardeners these insects are in their larva stage, we cannot over-estimate the value and importance of the services rendered by these most useful birds. From their peculiar toughness these

larvæ are in some districts called "leather-jackets"; and as an illustration of their destructive habits, Kirby and Spence state that "in the year 1813 hundreds of acres of pasture were entirely destroyed by them, being rendered as completely brown as if they had suffered a three months' drought, and destitute of all vegetation except a few thistles, and when a square foot of dead turf was dug up, 210 grubs were counted on it." Curtis also mentions a case at Southall where two crops of mangel-wurzel plants were utterly destroyed by them.

Pheasants are known to be great devourers of these larvæ. Mr Melton of Great Marlborough Street states that he once took from the crop of a cock pheasant the almost incredible number of 852 of these destructive grubs. A female crane-fly lays about 300 eggs.

I may mention that almost all the swallows I saw were *Hirundo rustica*, but there were also among them a few of the species *H. urbica*.

At this meeting Mr Hugh Fraser, of Leith Walk Nursery, made a few remarks on the "Oaks of the World," illustrated by a large collection of herbarium specimens of oak leaves, divided into four main groups—viz., British, Continental, American, and Chinese (including Japanese).

XV.—*FAWSIDE OR FALSIDE CASTLE.*

By T. A. DOUGLAS WOOD, F.S.A.Scot.

(Read May 25, 1887.)

SINCE I last had the honour of submitting a paper before your meeting, I have frequently intended to take up and study the history of the ancient royal burgh of Musselburgh, and become acquainted with its many relics—for, be it remembered, though now it lies in a semi-dormant condition as if removed far from the stir of a busy metropolis, the time was when its streets were thronged with the soldiers of the Roman occupation, and in later times with those who fought for the beautiful Mary and

the Young Pretender. Not far from its borders were two battles fought of the greatest interest and importance to Scotland.

Musselburgh, then, is ancient, and much could be written about it and its surroundings, the difficulty being to condense the material in hand so as to form a concise sketch. It is my intention to submit from time to time short notices, giving what particulars I may be able to lay my hands on regarding such names as Loretto, Elphinston, Pinkie, Inveresk Church, the Town Hall, and, if I may include within its pale the neighbouring parish of Tranent, the names of Fawside or Falside Castle and Morrison's Haven.

To-night, then, my subject will be Falside, or more properly Ffauside or Fawside Castle. It stands seven and a half miles from Edinburgh Castle as the crow flies, two from Tranent in a westerly direction, the same from the Forth or Musselburgh on the south, and one from Elphinston Tower on the north-east. Standing as it does on an eminence, it can be seen from a great distance, and for the same reason those who used to inhabit it could descry friends or foes long before they reached its precincts. I have long desired to learn who were its occupants and what was its history, but not till lately have I been able to get any information except what is to be found in any school history—viz., that here, or on the brae below, was fought the famous battle of Pinkie, and from here also Mary Queen of Scots watched the progress of the battle of Carberry Hill, which proved so disastrous for her. Little, then, is known of those who in earlier times defended its walls, but what is known leads one to the belief that they were hard, brave men—inclined to live peaceably with all around them, but if once roused it would be difficult to say what the consequences would be. Its date cannot go further back than the eleventh or twelfth century. M'Gibbon and Ross, in 'The Castellated and Domestic Architecture of Scotland,' lately published, give the latter part of the fourteenth century, but a deed has been found with the name of William de Ffauside as witness in the reign of David I., in the twelfth century. From this time down to the sixteenth century abundant evidence has been adduced connecting the chain of the Ffausides by the granting of deeds and mortgages. To take a few examples:—

In the twelfth century a charter was granted by David I. to

Thor of Tranent of certain lands, which was witnessed by Edmondo de Ffauside. Another, in the time of William the Lion, Gilberto de Ffauside, witnessed a charter of the monastery of St Maria of Newbattle. In 1246 Donatius Sybald witnessed a charter by De Quincy, Count de Wynton, to Adam of Seaton, de maritago hæredes Alani de Faside. Seven years thereafter this same Alan bound himself to pay to the monks of Dunfermline yearly the sum of "quinque solidas argenti." In 1371 William de Seaton granted to John de Fawside, for true and faithful service, the whole lands of Wester Fauside in the barony of Trauernent—a gift which was confirmed by King Robert II. on the 20th of June. Again, in 1425, William of Fawside and Marjorie Fleming his spouse obtained the lands of Tolygart; and the lands of Wester Fawside were confirmed to John of that Ilk in June 1472. John Fawside married Margaret, daughter of Sir John Swinton of that Ilk, and at his death she became prioress of the Cistercian nunnery of Elcho. The family is now extinct.

The nearest lands to the east were those of Preston, belonging to a kinsman of the Fawsidians, Hamilton by name. With them, as with all those around them, the Fawsidians lived in the greatest concord and friendship up to or near the year 1520. At this time disputes and misunderstandings arose between the two families regarding the removal of certain landmarks on the estate of Preston. The Fawsidians were charged with the offence, which was indignantly repudiated. Occasionally, too, there would be a raid made into each other's keeps, and depredation committed. These did not improve matters, but nothing of a serious description took place, nor was blood shed between them, till about 1540, when matters became more serious and complicated. There happened to be a small stream not far from the estates—indeed it flowed between the two, and served to water the cattle of both. As ill-luck would have it, the Prestonian cattle became suddenly sick, and many died. What was the cause of this sickness? The cattle had been quite well till within a day or two; now they suddenly dropped off. Had any one been seen near them? Their kinsmen the Fawsidians had, and the conclusion was that it was they who had poisoned the upper waters, for none of their cattle had as yet, at any rate, been so afflicted. Retaliation must take

place, and that immediately; so the warders at Fawside were surprised and killed, and the gates and walls burned. The Fawsidians, now thoroughly roused by so daring an act of injustice, could stand matters no longer. Accordingly the great bell was rung, and a council of war summoned: nothing but the sound of the war-horn was heard. Arrangements being settled, the next evening a strong select band was to be seen emerging about midnight from the gates, and treading gently, first to the east, and then, turning suddenly northwards, they slipped down by the Whinney Loan. Evading, if possible, Dolphinston Tower, they arrive at Preston before ever those near at hand knew of their presence. Having performed their murderous purpose, they as quickly and quietly disappear. These were, however, but the works of skirmishers, for on the next day both parties ranged their respective hosts, and nothing was to be heard but the noise of arms, each party thirsting for the other's blood. The Fawsidians, of course, were there to a man, led by their old chieftain, whose lady (a warlike woman) was left in the keep to defend it with the last drop of blood. It need not be stated that the battle was a fierce one: the prejudices and feelings engendered during the years gone by, with many raids and incursions that had taken place during these times, all culminated here; a decisive blow was now to be given, and each strove to give it. From east to west the forces came down heavily on each other, until at one time it seemed as if the Hamiltons were to have the worst of it. In time, after the battle had been waged hot and sore without much difference being made on the Preston side, Hamilton was seen to make a move to the east from the thickest part, and gain some ground. Old Fawside, anxious to meet him, pressed forward, and thus isolated himself from his followers. He was slain, and they, beholding their chief lying on the ground, fled. Thus the battle was ended. But what about the result? Had the cattle been poisoned? No; the Fawsidian herd also took the same sickness and died, and on proper inquiry being made, murrain was found to be the cause. Thus if a little forethought had been taken on both sides, and especially on that of the former, and inquiry into the cause been made, much bloodshed might have been saved, and the Laird of Fawside would have been spared at least to die in a nobler cause. When the real cause had been

ascertained, and no further doubt existed, Hamilton, like a man, went to Fawside and apologised to the widow for slaying her husband, and tried to make amends for what had been done in hot haste. To their honour no fresh outbreak of the kind ever took place again, so far as we can hear. Let us hope that before any dispute on so trivial a matter took so serious a turn, they would weigh the evidence better than they had done before.

Seven years have come and gone, and during that time the inmates of Fawside, and those near them, I doubt not plodded on their way quietly and cheerily, tending their flocks, sowing their seed, and reaping their harvests. There was nothing to disturb them. But the time did come when the sound of trumpet and roll of cannon were again heard. The crown of England was worn at the time by Edward VI. Negotiations had been made for the marriage of the young Queen Mary of Scotland with Edward; but these failing, war was proclaimed to compel the Scotch to submit. Accordingly an army crossed the Borders and marched on Edinburgh, Somerset being the Protector during the English minority, and the Earl of Arran Regent during the Scotch. The Scotch sent an army to meet the invaders, and both met about two miles from Musselburgh, on the ridge of ground just above Pinkie and close to Fawside. It was just seven years since old Fawside lost his life at Preston, and one could have wished he had lived to this time. On the 9th September 1547 a renewal of hostilities took place; it was but the precursor of the more bloody battle of the morrow. If more bloody, it was less fierce than that waged in 1540. The combatants were the English and Scotch; then it was between two kinsmen and neighbours. The English the next day renewed the fight, and as both parties waxed hotter and hotter in the fray, the scene lay in time around the castle, which at length had to stand a siege. On the ramparts might be seen the retainers and body-guard doing what was in their power to beat back their foes. Commanded by Lady Fawside, the widow of the same old Fawside, as each charge of the English was made she and her followers would stoop and throw over volleys of large stones, working considerable havoc on those beneath, while others would occasionally make a sortie from the gate. This continued till the English, tired of the siege, set the castle on

fire—the brave old lady preferring to die among the ruins of her ancestral home rather than flee, only to be captured and killed by her enemies. I need not enter further into the details of the struggle—it is well known to all; suffice it to say that, though victorious, the English gained nothing, for Mary was secretly sent across to France, there to be married to the Dauphin.

After this, Fawside was rendered for a time at least useless as a dwelling. By-and-by, however, it recruited itself, its massive walls and arched roof saving it from utter destruction. Of its after-history we know little or nothing. Twenty years elapse, and we find in Pitcairn that a Thomas Fawside signed a bond of association for defending the coronation and government of the young King James VI. against his mother, and in 1570 he formed one of the assize for the trial of Carkittle of Moreless for treason. In 1616 the servant of James Fawside was “delated for the crewl murder (slaughter) of umquhile John Fawside, in the house of Fawside, with a knife or dagger, on the 10th of November.” For this offence he suffered the extreme penalty at Edinburgh Castle. In 1631 Robert of Fawside is found to be on the commission for augmenting the stipend of the minister of Inveresk. Some years thereafter the estate was sold to one of the name of Hamilton in Edinburgh.

In 1666 James, eldest son of the deceased Fawside, witnesses a charter of George Earl of Haddington. He seems to be the last of the race of Fawside of Fauside.

I now come to the second part of my paper, and it will be brief—viz., the description of the building itself and its architecture. M'Gibbon and Ross, in their interesting work already mentioned, rank Falside as a keep extended into a mansion, and put it down to the Third period, which period, they say, “began with the fifteenth century.” Our authors continue: “About that time a few castles began to be erected on a different model from that of the keep tower. These consisted of buildings surrounded by a courtyard or quadrangle. The great castle of Doune, built by the Regent Murdoch, Duke of Albany, is of this description. The powerful castle of Tantallon, which also belonged to the Duke of Albany, and the rebuilding of Dirleton and Caerlaverock (both destroyed by Edward I.), were likewise carried out on this plan.”

The original building, then, or that which existed before or at

the time of the battle of Pinkie, was 39 feet 4 inches by 30 feet 7 inches over the walls, and contains four storeys, the upper being vaulted. The height to the under side of the vault is 41 feet 7 inches, and the entrance is by a round arched doorway to the north. On the ground-floor was the keep, on the first floor the common hall, and on the second the original great hall. The addition, evidently built after the battle, when the buildings were restored, contains on the ground-floor a kitchen with large fireplace nearest the keep on the one side, and another small one at the opposite. Above on the first floor, immediately above the kitchen, is the dining-hall, also with large fireplace: there is off this room a good-sized private apartment, at the end of which, on the west, there has been a window, splayed out like our own bow, in order to allow the inmates as good a view of Edinburgh and the district as possible. On the second floor of this building we have above the dining-hall two bedrooms, and also one above the private room. Off the first of the two bedrooms there was a small closet sufficiently large to admit a bed: here, too, was situated, a little to the west, a hiding-hole 3 feet 6 inches under the closet floor. These additions to the castle extend southwards, and measure 41 feet in length—indicating, according to M'Gibbon, a distinct advance in house-planning. The walls are 10 to 12 feet at base, and range from $4\frac{1}{2}$ to 6 feet thick. The gable-ends at the south were turreted, and range about 50 feet in height. There is a building, or the ruins of one, to the south of the castle. Whether it belonged to it, or was merely a house built for a dependant, I cannot say; it, however, bears the date of 1618, with the initials "I. F. I. L." I. F. is supposed to be John Fawside, to whose memory a tablet is erected in Tranent Parish Church. "The mode in which the additions have been made at Falside," say M'Gibbon and Ross, "is somewhat peculiar, resembling rather an addition of modern times than of old. In the sixteenth century an old keep was generally extended by the addition of single buildings round a courtyard, but here we have an addition made so as to render the whole building, old and new, one solid block."

There used to be a considerable village near at hand, at the base of the hill, numbering 145 of a population. They were principally composed of the mining class, and worked in the

coal-fields of Prestongrange or the distillery of St Clement's Wells. This was in the year 1791. The castle itself is now in the Prestongrange family, who have come to it through their maternal ancestors, the Setons, Earls of Hyndford.

M'Neil, in his 'History of Tranent,' thus describes his feelings as he enters these ruins, and with it I conclude: "As we enter the ruins the sensation becomes even more intense: we think how our feet now tread the same rough floor on which the Fawsidians of old were wont to stand, and that we gaze out from the same strong iron-stanchioned windows at which the lords and ladies of the fortalice used to wait and watch with heart and hand, ever ready to welcome a friend or oppose the incursions of an enemy; and as we musingly seek to recall the loud laughter, the grim jest, or the merry song of those stern but jovial retainers sitting round the wassail-bowl on a blithe Yule E'en, or anon cracking their jokes while tightening their girths and sharpening their swords for the bloody encounter of the morrow, spectres innumerable of the departed heroes we seem to see peering round every corner, or gazing out from every dark nook, eagerly listening to the footfall or keenly watching the scrutinising eye of the daring intruder on their ancient domain. Nothing, however, is seen, save the wicked leer of some limping old rat as he hies from one hiding-place to another, or heard save the gentle cooing of the timid stock-dove hurriedly taking its flight through the crumbling archway overhead."

XVI.—*LIST OF THE LESS COMMON PLANTS GATHERED AT THE EXCURSIONS DURING 1886 AND 1887, WITH LOCALITIES.*

BY MR ANDREW MOFFAT, SECRETARY.¹

Thalictrum minus L. Caroline Park.

Ranunculus auricomus L. Roslin.

Cerastium arvense L.

This plant I was able to gather abundantly in the Queen's Park on 1st June 1887.

¹ Former lists will be found in 'Transactions,' vol. i. pp. 254, 298.

Stellaria glauca With.

This very rare plant in the Edinburgh district was gathered abundantly at Philpstoun Loch on 3d July 1886.

Pyrus Aria L. Arthur's Seat.

Chrysosplenium alternifolium L. Auchendinny and Roslin.

C. oppositifolium L. Auchendinny and Roslin.

Parnassia palustris L. Pentlands near Clubbiedean.

Adoxa Moschatellina L. Firth Woods, Roslin.

Senecio aquaticus Huds. Duddingston.

Vinca minor L. Roslin; naturalised.

Littorella lacustris L. Philpstoun Loch.

Veronica montana L. Firth Woods.

V. scutellata L. Philpstoun Loch.

Bartsia Odontites Huds. Pentlands between Clubbiedean and Currie, and in the neighbourhood of Balerno.

Alisma Plantago L. Philpstoun Loch.

Butomus umbellatus L. Duddingston Loch; introduced.

Sparganium ramosum Huds. Duddingston Loch.

Typha latifolia L. Duddingston Loch.

Asplenium septentrionale Hull. Arthur's Seat.

Polypodium Phegopteris L. Tynehead, Habbie's Howe, Auchendinny.

P. Dryopteris L. Tynehead, Auchendinny.

XVII.—*THE DIATOMS OF LINLITHGOW LOCH.*

By Mr JOHN LINDSAY.

(*Read May 25, 1887.*)

At the Society's excursion to Linlithgow on the 30th ult., it occurred to some of the members of the Biological Section that a few samples of water from the loch might be taken, to be afterwards examined under the microscope. It was believed that a number of very interesting forms of "low life" were present in this loch: indeed, a few years ago Mr Pearcey, of the Challenger Commission, made an investigation on this

point, more particularly of the Ostracoda, from dredgings furnished by the son of the late Prof. Sir Wyville Thomson, when fourteen species of crustaceans alone were found, besides several other minute forms. It is well known, however, that "pond life" is very capricious, some species being found at one time in great abundance, while at another these may be almost entirely absent, and their place filled by others, and this altogether irrespective of the season of the year. It was therefore determined to take some samples from the loch, and a few bottles were filled from a boat in shallow water,—taking care to include not only some of the mud or ooze, but also submerged plants which had rusty-brown parasitic growths on them, as these growths were in all probability diatomaceous in character. When examined afterwards under the microscope, many beautiful specimens of Rotifera and Vorticellæ were observed, besides entomostraca, amœbæ, and numerous diatoms. Unfortunately, after a few days most of these interesting organisms began to disappear, probably for want of proper nourishment, or because of the small quantity of water in which they had been gathered; and by-and-by little or nothing was left but the indestructible siliceous frustules of the diatoms which had been seen shortly before under the microscope in the living state, moving through the water. It was therefore determined to secure these frustules, so as to preserve them in a permanent form; and Messrs Pearcey and Rattray kindly lent their valuable aid in preparing and naming the specimens. The result is, that to-night no fewer than twenty-three named forms are shown under the microscope, while there are several others which have not yet been identified. The full list is appended, showing that Gomphonema is represented by five species and varieties; Navicula by four; Cymbella, Diatoma, Fragilaria, and Synedra by two each; while other forms of fresh-water diatoms are also present, including the beautiful star-shaped Asterionella formosa. These diatoms are all, of course, very minute, requiring a high power of the microscope in order to examine them—fresh-water forms, as a rule, being smaller than those found in salt water. Additional species and varieties of diatoms are doubtless present in the loch, and those members who turn their attention to this subject are recommended to make further investigations, as opportunity offers.

The following is the list of diatoms now exhibited:—

Achnanthes exilis, Kütz.	Gomphonema olivaceum, var. vul-
Asterionella formosa, Hassal.	garis, Grun.
Cocconeis placentula, Ehr.	" olivaceum, var. sub-
Cymbella cistula, Hempr.	ramosum, Kütz.
" cistula maculata, Kütz.	Melosira, sp.
Diatoma elongatum, Ag.	Navicula gracilis, Ehr., var.
" vulgare, Bory.	" major, Kütz.
Encyonema ventricosum, Kütz., var.	" pelliculosa, Hilse.
minuta, Van Heurck.	" sp. (apparently similar to
Fragilaria mutabilis, var. elliptica,	the unnamed form figured by
Schum.	Schmidt (pl. 47, fig. 22) from near
" virescens, Ralfs.	York).
Gomphonema capitatum, Ehr.	Synedra ulna, var. danica, Kütz.
" dichotomum, Kütz.	" ulna, var. vitrea, Kütz.
" olivaceum, Ehr.	Tabellaria fenestrata, Kütz.

At this meeting Mr Hugh Fraser made some remarks on the subject of "Fasciation," as found more particularly in the Ash, exhibiting at the same time several interesting examples of this curious abnormal growth. Mr A. Frazer also exhibited and described certain objectives constructed by Mr Edward Swift of London. The lenses were submitted to the Society on the ground that they combined high quality with moderation in price. The objectives submitted were of $\frac{1}{2}$ -inch and $\frac{1}{8}$ -inch focus, and an immersion (water) objective of $\frac{1}{15}$ -inch focus. The last mentioned lens cost but £3, 15s., and the others were equally moderate in price. At the close of the meeting an opportunity was given of examining the lenses.

XVIII.—GROUSE DISEASE.

BY MR TOM SPEEDY.

(Read June 22, 1887.)

FROM the interest taken in grouse disease by all sportsmen and naturalists, it has occurred to me that a paper on this subject might not be unacceptable to the members of this Society. I confess to be one of those who regard these period-

ical outbreaks of disease among the grouse with concern. For the last quarter of a century I have been interested in studying the haunts, habits, and peculiarities of all kinds of game in Scotland, as well as the ravages of this malignant distemper among grouse. I therefore propose to deal shortly with the history and origin of the grouse disease, and to add a few words in the way of suggesting a remedy for it.

First, as to the *history* of the disease. It is difficult to say when this dreaded malady first made its appearance, but so early as in the 'Sporting Magazine' for October 1817, a paragraph appeared stating that "an extraordinary disease has lately spread more havoc among the grouse in the north of Scotland than the double-barrelled guns of the numerous sportsmen. The birds are found dead on the hills in great numbers, and in a state of extenuation, as if they had perished from hunger." It would be a mistake to suppose that the disease did not prevail prior to this period. Indeed it may have exhibited itself centuries before. This is by no means improbable, in view of the considerations that the value of grouse and grouse moors was then of little account, and that the means of disseminating information were at that time of a meagre kind. Be that as it may, it is now a matter of history that since the time referred to there have been periodic visitations of the epidemic, and, though differing in many respects, it is similar in this, that it is generally fatal in its character. In 1838 the disease attracted considerable attention south of the Forth, proving specially virulent in Lanarkshire and on the western extremities of the Pentland range. Again, in 1867, there was a more widespread visitation, the malignant and destructive character of which stimulated an inquiry into its nature and causes; but, like all subsequent investigations, this one was without any practical result, in so far as the remote or originating cause of the distemper was concerned. The next serious recurrence of the epidemic was in 1873. In the preceding year grouse were exceptionally numerous, but so fatal was the visitation that whole tracts of country were swept by the plague. The first time the disease obtruded itself upon my personal attention was in 1867, in that wild and mountainous tract of moorland between Blair Athole and Kingussie. On that occasion it proved alarmingly fatal, sweeping whole mountain ranges as

if by a fiery scourge, leaving few parts of the country unscathed by its desolating influence. For virulence and prevalence in all parts of Scotland, the grouse disease of that year was quite unprecedented; and whether it was a new kind of disease, or the former disease in a more aggravated shape, competent scientific authorities were divided in opinion. In previous attacks the birds were all externally wasted and "draggled," as if they had been starved to death; and a characteristic of the disease was the plucked appearance about the eyes and legs,—grouse in a healthy state being feathered to the claws. I must confess my inability to explain why, on their being smitten with disease, the legs should so speedily become denuded of feathers.

Second, as to the *origin* of the disease. Though I have read almost every article that has been written upon this subject, and spared no amount of effort to ascertain the originating cause of this dire calamity, I must confess that I am as yet ignorant of its primary origin. Notwithstanding the several conflicting theories that have, from time to time, been dogmatically submitted, and the pretentious claims of self-confident discoverers of the cause of the malady under discussion, I am persuaded that those remote forces, or germs, which *first* assail the healthy bird, are up to the present hour a profound mystery. What may be the results of the experiments and investigations undertaken by M. Pasteur I shall not anticipate; but if he shall be able to solve this mysterious problem, he, with the Editor of 'Land and Water,' will have earned the gratitude, not merely of naturalists and sportsmen, but of the entire community. There are those superficial thinkers who direct attention to the parasites which are found in incredible numbers in diseased grouse, and who triumphantly point to these as the cause of death. More recent discoverers point to the unhealthy condition of the blood, and affirm this to be the cause of death. But why those parasites? and why that condition of the blood? are questions which press for solution, in the absence of which we have no explanation worthy of the name. The eating of frosted heather, overstocking, the disturbance of the balance of nature, wet seasons, dry seasons, feeding on corn in late harvests, and the outrageous theory of the grouse picking up lead pellets on heavily-shot moors, are each in their turn sub-

mitted as the cause of those internal and diseased conditions of the grouse, but any evidence we have in support of these theories is absolutely *nil*.

The first of these supposed causes of the grouse disease, that of eating frosted heather, is so prominently and plausibly urged that it calls for a passing notice. It is argued by those who advocate this theory that on those moors where burning is not practised the heather becomes old and "fashionless," and when subjected to the frost, lacks nutriment, and is thus responsible for lowering the vitality of the birds. This theory is invested with a reasonableness which doubtless accounts for its being by many readily accepted; but a close examination of facts and conditions disposes of it in common with the others I have referred to. Some years ago I found the disease exceptionally fatal in Tweedsmuir, where rank old heather was very rare, and where young fresh heather was abundant. This in itself was sufficient to shake my faith in the frosted heather theory. The accuracy of my convictions has very recently received confirmation. A few days ago I made a tour of investigation along the base of the Pentlands. Last year I knew the grouse to be very plentiful, more especially along that watershed where the river Lyne takes its rise. I know few moors that have been more extensively burned, and where young fresh heather is more abundant. What, then, are the facts amid such conditions? There are few places where the disease has been more general, and more fatal in its consequences. Diseased birds were found in incredible numbers dead by the water-courses, one shepherd having observed that during his lifetime he had seen many visitations of the grouse disease, but in no case did he ever see anything approaching to it for malignity than during the present season. On asking him if the disease still continued, he replied that during the last week or two it appeared to have ceased, but it was only after the birds had disappeared! Another shepherd in the same district informed me that although on the moors daily, he had only seen one young bird during the entire season. It would be difficult to find a more conclusive reply to the advocates of the "frosted heather" theory than is here presented.

Had time permitted, I would have referred somewhat in detail to those other theories mentioned, although less reason-

able and important. Any one present interested in any of these, will find them discussed and disposed of in my recent work on sport and natural history. Setting aside all these theories as most unsatisfactory, personally I cannot divest my mind of the notion that the cause of this mysterious epidemic is largely atmospheric, and pertains to a class of diseases in the animal and vegetable world which have as yet baffled the researches of the most skilled scientific investigators. May it not reasonably be supposed that there is an affinity—not in the nature, but in the unseen causes in which the cattle plague may originate? Mark, I do not say so; but surely the supposition is admissible. I can remember a number of beautiful cows, belonging to my friend and neighbour, Mr Jack, of Liberton, which I often admired as they grazed in an adjoining park. After having one evening had them shut up in his byres, he retired to rest, but on the following morning he discovered that during the night the place had been visited by a destroying angel, and in little more than a week thirty-four out of thirty-five cows succumbed to the insidious malady. Similar attacks have manifested themselves in the vegetable world. Those of you who have lived in the country must have seen and admired the growth of a field of potatoes, few things being more beautiful when in full bloom. Everything indicates an excellent crop, and the farmer's prospects look bright. Without warning, however, "like a thief in the night," a mysterious agent visits the field, and in the morning it is discovered that the entire crop has been smitten with disease, leaving them blackened, and with an odour which is most offensive. Here, I ask, if the originating forces—spores, germs, or call them what you will—are not present in the atmosphere, where are they? Mr Jack, just referred to, informed me that both his father and his father-in-law were victims to cholera at Cambuslang about thirty years ago, and that the development of the disease was striking in its resemblance to that which proved so fatal among his cows.

As already indicated, I have given considerable attention to the subject in hand, and have, in conjunction with competent professional authorities, dissected scores of grouse, old as well as young, in all stages of this fatal epidemic. Since the present outbreak of the malady, I have had specimens sent me from

different parts of the southern counties, and I was interested to note that in some districts cocks seemed to suffer more than hens, and in others exactly the opposite. A gentleman from Peeblesshire writes, "Is it not singular that no cocks have been found dead? One old cock last week remained beside his dead mate a whole day, strutting round and near her, and evidently doing his best to attract her attention." With the same post I received a letter from a gamekeeper in Lanarkshire, who stated, "The grouse are dying here thick and fast. They are generally about burn-sides, and mostly old cocks." Receiving numerous similar statements, and getting specimens forwarded from different parts, I subjected them to a searching examination. The result only corroborated the examinations of previous years, no new facts being elicited. At the same time, I received specimens of healthy birds from Mr Campbell, gamekeeper to A. J. Balfour, Esq., in Strathconan forest, in Ross-shire, and specimens of diseased ones sent alive from Mr Stewart, gamekeeper to Sir Edward Colebrook, Abington, Lanarkshire, for purposes of comparison. The internal organs of the healthy and diseased birds corresponded in all particulars, with the exception of the intestines. In the healthy birds I found both *strongyli* and *tænia calva*, though in very limited numbers, and from which they seemed in no way to suffer. The diseased birds were externally of a wasted and emaciated appearance, and as bare about the legs as a plover, with the breast-bone almost cutting the skin. Only a few *tænia calva* were to be seen; but I discovered millions of *strongyli* in the *cæcum*, and which would undoubtedly have caused death in a short time had the birds not been killed. On examining some specimens forwarded from Ayrshire, I found them plump and fat, perfect and beautiful in their plumage, and feathered down to the very claws. In them I discovered that death was traceable to parts of the bowel being literally packed with *tænia calva*, and being so inflamed as to constitute a species of gangrene around this loathsome parasite. I have here an illustration which proves beyond question that the immediate cause of death was that which I have indicated. Here, also, are a large number—millions I should say—of *strongle* taken from the *cæcum* of an emaciated grouse. I am, therefore, of opinion that the mortality of plump fat birds is caused by *tænia calva*, and in thin ema-

ciated birds by *strongylus pergracelus*; but in view of both being found in healthy birds from Ross-shire, where disease has not been seen for years, we are forced to the conclusion that they are the natural parasite of the grouse. Why, then, should they cause death? Simply by a lowering of the vitality by some occult cause: the birds become weakened, the tone of their digestive organs and intestines lowered, and the internal action of the organisms is finally arrested. In such circumstances, it is apparent that increased mortality is inevitable. Looking back upon these investigations, it is a significant fact that it is only in connection with the digestive organs that any departure is found from the condition of health, and in this respect the grouse disease clearly shows its affinity to those diseases formerly referred to.

What can be done for the preservation of the grouse from this subtle distemper, is the question which presses itself upon the attention of all sportsmen and naturalists. While it may be impossible altogether to avert the malady, I feel sanguine that it might be modified. By a change of stock all over the country, there is no doubt that the general health of the birds would be vastly improved, and one of those forces in nature—viz., close breeding, which invariably tends to the deterioration of the species, would be counteracted, and an impulse given to the healthy and vigorous development of the stock. Were keepers to attend to this by a fair exchange of eggs and young birds from one district of the country to another at a considerable distance, I feel assured they would be amply repaid. This suggestion is no merely speculative proposal. It is an experiment which has been repeatedly acted upon by the Duke of Hamilton in transferring grouse from his Lanarkshire moors to the Island of Arran, with the best possible results.

At this meeting Mr A. Frazer, M.A., read a short communication from Mr John Turnbull, Galashiels, describing his process of taking photo-micrographs. It was explained that Mr Turnbull's apparatus consisted only of his microscope and a packing-case, and that by these appliances he was able to produce excellent photo-micrographs. Some specimens of Mr Turnbull's work were exhibited, and were much admired by the members present.

MEETINGS OF MICROSCOPIC SECTION.

THE Microscopic Section has now been put on a more firm basis than heretofore, with a Secretary and two Assistant Secretaries as office-bearers. For the past Session these were: Mr A. Frazer, M.A., Secretary; Mr J. Lindsay, Assistant Secretary, Biological department; and Mr J. D. Murray, Assistant Secretary, Optical department. The Session was opened by a Business Meeting, when office-bearers were appointed and the course of study for the Session was mapped out; and it was closed by a General Meeting of both departments, when the work done throughout the Session was reviewed, suggestions were made for future operations, and a statement as to funds was given in. The bi-monthly Journal of the Royal Microscopical Society is now also provided for the use of the members, and it is hoped that similar publications may be added as funds increase.

The meetings of the Optical department were held fortnightly during the Session, and had an average attendance of about twenty—the meetings taking place in the Society's room. The subjects chiefly considered were: Achromatic Condensers, Angular Aperture of Objectives, and the Polarisation of Light. Attention was also given to the phenomena of light. The meetings were, for the most part, of a conversational character, but papers were also read, explanatory of the subjects above mentioned, by Messrs Murray, Forgan, Penman, and A. Frazer.

The meetings of the Biological department were also held at intervals of a fortnight throughout the Session, when demonstrations of a practical nature were given. The subjects taken up were the following: The Structure of Insectivorous Plants, by Dr J. M. Macfarlane (two demonstrations); the Mounting of Marine Algæ, by Mr J. Allan (two demonstrations); the Mounting of Fresh-water Algæ, by Mr J. Terras; the Preparation and Mounting of Crystals, by Mr W. Penman; the Collecting and Mounting of Foraminifera, by Mr F. G. Pearcey; the Mounting of Animal Tissues in Glycerine-and-water, by Mr A. Moffat; the Hardening and Cutting of Animal Sections, by Mr A. Frazer; the Cutting, Staining, and Mounting of Vegetable Sections, by Mr J. Lindsay; and the Preparation and

Mounting of Mineral Sections, by Mr J. A. Johnston. The Society's room at 20 George Street was inconveniently crowded at most of these meetings, and the use of a larger room has been kindly granted, where the meetings of both departments will be held next Session.

A few of the members of the Microscopic Section contributed to the monthly meetings of the Society various exhibits of Microscopic apparatus and preparations; and two interesting papers, on subjects connected with Microscopy, by Messrs Penman and Forgan, are printed *in extenso* in the Society's 'Transactions' for the present Session (*ante*, pp. 21, 56).

The Annual Conversazione, which took place in the Freemason's Hall on March 29, partook largely, as in former years, of the character of a Natural History and Microscopic exhibition. The exhibits were numerous and varied, illustrating nearly every department of Natural History; while about seventy microscopes were placed, under which were shown a most interesting series of preparations, including animal and vegetable tissues, fungi, crystals, minerals, insect parts, diatoms, foraminifera, &c. These were examined by the large company present with keen enjoyment. As on a former occasion, the Albany Orchestral Society kindly supplied the music, aided by Messrs Chumley and Campbell.

ANNUAL BUSINESS MEETING.

THE Annual Business Meeting of the Society was held in the Hall, 20 George Street, on the evening of the 26th October 1887,—Mr Herbert, ex-President, in the Chair. From the Report submitted by the Secretary, it appeared that in all 27 meetings had been held during the past Session, 10 of these being indoor meetings,¹ and 17 field meetings. The following list gives the dates and localities of these meetings, viz.:—

INDOOR MEETINGS: (1) *Annual Meeting*—Oct. 22, 1886.
(2) *Ordinary Evening Meetings*, 1886—Nov. 24, Dec. 22;

¹ This does not include the meetings of the Microscopic Section, which are recorded separately, *ante*, p. 89.

1887—Jan. 26, Feb. 23, March 23, April 27, May 25, June 22. (3) *Annual Conversazione*—March 29, 1887.

FIELD MEETINGS, 1887: April 30, Linlithgow—Palace and Church; May 7, Polton to Roslin; May 14, North Berwick; May 21, Dunfermline; May 28, Crichton; June 1, Arthur Seat; June 11, Driving Excursion to Moorfoots; June 15, Visit to Pilrig Park Nursery; June 18, West Linton; June 25, Gosford; June 29, Duddingston Loch; July 2, Driving Excursion to Carlops; July 9, Dredging Excursion; July 13, Visit to Leith Walk Nursery; July 16, Haddington; July 23, Balerno; Oct. 1, Fungus Foray in Roslin Glen.

The Treasurer's Statement showed that, including a balance from last account, the income had been £83, and the expenditure £66, 11s. 3d., leaving a balance in favour of the Club of £16, 8s. 9d.

The election of Office-bearers was next proceeded with, when, after the vacancies were filled up, the complete list stood as under:—

President.—SYMINGTON GRIEVE.

Vice-Presidents.

ALEX. FRAZER, M.A. | GEORGE BIRD. | ROBERT STEWART, S.S.C.

Council.

WILLIAM FORGAN.		JOHN ALLAN.		Dr J. M. MACFARLANE.
WILLIAM BONNAR.		J. D. MURRAY.		JAMES TERRAS.
JOHN HENDERSON.		JOHN LINDSAY.		F. G. PEARCEY.
A. B. STEELE.		WM. PENMAN.		WILLIAM COATS.

Secretary and Treasurer.—ANDREW MOFFAT.

Auditors.—HUGH H. PILLANS; JOHN PAIRMAN, S.S.C.

During the past Session 40 names have been withdrawn from the roll, and 51 new names added, making a net increase of 11, and giving a total roll of ordinary members at the close of Session 1886-87 of 232.

Although the Society's field meetings have been on the whole always well attended, there was a marked increase at the meetings during 1887. A new feature of the field meetings was the Driving Excursions, of which there were two, both of them numerously attended. More attention was paid, also, to Archæology, four of the excursions having that subject

especially in view—viz.: Linlithgow, Crichton, Dunfermline, and Haddington. At Linlithgow, Mr John Lindsay read a paper giving a short account of the Palace and of St Michael's Church; at Crichton, Mr T. A. D. Wood, F.S.A.Scot., gave some notes on the history of the Castle; at Dunfermline, the party were met by Mr Geo. Robertson, F.S.A.Scot., Custodian of the Abbey, who explained the various features of the buildings; and at Haddington, Dr Brown and Mr Wm. Davie, of Haddington, conducted the party over the various antiquities of the town.

6 JUN 1889



LIST OF PAST PRESIDENTS.

Dr ROBT. BROWN, 1869. Mr R. SCOT SKIRVING, 1869-1874. Mr WM. GORRIE } 1874-1877. (deceased)		Rev. R. F. COLVIN, 1877-1879. Mr JOHN WALCOT, 1879-1882. Mr A. B. HERBERT, 1882-1885. Mr SYMINGTON GRIEVE, 1885-1887.
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OFFICE-BEARERS, 1887-88.

President.

SYMINGTON GRIEVE.

Vice-Presidents.

ALEXANDER FRAZER, M.A. | ROBERT STEWART, S.S.C.
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Council.

WILLIAM FORGAN.
 WILLIAM BONNAR.
 JOHN HENDERSON.
 A. B. STEELE.
 JOHN ALLAN.
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JOHN LINDSAY.
 WM. PENMAN.
 DR J. M. MACFARLANE.
 JAMES TERRAS.
 F. G. PEARCEY.
 WILLIAM COATS.

Joint-Editors of 'Transactions.'

ANDREW MOFFAT, JOHN LINDSAY.

Secretary and Treasurer.

ANDREW MOFFAT.

Auditors.

HUGH H. PILLANS; JOHN PAIRMAN, S.S.C.

LIST OF MEMBERS, 1886-87.

Original Members marked thus.*

Honorary Members.

BROWN, ROBERT, Ph.D., F.L.S., London.
 GRIEVE, DAVID, F.R.S.E., 1 Lockharton Gardens, Slateford.
 HENDERSON, Prof. JOHN R., M.B., C.M., The College, Madras.

Corresponding Members.

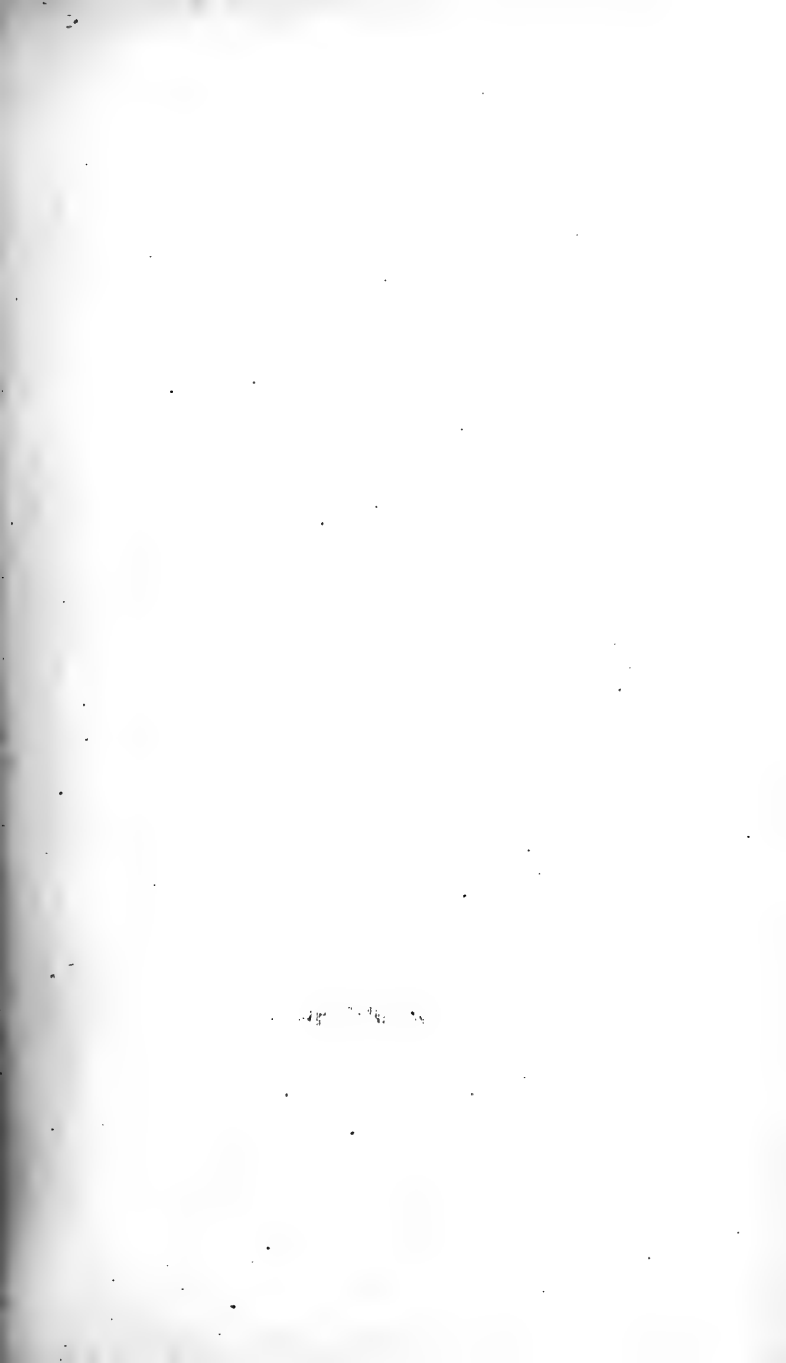
ARCHIBALD, STEWART, Carroch, Kirriemuir.
 BROTHERSTON, ANDREW, Kelso.
 CRUICKSHANK, T. M., South Ronaldshay.
 HOBKIRK, CHARLES P., Huddersfield.
 HOSSACK, B. H., Craigie Field, Kirkwall.
 THOMSON, JOHN, Stobo.

Ordinary Members.

- Adam, James, Comely Park, Dunfermline.
 Adams, William, Royal Bank, St Andrew Square.
 Aitken, D. Percy, 5 Grosvenor Cres.
 Alexander, Robert, 9 Montrose Ter.
 Allan, John, 15 Rosefield Avenue, Portobello.
 Amooore, J. S., 7 Abercromby Place.
 Anderson, G. R., 33 Howard Place.
 Archibald, Jas., 13 Clifton Terrace.
 Arthur, Charles, Royal Infirmary.
 10 Aytton, Alex., 43 N. Bruntsfield Pl.
 Barbour, T. F., Chemical Laboratory, University.
 Bashford, W. T., Argyle House, Portobello.
 Bathgate, John, 8 Wardie Avenue.
 Bird, George, 24 Queen Street.
 Black, William, S.S.C., 3 Hill St.
 Boa, Peter, 119 George Street.
 Bonnar, Wm., 54 Castle Street.
 Brodie, J. A., Bonnington Iron Foundry, Leith.
 Brotherston, G. M., 18 St John Street.
 20 Brown, George L., Millburn House, Morningside.
 Brown, R. Smith, 5 Marchmont Ter.
 Brown, Thos., 1 Gillespie Street.
 Bryden, Mrs, 72 Great King Street.
 Bryden, Miss, 72 Great King Street.
 Burn, C. M. P., Prestonfield House.
 Cairns, Wm. M'Gregor, 16 South Charlotte Street.
 Carter, A. E. J., 9 Argyle Crescent, Portobello.
 Carter, Wm. Allan, M. Inst. C.E., 5 St Andrew Square.
 Clapperton, Mrs Wm., 9 Strathearn Road.
 30 Clark, Alex., S.S.C., 80A Princes St.
 Clark, William, Greenside Cottage.
 Coats, William, 21 Nelson Street.
 *Colvin, Rev. R. F., 50 Ann Street.
 Cooper, James, 31 Howe Street.
 Cotton, Miss Maria, 26 Mayfield Ter.
 Cowan, Alfred, 19 Rutland Square.
 Cowan, Charles Wm., Valleyfield, Penicuik.
 Coyne, R. A. F. A., 21 Archibald Pl.
 Craig, Archibald, jun., 16 Blacket Place.
 40 Crawford, Wm. C., M.A., 1 Lockharton Gardens, Slateford.
 Crichton, George, 30 Restalrig Terrace.
 Dickson, Professor Alexander, M.D., F.R.S.E., F.L.S., 11 Royal Circus.
 Dobbin, Leonard, Ph.D., F.R.S.E., 4 Cobden Road.
 Dobbin, Mrs Leonard, 4 Cobden Road.
 Dowell, Mrs, 13 Palmerston Place.
 Dowell, Miss, 13 Palmerston Place.
 Duncan, Esdaile, Dean Public School.
 Dundas, George, 10 Grosvenor Crescent.
 Eld, Thos. W., 50 South Bruntsfield Place.
 50 Elliot, G. F. Scott, M.A., Royal Botanic Garden.
 Ewart, James, 1 Dundas Street.
 Farquharson, Miss, Roseville, St Catherine's Place, Grange.
 Farquharson, Thos. Ker, Roseville, St Catherine's Place, Grange.
 Ferguson, John, 15 Brighton Place, Portobello.
 Forbes, Miss Mary, 5 Brunstane Road, Joppa.
 Forgan, William, 3 Warriston Cres.
 Foulis, James, M.D., 34 Heriot Row.
 Fraser, Dr Angus, 232 Union Street, Aberdeen.
 Fraser, Charles, 13 Greenhill Place.
 60 Fraser, Mrs, 13 Greenhill Place.
 Fraser, Hugh, Leith Walk Nurseries.
 *Fraser, P. Neill, Rockville, Murrayfield.
 Frazer, Alex., M.A., 7 Lothian St.
 Galloway, James, St Fillans, Trinity.
 Gibb, Philip B., M.A., 14 Picardy Place.
 Gilchrist, James, 17 Manor Place.
 Gloag, David, 9 Barnton Terrace.
 Gordon, James, Royal Institution, Mound.
 Gray, Arch.
 70 Gray, Jos. T., M.A., Parkside.
 Gray, Mrs Robert.

- Grieve, Miss Amelia, Salisbury View, Dalkeith Road.
- Grieve, Somerville, Salisbury View, Dalkeith Road.
- Grieve, Symington, 1 Burgess Terrace.
- Grieve, Mrs Symington, 1 Burgess Terrace.
- Grosert, Robert, So. Oswald Road.
- Groves, Charles H., M.D., 36 Inverleith Row.
- Guthrie, Mrs, Almora, Liberton.
- Hardie, William, 49 Morningside Road.
- 80 Hart, James, M.A., Dean Public School.
- Hately, W., 12 Bruntsfield Place.
- Heggie, John, 1 Greenbank Terrace.
- Henderson, John, 21 Nicolson Sq.
- Henderson, Miss Jessie, 17 W. Preston Street.
- Henderson, Mrs, 6 Carlton Terrace.
- Henderson, Miss, 6 Carlton Terrace.
- Herbert, A. B., 13 Polwarth Terrace.
- Hoyle, W. E., M.A., M.R.C.S., F.R.S.E., 8 Kilmaurs Road.
- Hume, William, 1 Lothian Street.
- 90 Hunter, James, 7 Melgund Terrace.
- Hurry, Miss, 56 India Street.
- Hutchison, Robert, F.R.S.E., 29 Chester Street.
- Inches, Miss Ella M., 10 Broughton Place.
- Jamieson, P., Natural History Laboratory, University.
- Jenner, Charles, F.R.S.E., Easter Duddingston Lodge.
- Johnstone, Alex., 38 Lady Menzies Place.
- Johnstone, J. A., 30 Haddington Pl.
- Johnstone, Miss Annie, Eskhill, Roslin.
- Keith, Sydney, 69 So. Clerk Street.
- 100 Keith, Miss Catherine, 16 Mentone Terrace.
- Kennedy, Adam, 63 Haymarket Ter.
- Key, Rev. D. Ritchie, M.A., 17 Elm Row.
- Kilgour, Thos. W., 4 East Brighton Crescent, Portobello.
- King, J. Falconer, Minto House.
- King, Mark, 120 Pitt Street, Leith.
- Knight, Donald, 33 Regent Place.
- Kynoch, Miss, 2 Darnaway Street.
- Laing, Jas. H. W., M.A., B.Sc., 105 Warrender Park Road.
- Laughton, Wm., So. Darenth, Kent.
- 110 Law, Mrs John, 41 Heriot Row.
- Lee, William, 15 Craiglea Drive.
- Lennie, Joseph C., 25 Gayfield Sq.
- Lewis, David, 32 Findhorn Place.
- Ligertwood, George C., M.A., 9 Spot-tiswoode Street.
- Lindsay, John, 43 James St., Pilrig.
- Livingstone, Matthew, 108 Gilmore Place.
- Lockie, John, C.E., 39 Restalrig Ter.
- Lorimer, Miss, 16 Mayfield Terrace.
- MacAdam, W. Ivison, F.C.S., F.I.C., Surgeons' Hall.
- 120 M'Bride, James, 31 Buccleuch Pl.
- M'Craith, Miss, 26 Haddington Pl.
- MacDougall, W., Woodburn, Morningside.
- Macfarlane, J. M., D.Sc., F.R.S.E., 1 Wardie Avenue.
- M'Glashan, D., 12 West End Place.
- M'Glashen, Robert L., 1 Brandon St.
- M'Intosh, James, 42 Queen Street.
- Mackay, Miss, 69 Northumberland Street.
- M'Laren, J. R., M.A., 9 Gt. King Street.
- M'Kean, James, 3 Warrender Park Terrace.
- 130 M'Kean, Miss J., 1 Inverleith Ter.
- M'Kean, Miss Minnie, 1 Inverleith Terrace.
- M'Kechnie, Campbell, 60 Northumberland Street.
- Macpherson, C. E. W., C.A., 28 St Andrew Square.
- Macpherson, John C., 3 Warrender Park Terrace.
- Marshall, Hugh, B.Sc., 1 Lorne Ter.
- Marshall, Ralph, 1 Lorne Terrace.
- Maxwell, Graham, Royal Botanic Garden.
- Melvin, Alex., 40 Warrender Park Road.
- Methven, John, 6 Bellevue Crescent
- 140 Millar, R. C., C.A., 8 Broughton Pl.
- Millar, Miss Isabella, 8 Broughton Pl.
- Millar, Thos. John, 8 Broughton Pl.
- Miller, Rev. Robert, M.A., 15 Thirlstane Road, East.
- Miller, R. K., 13 Lennox Street.
- Miller, Peter, 8 Bellevue Terrace.
- Moffat, Andrew, 5 Scone Gardens.
- Morham, Robert, 2 Bright Crescent.
- Muir, John, 115 Warrender Park Road.

- Murray, Chas. G., 68 Haymarket Ter.
- 150 Murray, J. D., 68 Haymarket Ter.
Murray, Wm., 8 Clifton Terrace.
Neill, John, 3 Sylvan Place.
Nelson, W. F., Salisbury Green.
Nesbit, John, 162 High Street,
Portobello.
Nisbet, Miss, 28 E. Claremont St.
Norfor, Robt. T., C.A., 47 So.
Bruntsfield Place.
Ogilvie, Miss, 18 Buckingham Ter.
Oliphant, J. C., M.A., 23 Charlotte
Square.
Oliver, G. E., 4 Mostyn Terrace.
- 160 Oliver, John S., 12 Greenhill Park.
Pairman, John, S.S.C., 50 George St.
Paton, Henry, 15 Myrtle Terrace.
Patterson, J. C., 6 Mentone Terrace.
Peacock, Alex., 9 M'Laren Road.
Peacock, Miss, 9 M'Laren Road.
Peacock, Thomas R., 9 M'Laren Rd.
Pearcey, F. G., 37 Raeburn Place.
Penman, Wm., 8 Lauriston Park.
Philip, James, 5 Argyle Place.
- 170 Pillans, Hugh H., 12 Dryden Place.
Pillans, Miss, 12 Dryden Place.
Purves, Samuel, 70 Haymarket Ter.
Ranken, William, 11 Spence Street.
Reid, Andrew, 2 Lixmount Terrace,
Trinity.
Richardson, A. D., Royal Botanic
Garden.
Robertson, C. F., 54 Blacket Place.
Robertson, George, Lothian Road
Public School.
Sanderson, Dr Alfred, Lixmount,
Trinity.
Saxby, Charlie, 15 St Leonard's
Bank.
- 180 Semple, Andrew, Deputy Surgeon
General H. M. S., Caledonian
United Service Club.
Shaw, John O., Beauly, Victoria Park,
Trinity.
Simpson, James, 4 Middlefield, Leith
Walk.
Skinner, Jas., S.S.C., 14 Frederick St.
*Skirving, R. Scot, 29 Drummond Pl.
Smith, Miss, 34 Dublin Street.
Smith, Mrs Geo., 25 East Claremont
Street.
Smith, Walter A., Falcon Lodge,
Murrayfield.
Somerville, Alex., B.Sc., F.L.S., 34
Granby Ter., Hillhead, Glasgow.
Speedy, Tom, The Inch, Liberton.
- 190 Sprague, T. B., M.A., F.R.S.E., 29
Buckingham Terrace.
Sprague, Mrs T. B., 29 Buckingham
Terrace.
Steele, Adam B., 10 Comely Bank.
Steele, Miss, 16 Upper Gray Street.
Stewart, James R., 10 Salisbury Rd.
Stewart, Miss, 53 Lothian Street.
Stewart, Robert, S.S.C., 21 Warris-
ton Crescent
Storrie, James, 5 Bowhill Terrace.
Summers, Miss Maggie, 32 Craig-
millar Park.
Sutherland, John, 4 Caledonian Rd.
- 200 Tait, John, Lochend Road Public
School
Tait, John Scott, C.A., 8 Claremont
Terrace.
Taylor, William, M.D., 12 Melville
Street.
Terras, James, 34 Findhorn Place.
Thomson, Mrs, 6A Bruntsfield Place.
Torrie, Robert, 198 Bonnington
Road, Leith.
Turnbull, George, 16 Thistle Street.
Turnbull, J. M., 6 Rose Street.
Turner, Daniel, S.L., 24 George St.
Usher, Andrew, Blackford House.
- 210 Walcot, John, 50 Northumberland
Street.
Walker, David, 2 Bellevue Terrace.
Walker, Wm. F., 5 Restalrig Ter.
Wallace, William, Jessfield Terrace,
Newhaven Road.
Wardlaw, Geo., 14 St John's Hill.
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Watson, Mrs, 49 Grange Road.
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- 220 Williams, Caradoc, 4c Pilrig Street.
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Wilson, James T., Restalrig House
Wilson, Miss Helen, 1 Lennox St.
Wilson, Miss Katie, 2 Archibald Pl.
Wood, Alex., 4 Avondale Place.
Wood, T. A. D., Viewforth, Brun-
stane Road, Joppa.
Woodhead, Dr G. Sims, 6 Marchhall
Crescent.
Wright, Hilda, Ravensrood, Craig-
lockhart.
Wright, Thomas, 6 Greenside Place.
- 230 Young, David E., 22 Rosehall Ter.
Young, Mrs D. E., 22 Rosehall Ter.
Yule, Robert, 6 Mansfield Place.





TRANSACTIONS

OF

The Edinburgh Field Naturalists' and
Microscopical Society

SESSION 1887-88



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WILLIAM BLACKWOOD & SONS

MDCCCLXXXVIII





SPECIMEN OF GREAT AUK
(*Alca impennis* Linn.)

IN AMERICAN MUSEUM OF NATURAL HISTORY, CENTRAL PARK,
NEW YORK.

I.—*RECENT NOTES ON THE GREAT AUK OR
GAREFOWL (ALCA IMPENNIS LINN.)*

BY MR SYMINGTON GRIEVE, PRESIDENT.

(*Read Nov. 23, 1887.*)

I PRESUME you are all more or less acquainted with Great Auk history, and that none of you are under the belief I am about to address you regarding the sayings and doings of some Eastern potentate. It is not the first time that I have found persons who should have been better informed making such a mistake. They seemed determined to confound this poor bird with some ancient or modern human ruler, like the Great Mogul or the Khan of Khiva. However, in case there should be any one present who has forgotten the salient points of Great Auk history, I shall very briefly recapitulate some of its principal features, so as to present before your minds a few of the facts that make all that is known about this bird so interesting to every naturalist.

The Great Auks were large birds, and were good for food. They were so abundant at certain points on the coasts of the North Atlantic basin, that they attracted the attention of the early voyagers. Their wings were so small that they were unable to fly. At the nesting-season each year they landed in immense multitudes at the places at which they hatched their single egg, and fell an easy prey to such an enemy as man. The Great Auks may be said to have been stupid birds. They were not easily frightened, and allowed themselves to be massacred by the mariners, who knocked them over by striking them upon their heads with short sticks or clubs. At an island off the coast of Newfoundland, and probably at other places, they even permitted themselves to be driven across planks or sails stretched from the vessels to the shore. In this way such multitudes were captured that they

are described as having been got on board by the ton weight. The birds thus procured were salted down like herrings and packed in barrels, and formed for many years the staple food of the fishermen and others who visited the Newfoundland banks and explored the North American coasts. It may be admitted as a fact that, without the presence of the Great Auks, the explorations that led to the settlement of North America so quickly could not have been carried on, nor would the fisheries upon the banks of Newfoundland have been developed as they were. The Great Auk was also a British bird, and appears to have afforded food to our ancient inhabitants in much the same way that at a later date it supplied the wants of the voyagers to North America. The remnants of the Great Auk colonies, in sadly reduced numbers, lingered around the coasts of Britain and Iceland probably after the birds had disappeared from the coasts of North America. The final act in the drama, however, took place in the early days of June 1844, when what are believed to have been the last two Great Auks were killed upon a skerry called Eldey, off the south-west coast of Iceland. The remains of this bird, exterminated by man within the memory of those now living, are so rare that they are among the most prized objects in natural history collections. The skins and eggs are worth many times their weight in gold, and the prices fetched at public sales have caused quite a flutter of excitement far outside scientific circles. It is therefore no unworthy object we have in view if we can place on record any information regarding the Great Auk; and it is with that intention I am about to address you to-night.

Most of you are aware that a book was published a little over two years ago, entitled 'The Great Auk or Garefowl; its History, Archæology, and Remains.' In those departments of Great Auk research of which it treats, it may claim to be pretty exhaustive; but perhaps the most important result of its publication has been, that it has called attention to matters connected with the Great Auk. This has led to accurate information being given by critics and others upon a number of points that might otherwise have remained unascertained. It is with a portion of this supplementary information that I intend to try to interest you. As it is desirable that I should

endeavour to treat the subject in as connected a form as possible, I intend first to refer to some matters in connection with

THE GREAT AUK OR GAREFOWL WHEN LIVING.

In my work on this bird already mentioned (p. 62), I refer to the last notice of the occurrence of the Great Auk in the north-east of England, and perhaps it may be interesting to give you the original reference, which occurs in 'The Natural History and Antiquities of Northumberland, and so much of the county of Durham as lies between the rivers Tyne and Tweed, commonly called North Bishoprick.' In two volumes, by John Wallis, A.M.: published in London, 1769. In vol. i. p. 340 is the following: "The Penguin, a curious and uncommon bird, was taken alive a few years ago in the island of Farn, and presented to the late John William Bacon, Esq. of Etherston, with whom it grew so tame and familiar that it would follow him with its body erect to be fed." You will observe that the name used in the above quotation for the Great Auk is the "Penguin," which was one of its most common names, especially on the shores of North America.

The capture of what are believed to have been the last two Great Auks took place at Eldey at the beginning of June 1844, and the dead birds were sent by Hansen, the purchaser, to Herr Möller, the apothecary at Reykjavik, to be skinned. In a note at p. 21 of my book, I quote a letter of Professor J. Steenstrup of Copenhagen, in which he says that "the only claim this person had to be called an apothecary was that he prepared skins." After my book was issued, the venerable professor wrote me saying he was sorry there had been a misunderstanding as to his meaning in the letter referred to, and he adds, "Certainly my friend Möller was a good apothecary in every sense, but he also skinned birds extremely well."

In the 'Memoirs of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass.,' vol. xiii.—"The Water-Birds of North America," by S. T. Baird, T. M. Brewer, and R. Ridgeway, issued in continuation of the publications of the Geological Survey of California, vol. ii. p. 471, published at Boston, U.S., 1884: Little, Brown, & Co.,—there is the following: "In a work on 'Newfoundland and its Missionaries,'

printed in Halifax by Dakin & Metcalf, and published at the Wesleyan Book-room in 1866, p. 64, the following reference is made to the Great Auk: 'Half a century ago the Penguin was very plenty. It is a handsome bird, about the size of a goose, with a coal-black head and back, a white belly, and a milk-white spot under the right eye. They cannot fly well, —their wings are more like fins. They have on their bodies short feathers and down. The Penguin is now but seldom seen: such destruction of the bird was made for the sake of its feathers, that it is now all but extinct.'” Mr George A. Boardman having seen the above paragraph, and meeting its author, questioned him more particularly about the Penguin, and obtained a few further details. At the time of his residence in Newfoundland he was a Methodist missionary stationed on the coast, not far from Funk or Fogo Island, between the years 1818 and 1823. “He saw the Penguin during the whole of his stay in the island in considerable numbers, and frequently lectured the inhabitants for their cruelty in destroying them merely for their feathers. It was quite common for the boys to keep them tied by the legs as pets.” The foregoing is a most interesting and important statement, and refers to a period (as far as the history of the Great Auk on the shores of Newfoundland is concerned) about which very little appears to have been recorded. If the statement can be thoroughly depended upon, the Great Auk must have been much more plentiful in the region referred to from 1818 to 1823 than we have hitherto been led to suppose. There are one or two inaccuracies in the above statements, such as the reference to the bird having a white spot over only the right eye, and the remark, “not far from Funk or Fogo Island”—Funk Island and Fogo Island being separate places, although not far from each other. From other references to be met with, it appears that the fishermen who lived on Fogo Island were in the habit of visiting Funk Island to obtain the Great Auk, so it is probable the missionary was located on Fogo Island, as there are no human beings resident on Funk Island, and it is only visited a few times each season.¹

¹ Since the foregoing was written, Mr Frederic A. Lucas of the United States National Museum, Washington, has contributed a paper to the American Ornithological Journal, 'The Auk,' vol. v. p. 278 (July 1888). At p. 279 he

We may now go on to consider

DOUBTFUL OCCURRENCES OF THE GREAT AUK.

It is generally admitted that the last thoroughly authentic occurrence of the Great Auk in Scotland was the capture of one at St Kilda in 1821. But there have been stories told that may be more or less authentic, pointing to the occurrence in Scottish waters of the Great Auk nearly twenty years later than the time of the above capture. I need not refer to those treated of in the book I have already mentioned, but may as well place on record an interesting account I have received, through the kindness of Henry Evans, Esq. of Jura Forest, island of Jura, regarding the supposed occurrence of a Great Auk upon Stack-an-Armin, one of the skerries of the St Kilda group.

The first communication I received from Mr Evans is dated "At sea, off St Kilda, 8th August 1885." He says:—

Having read your account of the Great Auk at St Kilda in the year 1821, I can now give you particulars of the occurrence of a second example of this bird about the year 1840, or a year or two later, also on the St Kilda group of islands. You may at first sight imagine two stories have been made out of one, because Donald M'Queen's name appears in each instance. However, I am satisfied such is not the case, and I think the enclosed particulars will also satisfy you. Donald M'Queen died in 1880, aged 73. I know his son Donald very well. I often go to St Kilda and have conversations with the inhabitants. The present Donald M'Queen can tell me nothing about the Great Auk of 1821, except that, as other St Kilda men also say, the old men there remember their fathers talking about that bird. But M'Queen says his father with two other men helped to catch a Gairfowl on Stack-an-Armin, off Borera, about forty years ago, —perhaps a trifle over forty years. They kept this bird, tied by the legs, alive for three days, and then killed it with a stick, thinking it was a witch. The bird was left to decay behind the little bothy built of stones half-way up Stack-an-Armin, where they stay fishing for a week or ten days at a visit. I have seen this bothy, and the men are to search for the bones. I entertain little hope of discovering them. I enclose details. There are but few flat ledges of rock near sea-level about the St Kilda

says, "There is a rumour that twenty years ago the Great Auk was still to be found on the Penguin Islands, in the mouth of Gros Water Bay, sixteen miles from Grady Harbour, a locality about 250 miles north of Cape Norman, N.F. Of course this is possible, but it seems hardly probable." In a note he adds, "For this report I am indebted to Mr William Sclater of St John's, N.F."

group of islands. I know every rock there, and I think it impossible St Kilda can ever have been a great breeding-place of the Great Auk.

The following are the details referred to above:—

The Great Auk at Borera, St Kilda, about 1840-43.

Lauchlan M'Kinnon, now aged 75, tells me that, with his father-in-law and Donald M'Queen, he caught and killed a Gairfowl on Stack-an-Armin. He dates the event at about forty years ago. Donald M'Queen's son also says it was about forty years ago, or perhaps a year or two more. Lauchlan M'Kinnon is the only survivor of the three men. I know him quite well: he appears as bright and sharp as any man in St Kilda. He recognised at once as the Gairfowl a picture of the Great Auk I showed him. He especially called attention to the little wings for so large a bird, and to the white spot on the side of the head, which he remembered was on the bird. He spoke much of the great bill the bird had, which he said it kept open very long and often, "as if it would never shut its bill again." He also put both hands to his sides, and said the bird was very fat and fleshy there. The three men were fowling on Stack-an-Armin isle, off Borera, St Kilda, when they found this bird, which they caught sleeping. They tied it by the legs behind the bothy on Stack-an-Armin, where they stay a week or ten days at a time fowling. They kept it alive for three days, then killed it with a stick, thinking it must be a witch. It was left to decay.

In answer to my further inquiries, Mr Evans wrote me from Jura Forest on 24th October 1885, as follows:—

I think it is hopeless to search for remains of the Great Auk killed on Stack-an-Armin about 1840, but I asked the natives to look. I shall not see them before June 1886, but you may be sure we shall get nothing there.

In August 1886 I wrote Mr Evans, asking him kindly to let me know the result of the search for the Great Auk bones, and he replied from Jura Forest on the 26th September following:—

The bones of the Great Auk could not be found—it was very unlikely. I heard more on the same subject, and it all confirms what I have already told you.

Mr Evans refers to Donald M'Queen, who died in 1880, aged 73, who caught the last undoubted Scotch Great Auk in 1821. An obituary notice of him, written by Mr J. Sands, appeared in the 'Glasgow Herald' of 14th June 1886.

At p. 69 of 'The Great Auk; its History, Archæology, and Remains,' reference is made to a Great Auk said to have been

shot by Herr Laurenz Brodtkorb, near Vardö, Varanger Fjord, East Finmark, in 1848. Professor Steenstrup, who first referred to this supposed occurrence of the Great Auk as far back as 1855, has no doubt in his own mind *that the bird was certainly not a Garefowl*, and he had much better opportunities at that comparatively recent period after its supposed observation to get accurate information. His opinion has also been shared by most subsequent writers. However, the following interesting statements, published by Professor Robert Collett of Christiania in his valuable paper, "Über *Alca impennis* in Norwegen,"—'Mittheilungen des Ornithologischen Vereins in Wien, 1884,' translated from German, are worth recording for English-reading students of alcine history. Professor R. Collett (referring to the statements made by Professor J. Steenstrup in his 'Bidrag til Geirfuglens Naturhistorie,' &c., 1885, p. 95, as well as Nilsson in his "Skandinaviens Fauna," 1858 ('Foglarne,' p. 571), and Professor William Blasius in his 'Über die letzten Vorkommnisse des Riesen-Alks,' 1881-82 and 1882-83, p. 97, "*Alca impennis*," &c.), says:—

I have, however, been placed in a position to give more accurate particulars regarding the specimen in question—particulars which, I trust, will place it beyond doubt *that there is here an actual and unimpeachable case of the appearance of the Garefowl,—perhaps of the last appearance of all.* I have obtained these particulars directly from the two gentlemen concerned in the case—namely, Herr Brodtkorb, who killed the bird, and Herr Nordvi, to whom we owe it that the fact was at once made known in wider circles. I have recently got to know these two gentlemen personally, and they have, with the greatest readiness, placed at my disposal the following information, which they themselves put, at my desire, in the form of letters. These letters I subjoin, accompanying them only with the following observations:—

Herr Brodtkorb was in 1848 a young man of twenty, who had adopted a business career, and at the same time devoted himself eagerly to sport; and as the place in which he resided is an important breeding-place of sea-birds (*Fuglevar*), where masses of auks,¹ mewes, and cormorants breed on the adjacent islets of Hornö and Renö, he had the best opportunities for learning all the birds that normally appear near Vardö. When I visited that place last summer (1883), in order to examine these noteworthy bird-cliffs, I came to know Herr Brodtkorb as a man well informed in every respect, and thoroughly trustworthy. I caused myself to be rowed several times over the little strait in which the *Alca impennis* was shot. This arm of the sea separates the town of Vardö from the adjacent islets of Hornö and

¹ *Alca torda* and *Arctica alle*, in all probability.

Renö, on which the great bird-cliffs (*Fuglevar*) are. It is two English miles broad, and has a strong current. The shore of Renö is flatter than that of Hornö, though on it also breed a great quantity of birds, chiefly mews (*Larus argentatus*, *marinus*, and *canus*). The bird-cliff, properly so called, is on Hornö, and on its terraces are the nesting-places chiefly of the *Fratercula*, *Alca*, *Uria*, and the two species of *Phalacrocorax*. Herr Brodtkorb had for the present, however, given up sport, because the attention of every one on the little Arctic seaport was taken up with the whale-fisheries. In a letter dated Vardö, December 31, 1883, Herr Brodtkorb writes me as follows: "It is exactly so as Herr Nordvi has told you, that in April 1848 I shot near Vardö a strange bird, the like of which I never saw before nor since. . . . I was rowing on that day with some companions over to Renö, when we espied in the strait four large birds that attracted our notice. One of my companions, Herr Wind, now Tensmand Wessel, asked me to fire at them, in order by that means to learn exactly what sort of birds these could be which, instead of flying, only paddled upon the water with their wings. I fired, and one fell. We were all perfectly convinced we had never before seen that kind of bird. It was the size of a Ringgaus.¹ Its back was black, and, so far as I can remember, its whole head and neck were of that colour, but in other respects it was in shape like an Auk. I remember particularly that we observed a white spot at the eye on the side of the head. On the other side the ball, which had gone through the head, had torn away a piece of the white spot and shattered the beak, so that as regards the form of the beak I can tell nothing. The wings were so small that we were all agreed that this circumstance was the reason why the bird only paddled. . . . The bird was placed in the boat in order that it might be kept; but when we reached land, it was so soaked through with water and blood that we threw it away upon the shore, though it was my intention to examine it afterwards more minutely. But when I went to get it on the following day, it had been washed away by a high sea during a storm in the night. . . . A day or two later I was out again to seek for the remaining three birds; but I never found them. I remember, likewise, that several fishermen had taken notice of these birds before I shot the one referred to; but subsequently they were never seen again."

On the receipt of this letter I wrote to Herr Brodtkorb asking him to inform me as to any observations he might have made on the nature, voice, &c., of this bird. To these questions he replied as follows, in a letter dated Vardö, February 27, 1884: "On the day when I shot the bird a storm was blowing from the south, so that there was rather a heavy sea. The birds were swimming right against the wind, and as we were rowing in the same direction, we got a sight of them, when they were about twenty-five yards straight in front of the boat, without flying up. In swimming they used both wings and feet, and also dived, but did not stay long under the water. It almost seemed as if they only went through the tops of the waves ("som om de næsten blot gik gjennem Bølge Top-pene"). The birds kept together, and did not seem afraid. We also heard

¹ The Ringgaus is the *Bernicla brenta*.

a cry which they emitted when they drew more closely together. It resembled a cackling, as if they wished to call one another. At first I did not think of shooting, for the boat was rolling hard. It was only when the birds had removed to a distance of about seventy yards, and were only visible at intervals, that I resolved, at the request of my companions, to take aim. When the shot went off all the four birds disappeared; but shortly after I saw the remaining three paddling on farther until they disappeared behind the surging waves of the current."

To what is here said I need only remark, in addition, that during the winter the *Colymbus glacialis* is along the coast of the whole of Finmark (and also of all the rest of Norway) a perfectly well-known bird, which is called by sportsmen Immer or Hav-Immer (sea-immer). No confusion with it can therefore have taken place, as indeed becomes sufficiently plain from the following letter of Herr Nordvi. Any one who is at all acquainted with the nature of our different sea-birds will besides have remarked that none of the diver (*Colymbus*) species keep close together when they are lying on the water, whilst this is exactly a peculiarity of members of the Auk family. Herr Nordvi, who at present occupies the post of Inspector of the Archæological Museum in the University of Christiania, was formerly a merchant and collector of objects of natural history at Mortensnäs, a town lying to the south of Vadsö.¹ He is a man to whom science is indebted for many contributions to the knowledge of the ethnography and natural history of these northern regions, and even at that time he had entered into active correspondence with various men of science. In a letter dated "Christiania, March 11, 1884," he writes me as follows: "In December 1848 I received at Mortensnäs, to the south of Vadsö, then my place of abode, a visit from my friend Herr L. Brodtkorb of Vardö. On my asking him—who had been brought up in Vardö, and was from boyhood familiar with all the birds and fishes there, and whom I knew to be an eager sportsman and good observer—what in the way of novelty he had to tell me about the animal kingdom, he told me that in the last days of April he had, in a sporting tour in the strait between Vardö and Renö, come upon four birds hitherto unknown to him, one of which he had shot and taken away with him, but had afterwards thrown away upon the shore. I asked him if the bird shot might not perhaps be one of the larger divers (*Colymbus glacialis* or *arcticus*). He said that could not be, since he had shot many birds of that genus. When he stated that the bird killed by him had no proper wings, and, as he considered, could not fly at all, because it used its wing-stump (*vinge-lapper*) to aid it in swimming, and when he mentioned, in addition, that it had a large white spot beside the eye, the thought at once came to me that this might have been the *Alca impennis*. To be surer of the matter, I asked him to look over a book containing copperplates which I had, and to see if he could there find the bird that he had shot. Without any hesitation he pointed to the *Alca impennis* and said, 'There it is.' I then gave him some details

¹ Vardö and Vadsö are two small towns on the Varanger Fjord, which, in its extreme part, forms the boundary between Norway and Russia. Vardö lies farthest up, towards the Arctic Ocean.

regarding the *Alca impennis* and its history, and asked him to use every effort to discover if the other three birds should yet show themselves; but none of them were afterwards visible." When Brodtkorb had learned from Nordvi what a treasure he had cast into the sea, they both instituted in the following year careful searches after other specimens, but in vain. When Mr John Wolley, some years later (1855), visited Vardö, and heard this information from Brodtkorb's own lips, he too felt personally convinced that the bird shot was an *Alca impennis*, and made diligent investigation along the shore in the hope of finding parts of that or some other specimens.

The communications given above hardly leave a doubt possible that as late as 1848 isolated individuals of this species were living as homeless wanderers. It was some of these (perhaps the last survivors of the whole species) that were found in the spring of that year close inshore on the coast of the Arctic Ocean near Vardö—that is to say, a far way to the east of the North Cape, and under a latitude which is considerably higher than that which scientists had felt themselves justified in assigning as the limit of the Great Auk's diffusion, at least within historical times.

So writes Professor Collett; and, while giving due weight to his valuable opinion, we have to put in the opposite balance, as against the theory of the bird observed being a Great Auk, the opinion of Professor Japetus Steenstrup of Copenhagen, who referred to this supposed occurrence of *Alca impennis* as far back as 1855, as we have already mentioned, when he had far better opportunities of sifting the evidence than Professor Collett twenty-nine years later. After such a length of time even the memories of Herr L. Brodtkorb and Herr Nordvi may to some extent have failed them. Professor A. Newton of Cambridge agrees with the opinion expressed by Professor Steenstrup; and he has in his possession the manuscripts of the late Mr Wolley, whose opinion regarding the authenticity of this supposed occurrence of the Great Auk he must know, and it is not likely that Mr Wolley had expressed himself (in his notes at least) as at all certain that the bird referred to was really a Great Auk, or Professor Newton would have mentioned it. My own opinion is that it is better to leave such a matter an open question; and in any case the interesting statements collected by Professor Collett are well worth recording. If three specimens really did escape from Herr L. Brodtkorb, it is possible that we have not heard the last of the living Great Auk; and who knows but some fine morning the daily press will be filled with telegrams upon the rediscovery of the bird. We can picture the despair of possessors of

alcine remains, if ever such an event should happen. It would cause a tremendous fall in prices! But, if not extinct, the rediscovery of *Alca impennis* would likely seal its fate, and only be the beginning of its end.

It is well known that the Great Auk in prehistoric times frequented the Cattegat, as its remains have been found in the Danish kitchen-middens, but none of the more recently reported occurrences of the Great Auk in the Cattegat or on the coast of Norway have been sufficiently attested. As I am not aware that any detailed reasons have appeared in English for refusing to believe in these alleged observations of the Great Auk, I have thought it worth while to have what Professor Robert Collett says on the subject translated. He only refers to those specimens said to have been met with on the coast of Norway. He says:—

I now proceed to discuss the cases of an alleged appearance of the *Alca impennis* on the coast of Norway in the present century, and I shall treat each of these cases separately.

1. Boie, in his 'Tagebuch einer Reise durch Norwegen in 1817,' relates that one day in August 1817 he saw in the distance in the Ranen-fjord in Helgeland a bird which, as he thinks, was probably the Imber of Pontoppidan (*Alca impennis*), which undoubtedly exists in Norway. He also states that among the birds which are to be found in winter in the Westfjord (to the south of the Loffoden Islands), the Imber (*Alca impennis*) is to be included. How far Boie was correctly informed as regards this last case cannot now, of course, be determined. Since, however, he in both cases gives the Norwegian name "Imber," and relies for this designation on the authority of Pontoppidan, it must be observed that Pontoppidan by his "Imber" undoubtedly means the *Colymbus glacialis* (the Great Northern Diver), and that even Faber in his time ('Isis,' 1827, p. 681) assumes that Boie was in error.

2. In the year 1838 Professor Rasch, in the 'Nyt Magazin for Naturvidenskaberne,' 1 B., p. 386—"Fortegnelse og Bemærkninger over de i Norge forekommende Fugle" ("List of Birds found in Norway, with Notes thereon"), mentions that he had just received a communication to the effect that a specimen of the *Alca impennis* had been killed in the winter of 1837-38 in the neighbourhood of Frederikstad, a town situated between the mouth of the Christiania Fjord and the Swedish frontier. But Professor Rasch's authority for this statement, the present occupant of the botanical chair in the university of Christiania, Professor Schübeler, has since informed me that the specimen in question was never actually seen by him, and that there is no positive evidence to the effect that the bird then killed was really the *Alca impennis*.

3. In the year 1850 Lilljeborg, in the 'Kgl. Vet. Akad. Handl. f. 1850,' p. 331—"Bidrag til Norra Rysslands och Norrridges Fauna" ("Contribu-

tions to the Fauna of Northern Russia and Norway”), says: “An *Alca impennis* is said to have been shot a considerable time ago in the district of Tromsö.” Since this specimen, too, has not been preserved, this report must be regarded as quite as uncertain as the preceding one.¹

The next branch of our subject for consideration is

INFORMATION REGARDING THE HABITS OF THE GREAT AUK, AND
SOME OF THE LOCALITIES IN WHICH IT HAS BEEN SUPPOSED
TO HAVE LIVED.

There are several references by voyagers to North America about two hundred years ago, under different names, to what, from their descriptions, must, I think, be considered to be no other than the Great Auk. They make some interesting remarks regarding its habits. The Baron Lahontan, in ‘New Voyages to North America, from 1683 to 1694,’ translated from the French—London, 1735, vol. i. p. 241, says: “The moyacks are a sort of fowl as big as a goose, having a short neck and a broad foot; and, which is very strange, their eggs are half as big again as a swan’s, and yet they are all yelk, and that so thick that they must be diluted with water before they can be used as pancakes.” It would be interesting if any one has an opportunity of obtaining eggs of some allied bird, such as *Alca torda*, to experiment so as if possible to ascertain if there appears to be good reason for accepting as correct the observations of Baron Lahontan. It is unfortunate we cannot obtain any new-laid Great Auk eggs to definitely settle the question! It may be as well to remark that although Baron Lahontan appears to have visited the coast of Labrador, it was not during the particular voyage in which he met with the moyacks, as he then does not seem to have been farther north than the Gulf of St Lawrence. It must not, therefore, be supposed that he recorded the moyack in a region from which we have no authentic record of the Great Auk. It is evident from what we know that he either met with the moyack in the Gulf of St Lawrence or perhaps farther south, at some of the other then stations for the Great Auk, or, as it was then called, Penguin.

A bird named the “wobble” is referred to in a work on ‘New England Rarities,’ by John Josselyn, Gent.: London, 1672.

¹ For doubtful occurrence of Great Auk at Mevenklint, see *post*, p. 119, Note.

The following is what appears, and probably refers to the Great Auk: "The wobble is an ill-shaped fowl, having no long feathers in their pinions, which is the reason they cannot fly,—not much unlike the *Penguin*. They are in the spring very fat, or rather oily; but pulled and garbided, and laid to the fire to roast, they yield not one drop." Josselyn appears to have lived eight years in Scarborough, a hundred leagues east of Boston. This was probably in the neighbourhood of Casco Bay, in which locality the Great Auk was at one time used by the ancient inhabitants for food, its remains having been found in shell-heaps. Professor F. W. Putnam of the Peabody Museum of American Archæology and Ethnology, Harvard University, Cambridge, Mass., in a footnote in connection with a paper by Professor James Orton which appeared in the '*American Naturalist*,' vol. iii. p. 540, says:—

That the Great Auk was once very abundant on our New England shores is proved beyond a doubt by the large number of its bones that have been found in the ancient "shell-heaps" scattered along the coast from British America to Massachusetts. The "old hunter" who told Audubon of its having been found at Nahunt was undoubtedly correct in his statement, as we have bones of the species taken from the shell-heaps of Marblehead, Eaglehead in Ipswich, and Plumb Island; and Mr Elliot Cabot has informed me that an old fisherman living in Ipswich described a bird to him that was captured by his father in Ipswich many years ago, which, from the description, Mr Cabot was convinced was a specimen of the Great Auk.

I am indebted to Mr Frederic A. Lucas of the United States National Museum, Washington, D.C., for the following extract from the '*Gloucester Telegraph*,' August 7, 1839, taken from the '*Salem Register*,' no date given:—

All the mackerel-men who arrive report the scarcity of this fish, and at the same time I notice an improvement in taking them with nets at Cape Cod and other places. If this speculation is to go on without being checked or regulated by the Government, will not these fish be as scarce as Penguins are, which were so plenty before the Revolutionary war that our fishermen could take them with their gaffs? But during the war some mercenary and cruel individuals used to visit the islands on the eastern shore, where were the haunts of these birds for breeding, and take them for the sake of the fat, which they procured, and then let the birds go. This proceeding finally destroyed the whole race. It is many years since I have heard or seen one except on the coast of Cape Horn.—A FISHERMAN.

It seems, however, exceedingly probable that the Great Auk

went much farther south along the shores of the United States than Massachusetts, as Catesby, in 'The History of Carolina,' App., p. xxxvi, writing early last century, includes the species as an occasional winter visitant to the shores of Carolina. I am indebted to Mr Edward Bidwell of London for the following extract from an old catalogue. The title runs—

A Catalogue / of many natural Rarities / with / Great industry, Cost, and thirty years' travel in Foreign Countries / Collected by / Robert Hubert, alias Forges, / Gentleman and Servant to / His Majesty, / and daily to be seen at the / place formerly called the / Musick House, near the / West End of St Pauls' Church, London. Printed by Tho. Ratcliff for the Author. Anno Domini 1665.

At p. 9 of this catalogue is this description:—

A strange Sea-Fowle as big as a Goose: it is called the Sea Pinguin. It cannot fly, for his wings are like Pinnes, and is so thick of Feathers that one cannot shoot him, unlesse behind against the growth of his thick Down or Feathers. He is found threescore leagues from the coast of Canada.

Professor A. Newton of Cambridge, in his paper on "The Garefowl and its Historians," in the 'Natural History Review' for 1865, p. 486, says: "The only place where may possibly linger the last of the American Garefowls is the Virgin Rocks, near the edge of, and midway on the north-west side of, the Great Bank, off the coast of Newfoundland." On the 29th September 1885, Professor Newton told me in conversation that he was then satisfied that the Virgin Rocks could not have been a breeding-place for the Great Auk, as he had been told that these rocks are at times covered with water. Writing upon this subject in 'The Auk,' vol. v., No. 3, July 1888, p. 282, Mr Frederic A. Lucas, who evidently is unaware of the changed views now held by Professor Newton, says of the Virgin Rocks, "It will suffice to say that they lie three and one-half fathoms under water."

THE FOOD OF THE GREAT AUK.

At p. 72 of 'The Great Auk or Garefowl; its History, Archæology, and Remains,' I refer to the statement made by O. Fabricius about the Great Auk feeding upon the lump-fish (*Cyclopterus lumpus*). The following remarks on the same subject, by Mr Frederic A. Lucas, in 'The Auk,' vol. v., No. 3, July 1888, p. 282, are interesting:—

A word regarding the food of the Great Auk, and in support of the statement made by Fabricius that the lump-fish (*Cyclopterus lumpus*) formed an important item in its bill of fare. While the lump-fish is rather rough to look upon, the bones are extremely brittle, and the strong beak of the Gargawle would slice through the body of any specimen it might have captured as easily as the knife of the Eskimo does through the body of the lump-fish he dries or freezes for his winter store. The young lump-fish—and these would be most dainty morsels—keep near the surface of the water, and seek concealment in patches of floating rock-weed, where they would easily have been detected by the keen eye of a sea-fowl; while, being but indifferent swimmers, there would be no safety in flight.

REMAINS OF THE GREAT AUK.

The skins, bones, and eggs of the Great Auk are of considerable value, and the historians of this bird, whoever they are, will find it no easy matter to hear of all the changes that take place in ownership, so that they may be recorded. Much has been already done in recording all existing remains of the Great Auk, and the first place in this department of alcine work deservedly falls to Professor William Blasius of Brunswick. Since 1885, when I completed my former list, much interesting information has come into my hands, mostly the result of a large correspondence with numerous individuals both in Europe and America. I am most anxious to place as much of the information as possible on record, but space will only permit of my doing so in a curtailed form. I will first refer to matters connected with skins of the bird, then of the skeletons and separate bones, and afterwards to the eggs. I will not attempt to give a detailed list, as I did in my book, but will only mention matters that have come to my knowledge since then, and which I think worth recording. I therefore append a summary of the total remains now known.

Skins.

BRITISH ISLES.

Boyle Court, Essex, is the proper address of Mrs Lescher, who has a specimen of the Great Auk. In my book, by a printer's error, the name appeared as *Boyne Court*.

Clungunford House, Aston-on-Clun, Shropshire.—The specimen preserved here was purchased by the late Mr Rocke from Mr Henry Shaw of Shrewsbury.

Leeds. Museum of Philosophical Society.—I am indebted to Mr

R. Champley for introducing me to the Rev. S. Edward Fitch, M.D., Scarborough, who sent me the following information on 5th October 1885. After mentioning that he had got the information from the Rev. R. J. Buddicom, he says: "It appears about forty years ago a Mr Pinches of Ticherton Church, Shelton, Salop, purchased of Mr Henry Shaw, 45 High Street, Shrewsbury, this bird,—that at the death of Mr Pinches it came into the possession of Mrs Buddicom, his sister, and was sold about thirty years ago to Sir William Milner of Nunappleton, Yorkshire. From the letter received from Mr H. Shaw, to whom I at once wrote, I find that he purchased it from Mr Leadbetter, but does not know how, when, or where Mr Leadbetter obtained it." This specimen is now loaned to the Leeds Museum by Sir Frederick Milner, son of Sir William Milner. (For further information see 'The Great Auk; its History, Archæology, and Remains,' App., p. 14.)

GERMANY.

Metz. Town Museum.—Mr G. A. Frank, 9 Haverstock Hill, London, writing me on 25th October 1887, says: "I have seen this summer the specimen in Metz (Malherbe), but I fear that this bird will not last a great many years, as the moths have got in it."

HOLLAND.

Amsterdam. Museum of Royal Zoological Society.—On the 29th October 1885, Dr G. F. Westerman, Director of the Royal Zoological Museum, writes me: "I beg to inform you that the proper date we bought the stuffed specimen is May 18, 1840."

NORWAY.

Christiania. University Museum of Natural History.—The specimen that was in the collection of Herr Nicolai Aall at Naes, near Arendal, has been recently remounted, and is now in the above museum.

SWITZERLAND.

Lausanne. Museum of Natural History.—The Vouga collection from Cortaillod is now in this museum. Mr G. A. Frank of London wrote me from Lausanne on 13th June 1886, and says: "It may interest you to know that the Vouga collection was sold some five months ago to the Lausanne Museum. The price paid for it was 12,000 francs. I went to see the collection to-day with Dr Larguier. The birds are not unpacked yet. The only bird I saw was the Auk, a fine female."

UNITED STATES.

New York. American Museum of Natural History.—It has been clearly shown by a writer in 'The Auk,' vol. iii., No. 2, p. 263, that there is only one skin of *Alca impennis* in this museum, which is the fine specimen originally in the collection of Dr Troughton. (See 'The Great Auk; its History, Archæology, and Remains,' App., p. 19.)

Washington. National Museum.—There is only *one* specimen in this museum, and not two, as previously recorded. See 'The Auk,' vol. iii., No. 2, p. 263.

Skeletons.

There are twelve, or perhaps fifteen, additional skeletons of *Alca impennis* to record, besides those mentioned in 'The Great Auk,' &c., p. 82; and of the two mummy specimens said to exist in Harvard University Museum of Comparative Zoology, Cambridge, Mass., United States, one has to be deleted, as only one is preserved there. The following are particulars of these specimens:—

BRITISH ISLES.

Durham. In the collection of Dr Tristram, Canon of Durham.—I am indebted to the Rev. H. H. Slater, Irchester Vicarage, Wellingboro', for the following information (see below under Wellingboro'). One skeleton.

Edinburgh. Museum of Science and Art.—Mr Wm. Eagle Clarke informed me, 28th August 1888, that Dr R. H. Traquair, F.R.S., has just acquired from Mr Edward Gerrard, jun., for the Museum, a very fine skeleton of *Alca impennis*. I have been unable to ascertain its history, so it may be one of those already recorded changing hands.

Wellingboro'. In the collection of the Rev. H. H. Slater, Irchester Vicarage.—I am indebted to Mr Wm. Eagle Clarke of the Museum of Science and Art, Edinburgh, for first mentioning this skeleton to me, and for advising me to communicate with the Rev. H. H. Slater, who kindly sent me the following. Writing on 2d September 1885, he says: "The skeleton of *Alca impennis* in my possession was acquired thus. It is, as you surmise, part of the Funk Island find (Prof. J. Milne's). I was stopping at Dr Tristram's house in or about the year 1877, and he had just received a box of Great Auk bones, as far as I remember from Gerrard. Dr Tristram (I mean the Canon of Durham, not the Chancellor and Q.C.) asked me to look over them, and make him up a skeleton. I did so, being at the time in good practice with birds' bones, and made him a very good one, only a few vertebræ, ribs, and phalanges being absent. As Dr Tristram did not care to keep the rest of the bones, which would make a very fair skeleton also, I became their possessor. His skeleton is some degrees better than mine. His has a good vertebral column."

GERMANY.

Breslau.—In addition to the foregoing, it is just possible there may be still another skeleton to record in Germany, as will be seen from the following communication Professor Wm. Blasius of Brunswick sent me on 31st October 1887: "I lately got some information from Breslau, according to which *there* may still exist a skeleton of *Alca*."

Since the above communication reached me, I have been unable to ascertain anything more about this supposed skeleton, so possibly there is some mistake.

UNITED STATES.

Cambridge, Mass. Museum of Comparative Zoology.—A writer, "L. S.," in 'The Auk,' vol. iii., No. 2, p. 265, April 1886, says: "The Harvard University Museum (=Museum of Comparative Zoology, Cambridge, Mass.) is credited with the possession of two skeletons 'prepared from mummy Great Auks obtained at Funk Island during 1864.' Mr J. Allen, then curator at the Museum, wrote me under March 18, 1885, as follows: 'We have but one specimen of the Great Auk, and that is to be rated as a skeleton. It is in reality a so-called mummy, and is from the Funk Islands. Only a portion of the bones have yet been laid bare—one wing and one leg; the rest is still covered with the dried flesh. In some unaccountable way it is commonly and erroneously supposed that we have two of these Great Auk mummies.' Four mummy Great Auks were obtained on Funk Island—namely, one in 1863, and three in 1864—and of these the specimen got in 1863 is in Cambridge, England, and of the others, one is in London, and the other, as above mentioned, at Cambridge, Mass. The missing one was sent by the Bishop of Newfoundland to the Nova Scotian Institute of Natural Science. What has become of it, is the question. I have addressed repeated inquiries to the Secretary of the Nova Scotian Institute of Natural Science, but have had no reply. I hope this may meet the eye of some one who will be able to make the necessary inquiries in Nova Scotia. While referring to this subject, it may be as well to draw attention to an interesting statement made by Mr Frederic A. Lucas in 'The Auk,' vol. v., No. 3, July 1888, p. 280: 'The soil of Funk Island, by the way, is frozen for only a part of the year; and the statement that a mummy of the Great Auk was "taken from under ice which never melts," was doubtless made from a misapprehension of the facts in the case, for although floe ice is driven upon some portions of the island, it never reaches those places where the Auk remains lie buried, and never endures into the summer months.'

Washington. National Museum.—Writing me 9th August 1888, Mr Frederic A. Lucas informs me that there are "ten or twelve" more or less complete skeletons among the remains brought home by the Grampus Expedition to Funk Island in 1887.

Detached Bones.

At the time I wrote my book, my information led me to suppose that only bones representing about 45 or 50 Great Auks had been brought home from Funk Island in 1874 by Professor J. Milne. However, I was informed by Professor

A. Newton of Cambridge, into whose hands the collection was placed on arrival, that there were at the lowest computation from 60 to 70 crania. It was not long after my book was published that Mr Edward Gerrard, jun., dealer in natural history wares, London, into whose hands this collection went, sold the last bones in his possession. On 8th September 1885, Mr J. Whitaker, Rainworth Lodge, Mansfield, wrote me: "I have bought Gerrard's last bones of *Alca impennis*." From a list of the bones sent me, they appear to represent only one individual. On the 22d August 1885, Mr William Eagle Clarke, now of the Museum of Science and Art, Edinburgh, informed me by letter that Mr James Backhouse of York had some remains of *Alca impennis* in his possession. I wrote Mr James Backhouse, sen., and got a most courteous reply, on 21st October 1885, from Mr James Backhouse, jun., West Bank, York. He says: "In reply to yours of the 19th inst., my father has a set of 35 bones of the Great Auk from Funk Island, which are in a good state of preservation." These bones are also part of the Milne collection. In the Natural History Museum, Bergen, Norway, there are a few bones that were brought from Funk Island by Herr P. Stuvitz. The curator of the museum, Herr James A. Grüg, writing me on 5th November 1887, says: "In Bergen Museum there are only a cranium (maxill. inf. are wanting; the right os zygomaticus is broken off), a pair of maxill. inf., and a right humerus of *Alca impennis*."

The bones that were found by the late Professor Wyman in shell-heaps near Ipswich, Massachusetts, are now preserved in the Peabody Museum of American Archæology and Ethnology, Harvard University, Cambridge, Mass., as I have been informed by Professor F. W. Putnam, present curator, in a letter dated 29th October 1885. He writes: "The bones of the Great Auk mentioned by Professor Wyman are all in this museum. He afterwards obtained others from shell-heaps on Cape Cod, and I presume there are specimens among the many bones which I have taken from the shell-heaps on the coast of Maine, but which, as yet, have only been roughly identified. Cape Cod is the most southern limit of the Auk bones, so far as I am aware."

During the summer of 1887 the United States' fishery

cruiser Grampus, under the command of Captain J. W. Collins, now in charge of the Bureau of Statistics and Fisheries Investigation in the United States, visited the Bird Rocks in the Gulf of St Lawrence, and also Funk Island, off the Newfoundland coast. A most interesting account of the visit to the Bird Rocks, from the pen of Captain Collins, appeared in 'The Boston, Mass., Herald,' 25th July 1887, and there appears to be little doubt that they are the islands referred to by Jaques Carthier as the islands of Margaulx.

When the Grampus reached Funk Island, a landing was effected by the osteologist of the expedition, Mr Frederic A. Lucas, and a party. They were successful in obtaining a large quantity of Great Auk remains. Writing me on 9th August 1888, Mr Lucas says: "I have finished the count of Auk humeri, and find that we have 1424, so that we have representatives of at least 712 birds. This does not include about one and one-half cubic foot of earth containing bones *in situ* which will not be disturbed. And yet, with all this, we can make up only ten or twelve skeletons." Through the kind permission of Professor G. Brown Goode of the United States National Museum, Washington; Mr Lucas has been able to favour me with photographs of the skeleton of the Great Auk in the Museum, and also of some remains collected by the Grampus expedition. To both these gentlemen I desire to tender my best thanks. Mr Lucas has already contributed two valuable and interesting papers upon the Great Auk, resulting from his recent investigations. I have already repeatedly quoted from one of them which appeared in 'The Auk,' vol. v., No. 3, July 1888, pp. 278 to 283. The other will be found in 'The Popular Science Monthly,' August 1888, pp. 456 to 464. In this paper he gives a most particular description of Funk Island and its skerries. He tells about the places where a landing can be effected, and also the exact position of the island on which the Great Auk remains are found. He mentions that undoubtedly the Great Auks were slaughtered on Funk Island, and did not die natural deaths, as many of the crania are fractured, and one skull bears evidence of the stroke of a knife.

The only unrecorded British bone of *Alca impennis*, so far as

I am aware, is a dorsal vertebra, now in my possession, and found by me while examining a quantity of material brought from Caisteal-nan-Gillean, a shell-mound on the island of Oronsay,—the same place where the other bones discovered by me came from. (See 'The Great Auk; its History, Archæology, and Remains,' p. 47.)

Eggs.

BRITISH ISLES.

Addlestone Hall, Surrey. Collection of Leopold Field, Esq.—This egg was in the possession of the Rev. H. Burney, Woburn, Bedfordshire. It was sold at Stevens's Auction Rooms, Covent Garden, for £168, on 12th December 1887, and bought by Mr Field.

Cambridge. The collection of eggs that belonged to Lord Lilford is now in the Natural History Museum at Cambridge. It consists of five eggs, and the following additional particulars regarding two of these is worth recording.

Lord Lilford's collection. *Lausanne Egg.*—So as to prevent any mistake as to the way the egg obtained at Lausanne by Mr G. A. Frank, and purchased by Lord Lilford, came into Mr Frank's hands, it is as well to publish the following statement by Mr Frank, as at page 109 of my book I have given information from another source. He says: "I first heard of the two eggs by chance in 1881, and I quite believed myself to be the only person who knew of them—never having been aware that M. Fatio had seen or had given an account of them. In 1882 I went to see the hon. curator of the Lausanne Museum, and I then asked him if he would sell or make an exchange of one of the two eggs. His reply was that he could not dispose of such a rare specimen without the full consent of the Museum Committee. The Committee met later on, and they decided, as they had two specimens, to let me have one of the two for one stuffed gorilla (not a bad skin, as has been stated), a fine skull, and several bones of *Alca impennis* from Professor Milne's collection, and several other specimens which they selected. To this I agreed, fully believing that these two eggs were unknown to science. After keeping it three months, I sold it to Lord Lilford for £110, not £140. That his lordship obtained the finest egg was a mere chance, as Dr Larguier wished to keep the most perfect for the Lausanne Museum. I should have preferred the other one."

Dorsetshire Egg.—I am indebted to Mr J. E. Harting, editor of the Zoological and Natural History Department of the 'Field,' for the following information regarding this egg. Its owner, a farmer, Mr Hill, was quite unaware of its value, and several times had been inclined to throw it into the fire—as, being broken at one end, he began to think it was no ornament to his mantel-shelf. One day a clergyman called, and, knowing something about oology, his attention was

attracted by the broken egg-shell, and having some idea of its value, he asked Mr Hill why he did not take better care of it. The reply he got was that it was a useless egg-shell, and it had often been intended to destroy it, but that to settle the matter it would be thrown on the fire there and then. The clergyman advised Mr Hill not to be in such a hurry to destroy it, as he believed the egg-shell was of considerable value—if it was, as he supposed, that of a Great Auk. The farmer was incredulous, but agreed to wait until the authorities at the British Museum were communicated with. When he heard that, if it was really an egg of the Great Auk, it was very valuable, he brought it to London. He placed it in the hands of Mr Bowdler Sharpe, of the British Museum, who put him in communication with Lord Lilford, who bought it for £50.

Cambridge. Collection of Mr G. L. Russell.—Since this paper was read, this egg, along with a collection, has been presented to the Natural History Museum, Cambridge.

Croydon, Surrey. The egg that belonged to the late Mr Alfred Crowley is now in the possession of his brother, Mr Philip Crowley, at Waddon House.

London. Collection of the late Lord Garvagh.—On the 5th February 1886 the present Lord Garvagh wrote informing me that the whole collection of the late Lord Garvagh was sold to the Dublin Museum, and that if the broken egg was retained in the collection it would be found there. I have, however, ascertained that they know nothing regarding the broken egg in that Institution.

London. Collection of Mr Gardiner.—This egg belonged to Mrs Wise, who lived at one time near Reigate, Surrey. This lady removed to Steyning, near Brighton, and sold the egg in her possession at Mr J. C. Stevens's Auction Rooms, Covent Garden, on the 12th March 1888, for the sum of £225, to Mr Gardiner, dealer in natural history wares, Oxford Street, London. Holland was the maiden name of Mrs Wise, and her late father, Mr H. Lancelot Holland, bought the egg on 6th October 1851 for £18 from Williams of London, who, in turn, had bought it from Lefèvre of Paris.

Saffron-Walden. The egg that was in the collection of Mr Tuke, Hitchin, Hertfordshire, is now in the Saffron-Walden Museum. The curator, Mr Maynard, is said to have taken some casts of it.

Scarborough. Collection of Robert Champley, Esq.—I am much indebted to Mr Champley for kindly allowing me to publish the following information regarding the history of the nine eggs in his collection, which is the finest in existence. The information is from Mr Champley's private notes, made at the time of each transaction :—

No 1, figured in Thienemann.—The above egg, and the first I obtained, came into my possession in the following singular manner. I had written to Mr Newman, the editor of 'The Zoologist,' a letter asking him if he could inform me what had become of the egg that belonged to the late Mr Yarrell. I received no reply; but my letter

to Mr Newman, unknown to myself, was inserted on the outer cover of 'The Zoologist.' Some months after I received a letter from Kunz, Leipzig. He informed me he had seen my query respecting Yarrell's egg, and said he had an egg for sale. Would I have it? He wrote a second letter giving the price, £18 (July 1859). Five letters refer to this transaction. The egg, from its beautiful shape, is the finest known. This egg was purchased from Theodore Schultz in 1857, he then residing at Neuhaldensleben, Saxony (a short description of which appears in 'Cabanis,' January 1860). Schultz purchased it from a person of the same name then residing at Leipzig. He received it, with six others, from Iceland. No. 2.—This egg is engraved in Bädeker's 'European Oology.' My first intimation of its whereabouts was from reading a number of 'Cabanis.' I purchased the egg with the bird (said to have laid the egg) in 1861, from the apothecary Mecklenburg, residing at Flensburg, Denmark (now Germany),—the same person who sold Hancock his egg and bird obtained from Iceland, 1829. Egg perfect, well marked with blotches. Mecklenburg's son, after his father's death, sent me a catalogue of his eggs and skins for sale, including another skin of the Great Auk, but with, I think, false feet. I don't know what became of this last skin. No 3.—This egg was obtained during my Italian tour in 1861. I was at Verona, 31st May 1861. I met accidentally a Russian nobleman at the station (Porta Neuva). My acquaintance was renewed at Milan a few days later, on the evening of 2d June. I met him near the Duomo, the day of the celebration of the unity of Italy. He told me he was going to see the Certosa Monastery the following morning. We agreed to go together, and another friend accompanied us. We three took a carriage and pair, and arrived at the convent, fifteen miles distant, about noon. We then drove on to Pavia, five miles farther. After seeing the cathedral, we went to look at the university, and went over the Museum of Anatomy. I inquired if there were any eggs and birds in the museum, and was answered in the affirmative. On looking round the glass cases, I noticed many eggs stuck on wires on shelves, but all black over with dust. I noticed among some large eggs what I thought was an egg of a Great Auk. I asked the attendant to open the case, but he had not the key. I told him to go for the sub-director. He returned with him and opened the case, which was fastened with screws. I took down the egg, black over with dirt, and rubbed it clean, and saw it was an *Alca impennis*. I told the sub-director I would exchange some skins for it. He could not say anything, but referred me to the chief director, and at the same time told me that the collection was given by Professor Spallanzani one hundred years before, and that Spallanzani had been one of the lecturers in the University. My friend the Russian interpreted for me. When I obtained the address of the chief director, I proceeded to his residence, accompanied by a youth, a student of the college, who spoke English—my friends meanwhile staying at the museum waiting my return. On my arrival at the director's residence, I told him there was amongst the eggs an egg of "Le Grand Pinguin," and I should be

glad if he would let me have it for an exchange. He accompanied me back to the museum. After looking at the egg, the sub-director told him I had offered five napoleons or an equivalent in exchange for it. He said they would rather prefer the money. I therefore borrowed the amount from my Russian friend, and, after packing the egg carefully, left the museum, they seeming sorry that they had no more specimens, and considered they had got a good bargain. We arrived at Milan at seven in the evening. I had a box made for the egg the next day. The egg is perfect, and thickly pencilled at the thick end.

No. 4.—This fine egg was obtained as follows: Passing through Paris for Italy the same year (1861), I called on Parzudaki, the French naturalist. He told me the Abbé la Motte had an egg of *Alca impennis*, but was then in Algiers. I told him to buy it for me, and to write in three months to me at the *Poste Restante*, Rotterdam. On arriving there I found his letter, saying the son was at Abbeville, and asking instructions. I at once wrote telling him to buy the egg. This he did for £24. I have four letters referring to this purchase. No history, excepting a statement that it was obtained forty years previously from French whalers.

Nos. 5 and 6.—I bought these eggs in London from Ward, the naturalist in Vere Street, in 1864. Previously I had received a letter from Fairmaire, Paris, saying he had two eggs. Unfortunately his letter was sent to Scarborough while I was in London. There was consequently some delay in my knowing he had the two eggs for sale. As Fairmaire did not hear from me, he supposed I either did not care to have the eggs or that I had not got his letter. When I wrote he said he had parted with them. By chance the same week I called at Ward's, and he showed me one egg, for which I gave him £25, and asked him if he had any more. He then showed me another egg, for which I paid him £30. I then asked him if he had any more, as I would take twenty. He smiled. He would not say how he got them; but I afterwards found out they were the same as offered to me by Fairmaire. I called on Ward many times after, and he always regretted having parted with these eggs. They are perfect, and well marked. I don't know their previous history.

Nos. 7, 8, and 9.—These eggs were bought in 1864 from Professor Flower, then of the Royal College of Surgeons, London. They were part of the collection of ten eggs of *Alca impennis* in the Hunterian Collection. I had difficulty in getting them, as at the time they would not take money. I got over the difficulty by purchasing a collection of anatomical specimens for £45, which the museum was anxious to possess, and then exchanged it for the four eggs, all very fine specimens. If I had pressed at that time, I could have got the other four eggs afterwards sold at Stevens's salerooms in July 1865.

FRANCE.

Chateau de Manonville, Meurthe.—The three eggs in the collection of the Count de Baracé, Angers, have been purchased by Baron Louis d'Hamonville, Chateau de Manonville, par Noviant-aux-Pres, Meurthe, and are now in his possession. These, added to Yarrell's egg already

PLATE II.



GREAT AUK OR GAREFOWL.

(*Alca impennis* Linn.)



recorded as in Baron Louis d'Hamonville's collection, makes him the owner of four eggs in all.

GERMANY.

Breslau. Count Rödern's collection.—It is as well to explain, to avoid future confusion, that this is not the egg sold by Herr Mecklenburg of Flensburg to a Herr Platow of Breslau, and of which Mr Robert Champley of Scarborough has a drawing.

HOLLAND.

Amsterdam. Museum of Royal Zoological Society.—At p. 89 of my book I print a letter from Professor Schlegel of Leyden Zoological Museum to Robert Champley, Esq., Scarborough, from which it appears that in 1859 one of the eggs in the Leyden Museum had been presented to the Royal Zoological Museum at Amsterdam. From what Mr G. A. Frank of 9 Haverstock Hill, London, writes me, there appears to be some mistake with regard to the date of the egg reaching Amsterdam, as well as the conditions under which it came into that collection. On the 30th October 1885 Mr Frank wrote me: "I returned yesterday from Holland. Dr Westerman told me that Temminck gave him the egg between 1840 and 1845." Writing me again on 5th November 1885, he says: "It does not much matter when they came into possession of it [the egg], but I know for certain that it was never in Professor Schlegel's time. I often made a drawing of it when I was a boy some twenty-five years ago. Dr Westerman told me last week that he obtained it in exchange from Temminck."

Leyden. Zoological Museum.—Mr G. A. Frank, writing me 30th October 1885, says: "I believe that the two eggs (now one in Amsterdam) were bought by Temminck from my grandfather or father."

SUMMARY OF EXISTING REMAINS OF THE GREAT AUK.

	Total number of birds represented.
Skins,	78 or 79
Skeletons more or less complete, ¹	21 or 24
Detached bones, ²	841 or 851
Physiological preparations,	2 or 3
Eggs,	67 or 69

¹ If the skeleton recently acquired by the Museum of Science and Art, Edinburgh, is found to be one of those already recorded, it must then be deducted from the above total, which will read 21 or 23.

² Mr Frederic A. Lucas informs me that the result of his count of the humeri of *Alca impennis* collected by the s.s. Grampus expedition at Funk Island in 1887 is 1424; and supposing that exactly one-half of that number were right humeri and the other half left humeri, it would be evident that at least 712 Great Auks were represented by these remains. However, it is much more likely that there is an unequal number of either right or left humeri; and when this is ascertained, it will enable a much more accurate calculation of the exact number of birds represented by these remains to be made. In the meantime, it is only

REPUTED FRAGMENT OF GREAT AUK SKIN.

Boston. Collection of Mr Charles B. Cory.—A writer who signs himself "L. S." in 'The Auk,' vol. iii., No. 2, p. 263, says: "Mr Charles B. Cory has a few moments ago orally informed me that what he possesses is only a fragment of a skin of a breast and a few odd feathers, said to be from the Great Auk, which he bought some years ago of a dealer a little outside of London, and for which he paid £2." From the foregoing, it may be inferred that Mr Cory has some doubt as to the above-mentioned remains being really those of *Alca impennis* Linn. There are so many sea-birds from which portions of plumage can be obtained similar to that of the Great Auk, that it would be as well to have fuller information regarding the fragment of skin and the feathers in question, before including them among the genuine remains of the Great Auk.

IMITATION REMAINS OF *ALCA IMPENNIS* LINN.

It may interest you to know that recently the number of imitation skins of Great Auks has been on the increase, and most of them have been sold, or offered for sale, for what they actually are—namely, models. However, I recently heard of a collector who was offered what was described as an unrecorded skin of the Great Auk, but which, on examination, was found to be merely a model. It is only about a year ago that a well-known ornithologist was passing through a town in the midland counties, when by chance he happened to look into a confectioner's window. There he saw, to his amazement, a stuffed Great Auk. He at once went into the shop to make inquiries, no doubt with the idea that he would be able to record another specimen of *Alca impennis*. He saw the proprietor, who told him it was only an imitation, and that, besides selling confectionery, he did some bird-stuffing upon his own account in the back premises. It transpired that, having been a trip to Germany, the confectioner had seen a Great Auk model, and determined to make one for himself on his return home. To make sure of proceeding rightly, he visited the museums in York and Leeds, where there are stuffed specimens—made drawings, and then constructed his model from *Alca torda* and other skins. The ornithologist was so pleased with the correctness of the model that he purchased a rough approximation. In addition to the detached bones mentioned above, there is about 1½ cubic foot of earth got by the Grampus expedition with Great Auk bones *in situ*, which are not to be disturbed.

it, and it has found a place in his collection, no doubt properly ticketed.

With regard to the eggs, I may say that numerous casts of different eggs have been taken, and painted so like the originals that, when seen lying in drawers, they can hardly be identified. It appears to me that casts should be made of all Great Auk eggs, as they are so rare, and each egg has some peculiar difference in the markings. The best proof of the value of this practice is in the case of a Great Auk egg which was destroyed in a fire a good many years ago, and all knowledge of its appearance would have been lost had there not fortunately existed a beautifully painted cast.

In conclusion, I may be permitted to say that the tendency is for Great Auk remains in private collections steadily to find their way into public museums, where they will be more accessible to ornithologists, better cared for, and unobtainable by collectors. This will no doubt in time, to a great extent, remove the present necessity for recording changes in connection with alcine remains.

NOTE.—The most recent rumoured observation of a Great Auk comes from Iceland. On the 19th September 1888, after this paper was in the printers' hands, I was informed by Mr T. G. Paterson, who had just returned from Iceland, that while there he met an official, a well-educated and reliable man, who stated that nineteen years ago, when he was with a vessel engaged in the white-shark fishing near Mevenklint, he saw what he believed was a Great Auk. Mevenklint is said to be a skerry (about the size of Eldey, off Reykjanes) situated 40 miles N.N.W. of Grimsey, in about 67° N. lat. and 18° W. long. It is marked on the chart at the end of my book, but seems a doubtful station for the Great Auk, as it is considerably within the Arctic circle.

ILLUSTRATIONS.

PLATE I.—Figure of a stuffed specimen of the Great Auk in the American Museum of Natural History, Central Park, New York. This specimen at one time belonged to Dr Troughton, and after his death was bought by Mr D. G. Elliot, through the agency of Mr Cook, dealer in natural history wares, for the museum, where it is now preserved.

PLATE II.—Facsimile of the original figure of a Great Auk, reduced one-third, given by the Danish naturalist, Olaus Wormius, in his 'Museum Wormianum seu Historiæ Rerum Rariorum' (Copenhagen), Leyden, 1655, p. 301. It was probably drawn from a living Great Auk, as Wormius had one from the Faroes, which he succeeded in keeping alive for some months. The white ring round the neck was evidently intended to bear an inscription, and is not natural to the bird. The Scottish Society of Antiquaries has kindly given me the electrotype from which the figure is printed.

II.—*THE ROOK.*

BY MR TOM SPEEDY.

(Read Jan. 25, 1888.)

IN writing an essay on birds, I propose to introduce to you our familiar friend, the rook. No bird, I imagine, will be more welcome, as with it every person is more or less familiar. Even those living in towns have frequent facilities afforded them for observing the habits of this bird, especially at nesting-time, which is denied to many in the country. Rooks often take possession of a clump of trees in large centres of population, where, as a rule, they rear their young more safely than in rural districts, municipal law forbidding the use of firearms or the scaling of trees within its boundaries. Those who live in houses of high elevation, with windows overlooking rookeries in towns, as in the Meadows or Newington in our own city, must be interested in observing the habits of those birds. What an absence of sloth! and what a lesson of industry may there be learned! How scientific and business-like they appear, as if their whole energies were centred in their work. No trades-unionism, no strikes, no half-holidays on Saturday afternoons for them. From the time they begin to carry the first stick to the nest, till the young birds can take care of themselves, it is an endless scene of bustle and anxiety from early dawn till darkness has set in. It does seem strange that a pair of young rooks—or indeed any kind of birds—can the following spring commence a structure, and, without experience, but with unerring instinct, build a nest identical with the one in which they themselves were reared. As some of the old nests, with a little trimming and repair, are utilised, I may presume, by old birds, the difficulty of building devolves upon young ones. Their first and not the least important duty is to select a tree with sufficient forks to hold the nest together, and when a fit one is found, in a few days they commence the structure. It sometimes happens that they fly to a considerable distance for suitable sticks to make the frame which supports the inner parts of the nest. The branch of an elm or thorn is frequently chosen, and to watch them breaking

one off is most amusing. How they seize it with their powerful beaks, suspend themselves by it in the air, and bend it backwards and forwards in a most persevering manner till it eventually gives way, when they carry it off in triumph.

After their own nest is completed, it is no unusual thing to see rooks assisting others in building their nests—a neighbourly act, which, with the exception of the swallow, is rarely indulged in by the feathered tribe. That they occasionally violate the eighth commandment is true; but that they hold trials and condemn the delinquents to death, which is speedily put into execution, as asserted by some naturalists, is questionable. Certainly no such incident has ever come within my observation. The habits of rooks, like those of all other birds, are governed by uniform laws; and while exceptional incidents, which may be regarded as a departure from their normal habits, are occasionally met with, they are, I am certain, exceedingly rare. It has also been recorded that when a rook has been found stealing sticks from a neighbouring nest, the whole colony attack it, tear its nest to pieces, and drive it from the rookery. This also, if correct, is very exceptional,—though rooks frequently, after nests have been finished, evidently change their mind, and in an incredibly short time remove every stick. Why they should do so is one of the many secrets in the habits of birds which the closest observers have as yet failed satisfactorily to explain.

In April last a pair of rooks built their nest on the top of a chimney at The Inch, near Edinburgh, the house being immediately surrounded by a rookery, and the entire park thickly studded with trees. That they should have indulged in this strange freak is remarkable, as rooks seldom build their nests elsewhere than on trees when the facilities for their doing so exist. In due course five eggs were dropped into the nest, and the process of hatching entered upon. For a fortnight the hen bird—relieved occasionally by the male—sat closely on the nest, and the following week young birds were expected to be hatched. Though their motive will doubtless for ever remain a mystery, a number of rooks one morning commenced, and in a few hours removed every stick of the nest, using these to build another nest in the wood, though by this time a month behind the normal time for nidification. What be-

came of the eggs was never discovered, but had the punishment inflicted been for thieving, it is not too much to say it would have been dealt with more summarily, and that three weeks would not have elapsed before it was put into execution.

Though rooks, like most of the feathered tribe, display a deal of pugnacity at pairing time, there are few birds which possess more of social instinct, as in all circumstances they seem to enjoy the fellowship of each other. Though many birds may be termed gregarious, none in this country so strictly deserve the name as the rook. Starlings may be seen in large flocks feeding on our meadows. Plover in immense numbers frequent our fields. Wood-pigeons in thousands roost in our woods, and feed on our turnips and on our stubbles. No sooner, however, does spring come round, than they pair off to their respective haunts, to breed in solitude. It is not so with rooks. They invariably form themselves into colonies, scores and sometimes hundreds of nests being constructed on trees within a very limited area.

Whether rooks are the foes or friends of the farmer has long been a controverted question. Some assert they do a very considerable amount of damage to crops, while others maintain that any mischief they do is more than counterbalanced by the immense numbers of slugs, wire-worms, &c., they devour, which are so destructive to young plants. That they work a certain amount of mischief, especially in dry seasons, is true; but they are often mistakenly charged with eating up the crops, while they are taking the best possible means of protecting them. In illustration of this, some years ago, in the early spring, a farm-grieve tried to stalk a flock of rooks which were busy feeding on a field of grain. Meeting him, he requested me to shoot some of them, as they were "playing the vera mischief wi' the wheat." Concealing myself behind a hedge, I asked him to go round and startle them, to which he readily agreed, when I had no difficulty in killing a couple as they flew overhead. "Man, that's grand!" the grieve exclaimed, as he came forward. "I'll hing them up in the field to scaur ithers." Carrying the two birds in my hand, we walked to where the rooks had been feeding, when we discovered numerous holes dug by their powerful beaks, and

blades of young wheat strewn all around. On minute examination, however, I observed that the blades which had been pulled up corresponded with a considerable number which were not so bright in colour as healthy plants are, and digging one up with my knife, I discovered a small grub adhering to the root. On opening the gizzards of both birds, I found a large number of grubs, while no traces of wheat or green blades were discernible.

Another illustration in point. During the protracted drought of last summer, a blight seemed to come over a large quantity of onions in a market-garden at Craigmillar. The plants at first became slightly discoloured, and eventually withered away. My attention was called to the circumstance that the market-gardener was having his onions pulled up and eaten by the rooks. I felt that while it might be true that the onions were being pulled up, I was at the same time certain that it was not that they might be partaken of as food. On visiting the spot, I at once observed that the onions were blighted and fading away, as if they had been sown where there was neither moisture nor soil. This at once led to the solution of the difficulty, as, upon careful inspection, I found, as I had anticipated, that the onions were being destroyed by grubs, which in incalculable numbers pervaded the entire area on which they had been sown. It will thus be seen that the object of the rooks in pulling up the plants was to devour these pestilent insects, as not one of the plants exhibited the slightest indication of having been partaken of. It was interesting to note the sagacity which the birds displayed in pulling them up, as in no case did they make a mistake, even when discoloration could not be discovered by the human eye. It is needless to say that here, as in the case of the wheat referred to, the rooks rendered a valuable service to the farmer, and to society at large. It will be evident that there is a danger of the interests of the farmer being overlooked by superficial observers rushing to hasty conclusions, as was the case of the grievance referred to. As by scientific investigation many palpable mistakes in agriculture are being discovered, so will the interests of farmers and gardeners be promoted as the facts of natural history become more generally and accurately understood.

The same remarks may be said to apply to those occasional descents which are made upon newly singled turnip-fields in dry weather by rooks. While, as I have pointed out, they render immense service to agriculturists in picking up wire-worms and grubs, which are so destructive to plants, it is nevertheless true that in certain seasons they are responsible for a very considerable amount of mischief. When potatoes are appearing through the ground, they dig down for the seed, which they rarely fail to carry off, and in consequence numerous blanks are visible when the crop grows up, unless vigilance is practised by "herding" them. In the plundering of potato-fields, rooks display a more than ordinary degree of sagacity in their mode of getting at the early potatoes. Instead of digging down along the side of the plant from the top of the ridge, they are often to be found penetrating into the sides of the ridges at a lower level, right opposite the potatoes, so that labour is thereby economised.

In protracted droughts, as in hard frosts, rooks have extreme difficulty in obtaining their food-supplies. This I have frequently noticed by about a score of them coming regularly to feed in my back-garden, where scraps were thrown out to the birds. No sooner, however, had there been a few hours' rain than they disappeared, preferring grubs and worms—the catching of which was facilitated by the moisture—to the bits of bread and meat thrown out. So long as the weather remained damp, with occasional showers, they were never seen, but in dry weather, as in frost, they immediately returned. The reason of this is obvious, as in dry hot weather grubs go down into the cool earth beneath, but invariably return near the surface after rain.

It is asserted by some agriculturists that the damage done to young wheat by rooks is not by eating the seed, but by nipping off and devouring the shoot, which of course destroys the plant. If such were the case, it is not too much to say that when pressed by hunger in droughts or frost, they would regale themselves on the shoots of grain or grass, which they would have no difficulty in obtaining. This assertion I am exceedingly loath to believe, as in none of those whose gizzards I have examined have I ever found green blades of any description.

Recurring to rooks feeding in the garden, it is in such circumstances that their shrewdness and forethought obtrude themselves on our attention. Several cats were in the habit of appearing as soon as the food was thrown out. The rooks, by their noise and attitude of offence, proved themselves able to keep the cats at bay until their appetites were fully satisfied, when, on their leaving, the cats picked up the remaining food. On the rooks discovering this, it was an interesting study to observe them, as, after having satisfied themselves, they picked up pieces of the remaining meat and carried them off to different parts of the garden, where they carefully buried them in the earth. During the afternoon they regularly returned, and with unerring accuracy disinterred the pieces of meat buried in the morning.

The reflective instinct exhibited by the rook is proverbial, and developed to a larger extent than in most other birds. Its powers of arithmetical calculation have long attracted the attention of naturalists. It has been found that they can count numbers accurately up to three inclusive, but that this is the limit of their capacity of calculation. This peculiarity in the rook has been discredited by many, but, when tested by experiment, has been again and again verified. For example, when they are so pressed for food during a snow-storm as to visit a stack of grain, let a place of concealment be extemporised by branches of trees or other material within easy shot, where watchers can successfully conceal themselves. If, after being repeatedly fired at from the ambush in question, the rooks discover *one, two, or three* persons betake themselves to the place of concealment and leave at intervals, it will be found that they will not descend to feed until the last of the three has left. But should four or more persons place themselves under cover, it will be found that after the third has left their sense of danger disappears, as will be seen by their beginning to feed with apparent security. I am not aware of this peculiarity being possessed to the same extent by any other bird.

I have several times been much interested in observing the ingenuity displayed by rooks in extracting grease from the grease-box above the wheels of railway-waggons. Perching at the side of the wheel, and placing their necks awry, they

pushed their beaks sideways under the lid of the grease-box, and, by a process of ingenuity rarely equalled by the feathered tribe, were thus able to dine at the expense of the railway company.

There are few subjects of study more pleasing and interesting to the genial and generous mind than that of natural history, and few of our common birds more deserve a passing notice than our sable ubiquitous friend, the rook.

III.—NOTES ON THE CONIFERÆ.

BY MR HUGH FRASER.

(*Read Jan. 25, 1888.*)

AMONG the many Orders into which the vegetable kingdom is divided, it would be difficult, or probably impossible, to name one more important, either from an economic or ornamental point of view, than the Coniferæ. Their wonderful diversity of habit, from the procumbent junipers of Europe, whose stature is measured by inches, to the majestic Wellingtonia of California, rising to the almost fabulous height of 360 feet; the varieties of colour and tint which the foliage assumes, and the uniform gracefulness and symmetry of growth which characterise every member of the family, combined with the fact that a large proportion of the grandest forms are adapted to the soils and climate of this country—all render them universal favourites as ornamental plants. The well-known value, also, of many of them as timber-trees—of some for their resin, and of others for their fruit—must always ensure their extensive use in forest planting in this and every other country over the world.

There is no region or continent which does not produce its conifers; and as they are usually found at high altitudes, a singularly large proportion of the species are suitable for cultivation in our climate. China and Japan send us their quota of *Abies*, *Cupressus*, and *Pinus*; India, its magnificent cedars,

and many other most valued forms; South America, its araucaria; North America, a host of species of sorts which are peculiar to itself, including many which, we are persuaded, will rank one day as most useful timber-trees in Europe; while Europe, including Great Britain, has its pines and spruces, which, while lending their own peculiar effects to the landscape, are almost rivals to the oak as timber-producing trees.

From the very limited time at our disposal, and the magnitude of our subject, it seems very obvious that we will best consult your convenience if we briefly allude to some of the representative forms of the various genera on the table. We have arranged them in alphabetical order for easy reference: the more scientific study of the various divisions must necessarily be left for the private study of those who feel more particularly interested in the subject.

The following genera were then taken up *seriatim*, and a short descriptive account given of the habit of growth, geographical distribution, and cultivation of each:—

Abies.	Cupressus.	Prumnopitys.
Araucaria.	Fitz-Roya.	Retinospora.
Biota.	Juniperus.	Sciadopytis.
Cedrus.	Larix.	Taxus.
Cephalotaxus.	Libocedrus.	Thuja.
Chamæcyparis.	Picea.	Thujopsis.
Cryptomeria.	Pinus.	Wellingtonia.

IV.—POLARISED DARK-GROUND ILLUMINATION.

By MR WILLIAM PENMAN, ASSOC. M.INST.C.E.

(Read Feb. 22, 1888.)

LAST session I had the honour of making a communication to the Society upon the subject of "Diatoms under Dark-ground Illumination;" and as you have been good enough to embody the paper in your 'Transactions,' I will not recapitulate the methods and phenomena therein described, although they necessarily form the groundwork of the important subject I now desire to bring before your notice.

Some time ago I had the good fortune to become possessed of a very fine polarising prism, which fits into the substage arrangement of my Ross microscope; and it occurred to me that, on account of the largeness of the prism, I might to advantage employ polarisation with medium powers—especially as my substage is capable of carrying a condenser along with the polariser. With this in view, I began to experiment with a half-inch objective and open aperture on diatoms, and was rather startled to find that certain forms polarised quite readily, and that those were the same diatoms that appeared most brilliantly iridescent under dark-ground illumination. No sooner did this strike me than I introduced a stop, or spot, into the substage condenser, thereby producing a dark ground, and saw for the first time what I believe to be one of the finest microscopical effects—namely, polarised diatoms upon a black ground. I soon found that pursuing these observations only served to bring out fresh examples of the magnificence of this illumination, and so I have thought that a short paper to the Society upon this subject might be acceptable.

This polarising—or, more properly speaking, depolarising—property of the Diatomaceæ is not in itself surprising, when we remember that they are composed of silica—*i.e.*, quartz or flint—which is a positive uniaxial crystal, and consequently depolarises light. Unfortunately, but like very many other things, good results in polarised dark-ground treatment can only be attained by the exercise of some trouble, and the bringing together of certain factors in their most favourable conditions. To begin with: it is necessary to be possessed of a microscope fitted with a substage which is capable of carrying both a polariser and a condenser at the same time. The polarising prism should be large, so as to admit a very powerful beam of light to the condenser above. In order to make the illumination as bright as possible, a good lamp and a large deep bull's-eye condenser should be used, and the light thrown into the substage from the concave side of the mirror. Owing to the maximum power of ordinary micro. illumination being a fixed quantity, only a limited number of diatoms can be selected for dark-ground exhibition—namely, those that are large enough to be properly seen under a medium-power objective. Smaller diatoms, requiring higher powers, either

have their radiancy killed by the inevitable loss of light, or cannot be made to stand on dark-ground by reason of the increased aperture of the objective. For this work I would therefore recommend the use of a half-inch objective of moderate aperture, so that all the frustules in the field of the instrument may be sharp to the edges. Deep eyepiecing consumes light, and should be avoided, although I admit that the effect of occasionally inserting the Kelner orthoscopic C is very striking, on account of its enormous field. Lastly, the selenites should be in the form of discs, set on the top of the polariser, and beneath the condenser, so as not to interfere with the focus of the emergent rays from the condenser.

Considering the somewhat complicated nature of the substage apparatus, at first sight it must seem a matter of difficulty to adjust this kind of illumination, but in reality it is not so. The operation is as follows: Transmit the light in the ordinary way, focus the object, and centre the stop of the substage condenser so as to get a perfectly black ground, at the same time being careful not to cross the prisms, otherwise, in the first instance, you will get too much darkness. In conjunction with the adjustment of the stop, it is necessary to rack the condenser up or down until a position is found where the field and object are in greatest contrast—namely, where the object is most brightly lit up and the field darkest. One or two movements of the mirror generally require to be made during this operation of centering. By rotating the analysing prism the splendid effects are then seen, the thickness of the selenite governing the prevailing colours. I wish again to mention that, in order to get bright images, and a large number of them in the field, a low ocular should be used. The brightness may be greatly enhanced by the application of glycerine between the condenser and slide; and if a slip selenite is used, it also should be brought into contact with the slide by the same means. With your indulgence I will endeavour to describe the effects of polar dark-ground upon a few familiar diatoms, the power used being a half-inch, with an A eyepiece on a ten-inch tube—that is to say, under a magnification of 100 diameters.

A very slight study will suffice to convince the observer that there are two distinct classes of diatoms—first, iridescent

or spectral; and, second, opaque: and, for convenience, I will call the one iridescent and the other opaque. For example, if you examine *Aulacodiscus* with ordinary dark-ground, you will find the diatom tinted with certain colours for which it appears to have an affinity; if you now add the polariscope, you will produce an extra colour derived from the selenite. *Isthmia enervis*, *Arachnoidiscus*, &c., may be taken as examples of the other or opaque class, because, when viewed by ordinary dark-ground light, they appear colourless; but if the polariscope is applied, they are immediately coated over by the selenite colour, and never present more than one colour at a time. In my former paper, I took the liberty of suggesting possible explanations for the phenomenon of colour in diatoms under ordinary dark-ground illumination, and the subsequent examinations I have made confirm my opinion in these respects—(1), that some diatoms have an affinity, so to speak, for a certain colour, and this colour is evolved from those parts of the frustules only where the markings exist; (2), that it is possible, by racking the spot-lens up or down, to change this colour from one end of the spectrum to the other, demonstrating the great dispersive power of the object; and, (3), that on account of the form of other diatoms, the pencils of light may impinge upon various parts at angles of greater or less obliquity, and thus appear variegated. Bearing in mind, therefore, that dark-ground illumination is entirely produced by reflection, the foregoing appearances are the direct outcome of the changed angle of incident ray, depending mainly on the focal length of the condenser.

With regard to these spectral colours, let me explain that Sir David Brewster, in his celebrated experiments upon mother-of-pearl, discovered by means of the microscope that the surface of that material is of grooved or striated structure, resembling that on the tip of a child's finger, and that these grooves are not of uniform interval, but range from 200 to 3000 to the inch. It was also discovered that an impression of these lines, taken in wax, or almost any suitably plastic material, gives the same effect, from whence it follows that the beautiful iridescence of this and many other substances emanates. About the same time Sir John Barton succeeded, by cutting fine lines upon steel from 2000 to 10,000 to the

inch, in producing the well-known buttons, known originally as "Barton's buttons." Sir David Brewster, in experimenting on steel lines, found that grooves of 1000 to the inch, with the light striking at various angles, gave as follows: at 90° , white; 74° , brilliant blue; 60° , pink; 24° , green; while a specimen ruled to 500 lines to the inch gave yellow throughout. You will thus observe that we have now two factors in the proposition—namely, (1), fineness or degree of marking; and, (2), angle of incident light. Sir David Brewster also found, that if the surface of the steel be covered with fluid, more orders of colour were developed. For example, it was ascertained that by applying oil of cassia the result was as follows:—

Lines per inch.	Colour when dry.	Colour when immersed.
312	White.	Reddish-yellow.
1,000	Yellowish-green.	Greenish-blue.
2,500	Blue.	Yellow.
3,333	Yellow.	Bright blue.
10,000	Blue.	Yellow.

Now, I think you will readily note the significance of these facts, when applied to the behaviour of some of the Diatomaceæ upon the stage of a microscope arranged as I have described. In the first place, if the angle of the incident ray is altered by a movement of the mirror, the colour becomes changed; second, coarsely lined diatoms, or parts of diatoms, such as *P. balticum*, *Pinnularia major*, &c., the markings of which are from 400 to 800 to the inch, appear yellow or orange, irrespective of change of direction of light or medium in which they are mounted; and, third, finely marked diatoms, or parts of diatoms, such as *P. angulatum*, from 10,000 to the inch upwards in striation, are from pale to bright blue; and, as an example of the effect that a diatom of two different textures presents, I have noticed that *Surirella gemma* has its main ribs yellow and its fine longitudinal lines blue. Before leaving this, I may mention that it is hardly possible to manipulate so as to be able to compare the change of colour that a single diatom will undergo when dry and mounted in a

medium; but on carefully examining different mounts of the same genera, I have invariably found the dry, and also the chloride of zinc, to give the greatest brilliancy: monobromide does not appear to be suitable for this purpose. With regard to the diatoms I have referred to, and classed as opaque, on which there is no dispersion of light, I am inclined to believe that, while they are in all other conditions the same as their brethren, they present a calcareous appearance, their surface being dead, like that of obscure glass.

Now, concerning the polarising property of certain diatoms treated with open aperture, I desire particularly to point out that those frustules only polarise which come under the head of my first class—namely, the iridescent ones. Take, as an example, *P. angulatum* polarised under a blue and yellow selenite. All the valves that appear erect in the field will be coloured, say red, and all those at right angles green. At first sight it seems strange that, by using a blue and yellow selenite, while the field conforms to these colours, the frustules should become red and green; but this arises from the fact that the diatoms have the power of retarding the light one quarter of a wave length, in the same way as a quarter plate of mica. This makes a very pretty as well as instructive subject, and is only one of the many interesting phases under which this diatom shows itself. By removing the selenite and crossing the prisms, the highly polar nature of this *Pleurosigma* becomes more apparent. The valves shine out clearly and distinctly on the dark ground—which, as I remarked before, proves unmistakably their property of polarisation. Beyond this, however, it will be noticed that each valve retains a slight colour—either a tinge of bluish green, or one here and there from a dark purple to a dingy red. By this I conclude that a minute quantity of light is admitted, on account of the imperfections of the prisms or their centering, which reaches the diatoms in a retarded form, and is partially polarised, partially dispersed; but I am inclined to believe that, while both actions are traceable, dispersion is the principal colour-producer. If the selenite is now replaced, and the dark ground maintained by the insertion of the stop, both the iridescent and polar colours will be visible—the former directly from interference if the prisms are open,

and from accidental light if they are crossed. These spectral colours can indeed be seen without the use of any apparatus, by simply allowing the light to fall upon a prepared slide of this class. I suppose every one who has handled a slide of *P. angulatum* has been struck with its glittering colours.

I have constructed a table embracing some of the more familiar diatoms that I have found suitable for this light, and arranged them in terms of the classification I have endeavoured to explain.

Diatom.	Class.	Colours.	Remarks.
<i>Pleurosigma angulatum</i> .	spectral	variegated	very brilliant.
" <i>balticum</i> .	do.	do.	do.
" <i>hippocampus</i> .	do.	do.	do.
<i>Heliopelta metu</i> , &c. .	do.	do.	do.
<i>Meridion circulare</i> .	do.	do.	edges only illuminated.
<i>Triceratium septangulatum</i> , &c.	opaque	single	meshes brilliant.
<i>Navicula lyra</i>	spectral	variegated	dingy.
<i>Arachnoidiscus</i> , &c.	opaque	single	well defined.
<i>Eupodiscus Rogersii</i>	spectral	variegated	very bright and well defined.
<i>Aulacodiscus</i> , &c.	spectral	do.	do. do.
<i>Podosira</i> , &c.	spectral	do.	do. do.
<i>Isthmia enervis</i>	opaque	single	do. do.

In dealing formerly with the subject of dark-ground illumination of diatoms, I stated that resolution was not thereby assisted; but with the class of illumination we are at present considering, the resolving power is undoubtedly augmented. It is, consequently, the addition of the polariscope that brings this about. A few months ago, a writer in one of our science journals announced that, by using the analysing prism in its place on the microscope, he could strengthen the resolving or separating power of his objectives. The matter was immediately investigated, and has been most favourably received by one or two eminent London microscopists; and, along with several of our own members, I have tried this simple means, and found that it was a decided, and therefore a valuable, improvement. I make no doubt that, in polar dark-ground illumination, the increased definition emanates from the same source.

In using, say, a $\frac{1}{4}$ -inch or $\frac{1}{8}$ -inch objective, the manipulation

consists in making use of a high-angled condenser, or, what does equally as well, a small hemisphere of glass not more than $\frac{3}{16}$ of an inch in diameter, either of which must be brought into contact with the under side of the slip by means of glycerine. To this an oblique pencil of light should be admitted, and a zone of dark ground will extend round the periphery of the illuminator, on the edges of which the diatoms may be seen iridescent, polarised, and resolved to great perfection. I have found that a green colour on the diatom gives best results—consequently, a blue selenite should be used.

Another class of subjects equally adapted for examination by this light upon a $\frac{1}{2}$ -inch power are insect scales. Microscopists know that these objects polarise to a limited extent in the ordinary way, but as the colours are dull this quality gives them no particular interest. It is only when thrown upon a dark ground that their beauty under polar light is fully developed. The scales appear almost as brilliant as the feathers of the humming-bird—microscopically familiar to you all. I consider that this opens up a question for deep optical study, at the same time affording one of the most pleasing subjects for the microscope; and as they generally have more than one colour, or rather lustre, the scales are specially beautiful. Amongst those I have examined under this light are *Lepisma saccharina*, *Pieris brassicæ*, *Hepitus humuli*, &c. This illumination can be applied to low powers by the substitution of the common spot-lens for the stopped condenser—because the emergent rays from most condensers are too oblique, or, in other words, the condenser focus is too short for objectives of long focus. In the case of my Ross microscope, I have simply to screw the spot into the substage diaphragm-holder, and add the polarising prism underneath as before; and with this arrangement I can manipulate the light from objectives of from 1-inch to 2-inch focal length. By this means algæ and desmidaceous matter can be splendidly shown. Its remarkable differentiating quality is displayed to great advantage on anatomical and other tissues; for not only are the various parts differently coloured, but the whole has the appearance of relief, as if seen through a binocular arrangement. Micro-crystals also produce fine effects. Some, however, are disappointing—no doubt attributable to the media in which they are preserved.

One peculiar feature is, that dichroic crystals under this light have their prevailing colour intensified—as in the red of platino-cyanide of magnesium; and in every position of the prisms and selenites, crystals of this class adhere firmly to the one colour, to the entire exclusion of all other polar tints. The reason of this is obvious, when you consider that, in the case of a crystal under polar dark-ground, the light, before reflection, must take the colour of the medium it passes through, thus becoming monochromatic. This fact is pointed out by Tyndall; and the example we here find is particularly interesting and instructive to students of polarised light.

In closing, permit me to indicate that, by arranging the microscope for polar dark-ground illumination, it will be found that a very large number of slides that may have become comparatively uninteresting under ordinary manipulation will be found possessed of new interest; and by attention to the management of the instrument, and careful observations of the many optical effects at command, it is possible to acquire a more intimate acquaintance with the various subjects than by mere book study or any other means.

[Several coloured diagrams of diatoms, enlarged from photo-micrographs, were exhibited in illustration of the above paper.]

V.—*AN ANCIENT LAKE-DEPOSIT IN QUEEN'S PARK.*

BY MESSRS J. A. JOHNSTON AND J. LINDSAY.

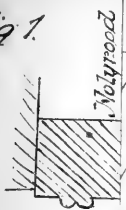
(*Read Feb. 22, 1888.*)

For some months past extensive excavations have been in progress in the Queen's Park, in connection with the making of a new main-drain, and many interesting sections have thus been exposed, all helping to reveal more clearly the successive geological changes of which this well-known locality has been the scene. At one portion of the workings, near Holyrood Palace, the attention was particularly arrested by the masses of shell-marl which the workmen were throwing out of the

cutting, indicating that a lake of somewhat considerable extent had at one time covered the site. This portion of the Queen's Park has until a comparatively recent date been in some parts of a more or less marshy nature, corroborating the evidence thus furnished of its much earlier condition. The questions thus naturally occur to one, When did this lake probably exist? and, What was its fullest extent before it had begun to get silted up and choked with decaying vegetable matter? What follows may perhaps help us to give approximate answers to these questions.

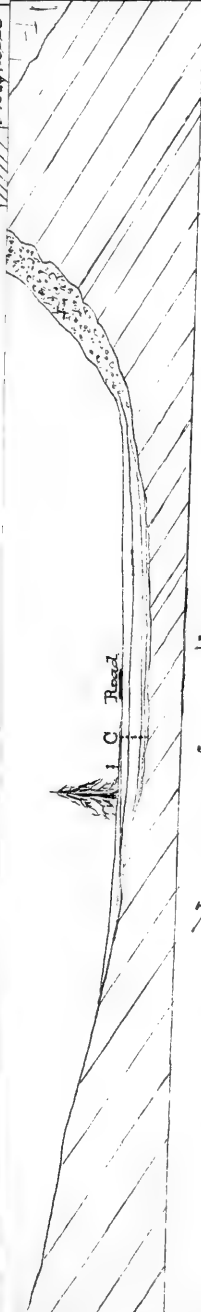
It is said that a chief reason for Queen Mary's frequent absences from her Palace of Holyrood was the marshy nature of the ground surrounding it, which rendered this royal residence disagreeable and unhealthy. It is extremely probable that amongst these marshy portions would be the ground now under consideration—which, indeed, in the first half of the 16th century must have been very much of a quagmire. In that most readable volume of essays by Hugh Miller entitled 'Edinburgh and its Neighbourhood,' there is a paper, written in 1842, on the Borough Loch, then in process of being drained to form part of what is now known as the Meadows. In this paper, speaking of the numerous sheets of water at an early period existing in and around the city, the writer says: "The records of the Medical Faculty of Edinburgh do not extend to a period by any means remote. We have been informed, however, by a medical friend, that among their earlier entries agues and marsh fevers occur as usual diseases of the town and neighbourhood." And in an earlier essay on the "geological features" of the city, a beautiful word-picture is drawn, in the author's well-known graphic style, of the salient points of the landscape in the bronze age, with rocky ridge and alternating valley and blue gleaming lake as prominent objects in the scene. These lakes are enumerated—viz., the Nor' Loch of what is now the Princes Street valley; the South Loch, in the valley of the Cowgate and Grassmarket; the Borough Loch of the present Meadows; a lake at St Leonards and another at the Hunter's Bog; with the two which are still familiar to us—Duddingston and the restored Dunsappie Loch. "And thus," Hugh Miller concludes, "in a tract of country little more than one and a half square miles in extent, at least seven

Fig 1.



Zoochlyon

Fig 3.



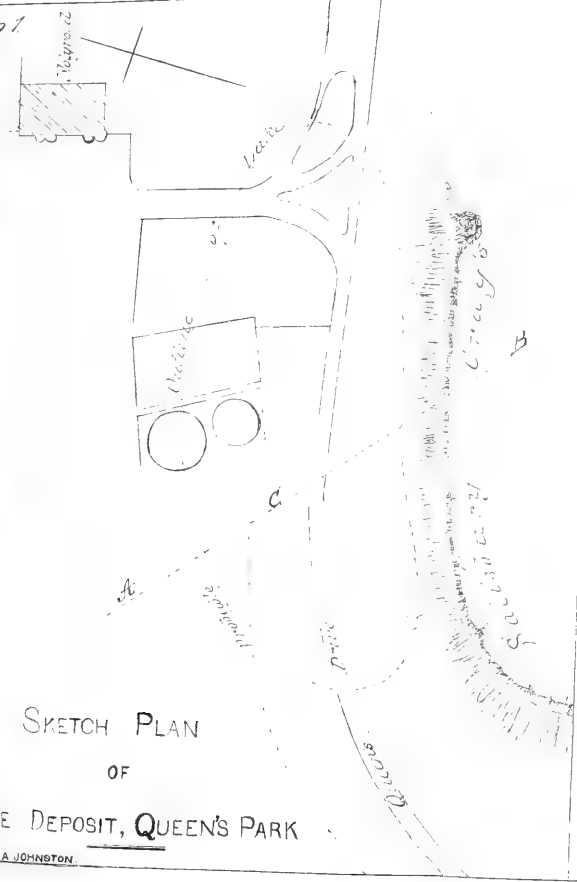
- 3'-2" Forced Material
- 2'-4" Yellow Clay.
- 3'-0" Peat.
- 9'-0" Marl.
- 2'-6" Macd (White & Brown.
- 1'-9" Clay. (Blue & Red.
- 4'-6" Rough Gravel.
- 5'-6" Clay & Small Stones
- 7'-7" Blue Clay.
- Blacs.

Section of Bore at C. Fig 2.

SKET

LAKE DEP

Fig 1



SKETCH PLAN

OF

LAKE DEPOSIT, QUEEN'S PARK

JOHN A. JOHNSTON

Fig 2.

Section through line A B Fig 1.

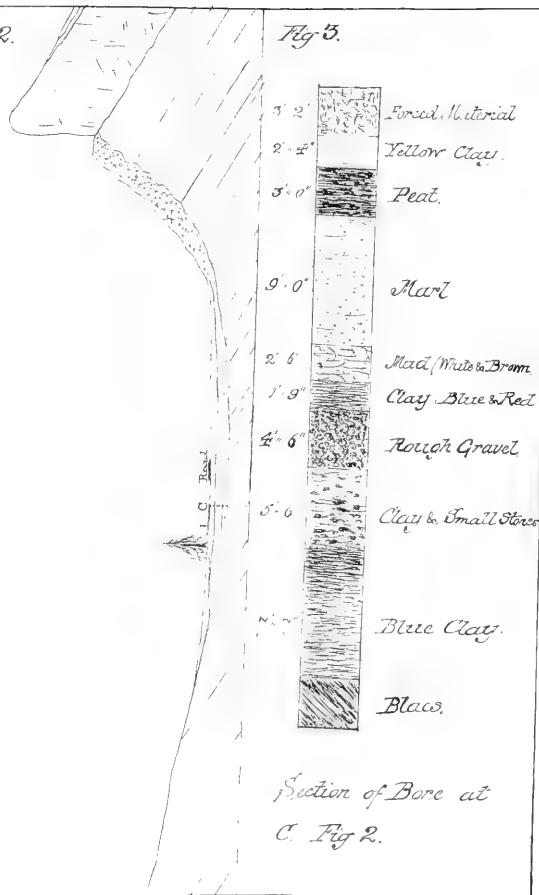


Fig 3.

Section of Bore at C. Fig 2.

lakes must have opened their blue eyes to the sky, and given in these early times lightness and beauty to the otherwise shaggy landscape." We may now add to this enumeration the lake at Holyrood, the site of which has in part been now opened up and spread out before us.

After having completed the investigations and collected the facts for this paper, it was discovered that another of our members had some time before been at the same work. In February last, Mr John Henderson read a paper before the Geological Society "On Sections exposed in making a Drain through the Queen's Park at Holyrood." In this paper the earlier portion of the cutting, from its commencement at Spring Gardens, is described, as well as part of the excavation southwards, where the lake-deposit more particularly to be dealt with here was entered upon. In the cutting near the garden wall of the Palace "several thin beds of black shale were exposed, containing entomostraca and fragments of fish remains." These fossils have been identified with known carboniferous species, and any of our members who feel interested in the subject may refer to Mr Henderson's paper, published in the 'Transactions' of the Geological Society, where full information on this point will be obtained. It is now proposed to confine attention to the cutting near the roadway forming the entrance to the Park at Holyrood, through the shell-marl deposit in a south-westerly direction, till the cutting met the old drain from the foot of Arthur Street. In describing this cutting, reference is made to the accompanying diagram (fig. 3), partly founded on measurements and the results of borings kindly furnished by J. Massie, Esq., of the Burgh Engineers' Office.

The present section, then, extending from the roadway to a distance of about 200 yards, exposed, first, a layer of forced material and natural soil from 3 feet to 10 feet in thickness; next a yellowish clay, from 1 foot to $4\frac{1}{2}$ feet thick; then came the peat, varying in thickness from 1 foot to $14\frac{1}{2}$ feet; and underneath this was the marl, from 5 feet to 9 feet thick. On reaching the marl, which was excavated in some parts to a depth of 2 feet, borings were made in six different places in order to secure a solid foundation for the heavy mass of material forming the drain. These borings

disclosed the soft, loose nature of a considerable portion of the strata beneath the marl, in alternating bands of mud and clay and gravel, so that piles had to be driven to the depth, in some cases, of nearly twenty-five feet for the drain to rest on. No. 3 bore gave a section in all of fully 40 feet before the underlying rock was struck, and here the peat was 3 feet thick and the white marl 9 feet. At No. 5 bore 9 inches of tree-roots were found embedded in the peat. At No. 6 bore the marl disappeared, showing that the margin of the lake had been reached, and here the peat extended to the thickness of 14 feet 6 inches.

The peat and its underlying shell-marl would alone unmistakably indicate the lacustrine nature of this deposit, and its character in past ages, when the whole trough or cavity was filled by a sheet of water. The peat, when examined under the microscope, revealed an aquatic vegetation in the shape of reeds and rushes and plants of similar nature. The striated and knotted stems of some of these plants were very characteristic, and wonderfully fresh after their long entombment. The marl was studded with countless myriads of shells, testifying to the abundant molluscan life which inhabited these waters. The genera observed were few—viz., one bivalve and three univales—but of some there were several species. The most plentiful was the whorled limnæa or pond-snail (*Limnæa pereger*); the next, the bivalve cyclas (*Cyclas obtusale*), like a miniature cockle; then the trochus-like valvata (*Valvata piscinalis* and *V. cristata*); and, lastly, the beautiful discoid planorbis (*Planorbis nitidus* and *P. glaber*), like a tiny ammonite, which seemed to be relatively least plentiful. On comparing these shells with those taken from the Borough Loch in 1842, and included in the "Hugh Miller Collection" at the Museum of Science and Art, they will be found to be nearly identical. Nor need this surprise us when we remember that the same mollusca are still alive in the neighbouring lochs and ditches. The shells were very light, and extremely brittle. Hugh Miller, in the work already quoted, speaking of the shells taken from the Borough Loch deposit, remarks that "twenty of them, of the average size, scarce weigh a grain." In order to test this, a hundred of by no means the smallest specimens from the Queen's Park deposit

were selected and weighed in a chemical balance, when it was found that the hundred weighed only three-tenths of a grain! So friable were they, that even a slight pressure with a camel-hair pencil in cleaning them reduced many of them to powder. The marl itself is, of course, largely composed of these rubbed-down shells, in the shape of carbonate of lime. Samples of the marl, from different parts of the cutting, were sent to two of our members, Mr Wm. Wallace and Mr Fred. G. Pearcey, who kindly subjected them to a careful independent analysis, and found them to contain respectively 89.4 per cent and 92.35 per cent of carbonate of lime. When the use of shell-marl in agriculture was more common than it is at present, a rich deposit like this might have been a good "find." In 1810, at a meeting of the Selkirk Farmers' Club, when Mr Walter—afterwards Sir Walter—Scott was in the chair, "the thirty-six members present discussed with energy the question of the day, 'Whether, in low land of light soil, like the haughs near Selkirk, lime or marl would be most profitable during a nineteen years' lease, supposing them to be equally cheap?' By a majority of four, it was decided in favour of marl."¹

While examining under the microscope the finer particles of the marl, a small insect, like a very minute water-beetle, was observed, of which about a dozen specimens were found, but all in a less or more imperfect condition. This insect proved to be one of the Hydrachnidæ or water-mites, belonging to the family of the Oribatidæ, but, owing to the fragmentary nature of the remains, the species was difficult to determine.

We now come back to the two questions put at the outset of this paper—1st, How large was this lake originally? and 2d, When did it spread out its blue waters under the summer sky? The answers to both questions can, after all, be little more than mere "guesses at truth." As to the extent of the lake, Mr Henderson is inclined to think that at one time it stretched northwards for a considerable distance, covering the area now occupied by Holyrood Palace and grounds. In the diagram accompanying this paper (fig. 1) the probable extent is given as somewhat less. But that it must have had its greatest dimension from north to south may be regarded as certain; while as to its breadth, it would be confined on

¹ 'Hist. of Selkirkshire,' by T. Craig-Brown, vol. i. p. 243.

the east, speaking generally, by the northern portion of Salisbury Crags, but in all likelihood extended some distance westwards, for in 1884, when the foundation for the gasometers was being excavated, shell-marl was there met with. As to its age, if we regard it geologically it is of course recent; but reckoned by human chronology, it may well be termed "ancient." It would, no doubt, be contemporaneous with those other neighbouring sheets of water which have most of them, like itself, now disappeared; and it may be interesting, therefore, in this connection, to quote what is said in 'Edinburgh and its Neighbourhood' of the Borough Loch. Hugh Miller writes of it thus: "The bittern has boomed amid its reeds, and the stately swan skimmed over its surface, when yonder Castle rock was a naked cliff, rising amid an uninhabited country, and the gigantic elk and the bear found shelter in the shaggy forest which waved on their ridges, now covered by their ten thousand human habitations, and musical with the murmurous hum of a busy population. It is not improbable that some of the shells in the lower portion of that marl bed were browsing, according to their nature, on aquatic plants, or alternately rising to the surface to respire and descending to feed, full four thousand years ago."¹ How this lake came to be gradually filled up may be easily understood, for the process of silting can be seen going on in many of our lochs at the present day, as witness Lochend or Duddingston. In the 'Lithology of Edinburgh,' Professor Fleming says, speaking of Duddingston Loch as it was between thirty and forty years ago, that it was "only interesting to the observer as an example of the process of upfiltering by aquatic vegetation." "The lake on the west side especially," he adds, "would soon pass into a bog or morass if the reeds which now grow luxuriantly were not annually cut down and removed for thatching purposes." What Professor Fleming here predicted has actually come to pass, for the lake on the west side is now, and has been for years, represented by a wet spongy bog, and will in the course of time become, no doubt, a verdant meadow. Duddingston Loch itself has only been preserved as a sheet of water by frequent removals of the rank vegetation.

¹ 'Edinburgh and its Neighbourhood' (8th edition), p. 145.

It is to the same process of "upfiltering" that most of our Scottish straths and English dales owe their origin.

Here may conclude the notice of this ancient lake-deposit, with the interesting story it tells of its early history, while its banks were yet trod by the foot of the primitive inhabitant. Looking on the tons of peat and shell-marl thrown up and spread out, and the multitudes of tenantless habitations, one is led almost unconsciously to reflect on the time when a luxuriant aquatic vegetation filled the waters or waved in the breeze around its margin, overshadowing still depths where innumerable generations of animal life flourished, and then sank out of sight. And the northern portion of the cutting, with its exposed fossiliferous shales, calls up yet another scene, long ages before the underlying beds of sandstone were tilted up on edge by igneous agency, and the cavity of this ancient lake was gradually scooped out. Over the place where these sedimentary rocks were deposited the sea then rolled, leaving the remains of fishes and marine crustaceans to tell the tale,—for there was no human historian to chronicle it! All this, and much more when read aright, is taught by what some may have glanced at, and then passed by with a half-contemptuous shrug, and a muttered "Only a drain!"

VI.—NOTES ON AN ORNITHOLOGICAL VISIT TO WARWICKSHIRE.

BY MR ARCHD. CRAIG, JUN.

(Read March 28, 1888.)

DURING the months of April and May 1887 it was my good fortune, accompanied by a friend, to spend a few days in Warwickshire, and, thanks to the very kind permission of one of the largest landed proprietors in the county (Robert N. Philips, Esq. of Welcombe), I was enabled to traverse a tract of ground several square miles in extent, which, varying considerably in aspect, gave opportunity for forming a fair idea of the feathered fauna frequenting the district. With every

facility offered for identifying the various birds, and absolute freedom to wander alone anywhere on the estate, I cannot conceal the fact that the results were most disappointing, both as regards numbers and species; but this was to be attributed not to the unfavourable nature of the locality, but solely to the inclement weather, which was of a most boisterous kind, being made up of rain, cold, high winds, and hail—incontestably the very worst that could be conceived for studying bird-life. Notwithstanding these drawbacks, however, several species hitherto strangers to myself, and unknown, or at best rare, to Scotland, were marked; and this circumstance may perhaps be sufficient warrant for bringing the subject under your notice. A very few remarks upon the county itself, before turning to the other part of the paper, may not be out of place.

Our headquarters were at a little inn in the village of Snitterfield, about four miles from Stratford-on-Avon and six from Warwick. The village itself is probably one of the prettiest in all Warwickshire, and thoroughly typical in character,—curious cottages of red brick, or the same whitewashed, with high gables and thatched roofs; creepers trained up the walls, and beautiful little patches of garden-ground in front—some laid out in flower-beds, others in lawn studded with fruit-trees, which, at the time of our visit, were hanging thick with blossom; immense trees scattered here and there by the roadside, overshadowing the houses—the whole place displaying a peaceful air and picturesque appearance that is entirely absent from our colder-looking stone-built villages of Lowland Scotland. Many of the neighbouring hamlets—notably Leek-Wooton and Hampton-Lucy—are even more antiquated-looking than Snitterfield, the brick building interlaced with huge oak-beams predominating, and presenting an object of great interest to one who has hitherto been unused to this style of edifice. These combination cottages, so to speak, last much longer than a stranger would imagine, many being several centuries old; but as age creeps upon them the oak beams warp, and in the process twist the house at the same time in a fantastic manner, so that it is not unusual to find the same cottage leaning towards the four points of the compass, and yet the building seems to stand as well as ever, and, albeit its distorted appearance, to give the occupants no uneasiness.

With the exception of a few long worm-like ridges traversing the county, and isolated mounds that crop up here and there, the whole ground is flat and richly cultivated, save in some parts where large tracts are entirely under wood. The most important of these latter are the Bearley and Snitterfield Bushes, which in summer, when the leaf is full out, and vegetation at its prime, will almost vie with a virgin forest in the possession of tangled masses of impenetrable undergrowth, chiefly brambles, blackthorn, and another hateful prickly plant which I am not botanist enough to name. Periodical raids are made upon these obstructions, and a thorough clearance effected, but in a very few years the growth is as thick as ever. Wide turf-walks intersect the woods for the benefit of the sportsman and fox-hunter; but although to all intents and purposes a game-covert, any respectable person is free to wander over it, and, to the credit of the inhabitants be it said, little or no damage is ever done. *Apropos* of this latter remark, there are two things which cannot fail to strike a Scotsman, however casual an observer, who visits Warwickshire: the first is the number of bypaths through woods and rights-of-way over fields—two items which greatly enhance the pleasure to be derived from a sojourn in these parts, when compared with our own country districts, where one hardly dare leave the bare turnpike without being hounded off the ground by some irate agriculturist, or by the minions of the proprietor. The second noticeable feature is the marked politeness of the labouring population to strangers—a welcome contrast to the manners of the same class in the south of Scotland. Whatever may be said of the relative brain-power of the two—and the Warwickshire farm-servant certainly does not seem to have a superfluity of that commodity at his disposal,—it is beyond dispute that he displays none of that stolid boorishness and want of politeness to visitors which our men indulge in, and erroneously consider to be independence of spirit. I merely mention these two facts in passing as being too conspicuous to escape observation, and also out of grateful remembrance for the universal civility accorded to us during the time we passed in the county.

Over and above the scenic features, which of themselves are well worthy of attention, the historic interest attaching to the

county of Warwick is sufficient of itself to cause thousands annually to make the round of its numerous attractions. Mention need only be made of Leicester's Hospital, Warwick Castle, Kenilworth, Guy's Cliff, &c., to show that important events in English history have been enacted in this now quiet and tranquil county. But what to most folks in Britain, and, in fact, wherever the English tongue is spoken, is of infinitely greater importance than all the castles, mansions, battles, sieges, and turbulent actions of the old nobility put together, is the simple circumstance that a little over three centuries ago, in the dead little town of Stratford-on-Avon, Shakespeare first saw the light of day, lived there for a considerable portion of his life, and at last was laid to rest in the old parish church in which, no doubt, he had often worshipped. This event, with all its kindred associations, has been so often commemorated in writing, and is matter of such universal notoriety, that it would be presumptuous on my part to attempt to add another word on the subject. In wandering through the little hamlets, and visiting towns like Warwick, one feels as if he had fallen asleep, and, by a process of retrogression, awoke in the 17th century, there is such an old-world look about everything—a want of modern bustle, and a quaint standstill sort of aspect, that reminds one of the old Scotch saying, “As quiet as the grave—or Lauder.” The effect of this feeling is rather pleasant than otherwise, and the total change from bustling cities like Birmingham or Glasgow comes as a relief doubly grateful to all whose daily occupations are of an active and often harassing character. Most of the villages have composite names, such as Norton-Lindsey, Henley-in-Arden, Bishop's-Hampton, and so on; and, as already mentioned, many are beautifully situated and highly picturesque, perhaps none more so than the last named, which is in the immediate vicinity of the park where tradition says that Shakespeare enacted the *rôle* of poacher, and was brought before the Lucy of the day to have punishment meted out to him. The old park is still tenanted by deer and the mansion-house by a descendant of the Lucy family. The latter, however, hardly wields the same power in the district as did his ancestor. As already hinted, the weather during our stay was most unpropitious, and, somewhat to our surprise, heavy showers of hail

constantly discharged themselves at unexpected moments, to be succeeded by bursts of bright sunshine, these latter of short duration. The hail itself was about the size of small beans, and not calculated to improve one's temper as it rattled on the face. But this, it seems, is nothing unusual, if we are to judge from the fact that in Stratford an Insurance Company exists for the purpose of recouping farmers for the damage done to their crops by such destructive climatic vagaries. Time would not permit of further enlargement on the external features of this most pleasant neighbourhood; suffice it to say that, for beauty of a quiet modest nature, a judicious mixture of the agricultural and the woodland, for fine mansion-houses with magnificent policies surrounding them, for pleasing associations of the historic past, there are few counties that can surpass Warwickshire.

Now as to the bird-life of the district. It would serve no good purpose to recapitulate and describe all the species found there, as that would not only be a formidable task, but a tiresome process for the listeners, whose patience could scarcely be expected to stand the test, so I shall only advert to the more uncommon members of the family. To commence with the warblers: the blackcap, garden-warbler, whitethroat, willow-wren, and wood-wren were all numerous, but, in addition to these, the presence in considerable numbers must be recorded of the chiff-chaff and nightingale. The former little bird is not much known in Scotland, although it would be wrong to say that it is rare, occurring as it does here and there over the country, but nowhere in such numbers as the willow warbler. It is uncommonly like the last named, and were it not for the distinctive note it would be difficult to distinguish one from the other. Apart from the call-note, the difference lies in this, that the chiff-chaff is slightly smaller in body and darker in the legs, but at a distance, when both species were mute, he would indeed be a bold man who could authoritatively discriminate between one species and the other. I have never on any occasion observed this bird in Scotland, but in Warwickshire it is abundant, and could be heard giving vent to its somewhat monotonous song in every wood and garden round Snitterfield, even within half-a-dozen yards of the inn-door. No one possessed even of the most elastic

imagination can call its music beautiful, as it seems to consist solely of the same few notes repeated indefinitely; yet the sound is cheerful, and by no means unpleasant. The bird itself is lively and restless, usually jumping about the tops of high trees, and seldom remaining long in any one position, although the radius of its movements is not great, as it seems to confine these to one specified locality, where, judging from the sound, it must be indulging in what to it is circumnavigation of the globe on a diminished scale. Why this species is not more frequent in Scotland would be difficult to tell, as it is quite as hardy as the willow-wren and wood-wren—in fact, more so, as in some years it arrives very early, when cold wintry blasts inform us that, notwithstanding the calendar division of the year into seasons, the months of March and April are often only spring months in name, and hardly deserve to be designated as such. Not to prolong description of this less attractive species, let us turn to the much more interesting nightingale. Probably no bird has been the subject of so much writing in prose, or provoked in a greater degree the zeal of the poets, among which latter class are included for the time being all those who imagine themselves possessed of the “sacred fire,” whatever that article may be. An ill-natured writer once said that a poet was a man who wrote stuff that nobody would read, and that he could not understand himself; but without acquiescing in that sweeping denunciation, there is no doubt that many rhymers are responsible for much erroneous matter when they go into raptures over bird-life. An old idea, now happily exploded, used to pass muster that the nightingale placed a sharp thorn in *her* nest, and, by leaning painfully against it, was thereby induced to sing in a more plaintive and sorrowful tone. Overlooking for the moment the curious inaccuracy of attributing vocal powers to the female, as it is only the male who warbles, it can scarcely be thought probable that a thorn inflicting pain upon the performer would be an incentive to melody. Mr Harting, author of several ornithological works, and among them ‘The Ornithology of Shakespeare,’ gives an interesting account of this superstition, and indicates two passages where the great dramatist himself makes allusion to the belief. It by no means follows, however, that Shakespeare believed in its

truth, although he made use of the tradition. In the present day, even, many intelligent people suppose the nightingale to be of large dimensions; and when they dream of its far-famed song, their imaginations depict a bird about the size of a crow, warbling in the dark, whereas, as the accompanying specimen proves, the species is very small. It is quite a mistake to conclude that the nightingale sings only at night, as it may be heard during the whole day, only then it is not nearly so noticeable, being drowned to a certain extent by the general chorus of other birds in the vicinity; but at the darkening, when most species, with a few exceptions, have retired to roost, the song rings out clearly in the silence of the woods, and rivets attention in a tenfold degree. Without expatiating on its merits, in a word it may claim pre-eminence over all the other warblers that visit Great Britain, and perhaps there is truth in the statement that no other species excels it in these islands. The reason for qualifying the latter assertion is, that many people consider the thrush not to be far short of it in point of merit. There cannot be hesitation for a moment in saying that, taking its small size into account, the variety and depth of melody emitted by the nightingale are perfectly marvellous; but again, the song of the thrush may be capable of giving as much enjoyment to the listener, and it really amounts in the long-run to a matter of taste. Let me ask you, can anything be finer than the song of the mavis on a calm mild evening in May, when the woods have just been refreshed by a shower of gentle rain? I think not. It may be prejudice, of course, but, having heard both frequently, I am fain to confess that to me the melody of the thrush is quite as pleasing; and there is no denying that many people whose knowledge of bird-life is limited, on hearing a sweet song at the gloaming, have given to the nightingale the credit of the music, which in reality should have been attributed to the more familiar mavis. It is a trite observation that the nightingale neither appears in Scotland nor Ireland; and even in England, its visits north of the Trent are rare, and in many parts farther south its distribution is extremely local. It seems also impossible to domesticate it in the northern part of the island, as witness the laudable attempts of the Earl of Buchan and Sir John Sinclair, who procured eggs from England and placed them

in the nests of robins, hedge-accentors, &c.—the former in Roxburghshire, the latter in Caithness ; but although successfully hatched, when the period of autumnal migration arrived the birds disappeared, but did *not* return next year, as it was fondly hoped they would. In habits this species is shy, and very easily frightened, and, owing to the matted and dense nature of the thickets it haunts, it is almost impossible at times to observe it, notwithstanding that the curious guttural chatter (the preliminary to warbling) may be quite audible ; and as during this performance it seems to be constantly changing its position, the sound has somewhat the effect of ventriloquism. Where its abode borders on a grass field or other open space, by the exercise of a little patience a good view may be obtained, as it has a knack of darting suddenly out from the hedge or thicket, and settling on the ground for a short space, at the same time expanding its rusty-coloured tail, after the manner of the redstart. The robin, as well as the last named, does exactly the same thing, and we might add also the hedge-sparrow occasionally. Many curious and absurd stories are fathered on the nightingale, but the following specimen in illustration will suffice.

In a quaint old volume entitled ‘ *The Ornithology of Francis Willughby of Middleton, in the county of Warwick, Esq.*,’ edited by Ray, and published in the year 1678, occurs a long description of this species, both in a wild state and in captivity ; and among other literary tit-bits, the following tale is told, on the authority of a still older ornithological writer called Gesner, who, moreover, received the anecdote from a friend. This said friend, in the year 1546, was lodging at an inn in Ratisbon, where, owing to illness, he was confined to bed, and, as he says himself, unable to sleep. In the room were three nightingales in separate cages, and according to this voracious individual, when all was quiet at dead of night, two of them began, with what he calls “strange janglings and emulations,” to talk to each other in imitation of the voices of human beings. Their conversation must have been gratifying to our invalid, and pleasing withal, as the topics discussed were various. It appears from the context that the birds incited each other to divulge all the tittle-tattle that went the round of the tap-room during the day, and among other curio-

sities they prophesied what was going to take place in a war against the Protestants, and also exposed a plot against the Duke of Brunswick. What was perhaps more interesting, if not so edifying, to the listener, was the apt manner in which they recounted, word for word, the domestic squabbings of the tapster and his wife, whose matrimonial relations seemed to have been none of the happiest; and, as the writer naïvely remarks, they repeated not only the ordinary recriminations, but apparently with gusto all the bad language attendant thereon. Having regard to the truth of this narrative, it is perhaps as well that the narrator confesses he was incapacitated at the time of its occurrence, as the sceptical reader may perhaps be excused for attributing the cause of his malady to an over-indulgence in strong waters, which no doubt had the effect of heightening his imagination.

Another very curious species common to Warwickshire, but, except in isolated instances, non-resident in Scotland, is the nuthatch. This is a smallish blue-coloured bird, about the size of an ox-eye, and in certain respects not unlike it in habits. Its *forte* is the ease with which it creeps upon tree trunks or branches in any given direction, perpendicularly, horizontally, or in a downward course—in this differing vastly from the common creeper (or “tree-speeler,” as it is called in Scotland), which, as a rule, works its way upwards, and rarely if ever downwards. The creeper also, while ascending, makes use of its tail as a prop, and this is useful as a staying power, while it is engaged poking its bill into crevices of the bark; but the nuthatch, again, relies upon nothing save its claws and legs for a sure foothold, and it is truly wonderful with what ease it runs in any fashion upon the surface of the bark, twisting and turning like a gymnast devoid of bones. Its bill is powerful, and well adapted for hammering purposes, such as breaking hazel and beech nuts, upon which it feeds at certain seasons. But its chief object in clambering up trees is to secure the abundant larvæ, and insect life in various stages, found concealed in the interstices of the bark. Although not numerous, one could scarcely fail to meet with it now and again; and I noticed a pair on the highroad from Warwick to Kenilworth busily pecking at something on the ground, but whether an edible substance, or mud to plaster up the entrance

to a late or second nest, I am unable to say. It does not strike one as being a timorous bird, as it permits a very near approach, and at intervals utters a curious short note, easily enough recognised, but difficult to describe on paper. For further and fuller information regarding it, I cannot do better than refer members to Mr Herbert's interesting note in the Society's 'Transactions' (vol. i. p. 184).

The stock-dove is another bird very numerous in Warwickshire, but scarce in Scotland—so much so, that one may almost be excused for supposing that the writer of the beautiful song, "Afton Water," wherein occurs the line, "Thou stock-dove whose echo resounds through the glen," must have mistaken the common ring-dove for this species. In general habits it resembles the wood-pigeon or "cushie," but is not so large, and wants the distinctive white patch on the sides of the neck. Besides, the cooing-note is not so clear or loud, and in various minor points it differs considerably from the other. At Snitterfield, the favourite breeding-haunt was a large clump of ivy-grown trees, whose great height was a perfect safeguard against intrusion, and towards nightfall the numbers of birds that flew in there from all directions were astonishing. When startled they set off at great speed, snapping their wings together with a sharp concussion, similar to the tame pigeons known among fanciers as "smiters"; and, like most of the *Columbidae*, the species is timid, and leaves its resting-place on very slight occasion. Although found in various parts of the county, the smaller turtle-dove does not appear to inhabit the immediate neighbourhood around Stratford, and I was unable to learn from any one in the Snitterfield direction if it was ever identified there. While on the subject of doves, I trust you will pardon me for once more referring to Willughby's work. Under the heading, "Divers sorts of tame pigeons," the author takes occasion to indicate a large number of diseases which may be cured, or at least alleviated, by the use of the flesh and blood of doves. Take one quotation as a sample: "A live pigeon cut asunder along the backbone, and clapt hot upon the head, mitigates fierce humours, and discusses melancholy sadness; hence it is a most proper medicine in the phrenzie, headache, melancholy, and gout—some add, also in the apoplexy." It is, however, a moot-point

whether the cure or the disease would be the worse to bear. But not to weary you with further quotations, just let me mention, in passing, a few of the more prominent disorders that fly before this sovereign panacea: bleared and bloodshot eyes, colics, vertigoes, lethargies, tumours, blood in the brain, falling out of the hair, and numerous other ailments which shall be nameless. After this varied category, one is inclined to wonder if this same hot pigeon would cure hot tempers, as if so, a stock of doves would be a valuable possession from a commercial point of view.

The jay and the magpie abound in the bushes, the former especially, and, notwithstanding the incessant persecutions of the gamekeepers, contrive to flourish, both species having very sound ideas on the subject of self-preservation. In spring the jay is perhaps as wary a bird as one would wish to see. It is not of much use hunting him: he is quite equal to the occasion, and won't allow himself to be caught napping. Yet nevertheless, with all his caution, great numbers fall victims to the gunner and poisoner, and it is really pitiable to see the rows of these handsome birds hanging at the ends of the keepers' houses, and at the edges of woods, in all stages of putrefaction. There is no blinking the fact that they are destructive to the eggs of game-birds, and that, of course, causes them to be "anathema" in the eyes of the sportsman, who, from his point of view, is justified in attempting to preserve what he has purchased at considerable expenditure of money. But to an outsider uninterested in the game mania, it cannot fail to be a source of regret when beautiful species like the present are exterminated. In many districts of Scotland, where formerly plentiful, this bird is now extinct; and at the present rate of progression it bids fair to become a thing of the past in several English counties as well. On the Welcombe estate they are not hunted down so relentlessly; but on that of Lord Leigh at Stoneleigh Park, if we are to judge by the numbers of dead specimens hung in clusters about the woods, systematic destruction seems to be the order of the day. The note is very harsh and grating, falling on the ear with alarming suddenness at times while wandering through the woods. The extraordinary talent they display in skulking through the thick bushes completely baffles pur-

suit, so that the only mode of observing them reasonably near at hand is to sit quietly in one spot for an hour or two, on the chance of their working round in the direction of the place of concealment. What, perhaps, induces their slaughter as much as any other motive, is the circumstance that the blue feathers on the sides of the wings are much prized by the fishing community for dressing fly-hooks; but this practice can hardly be characterised by any milder epithet than that of cruelty, as it really seems a wanton act to kill ornamental birds of this kind for the sake of luring a few trout out of a stream.

Among the rarer birds found in Warwickshire which may be glanced at slightly in conclusion are the woodpecker, kingfisher, goldfinch, and hawfinch. Of the former tribe, the green woodpecker is the commonest, although the greater and lesser spotted species are also found occasionally; but unfortunately I failed to get even a glimpse of any, notwithstanding that the loud laughing sound could be distinctly heard in the silence of the woods. This failure must be attributed to want of acquaintance with the bird's peculiar habits, as its shyness and cunning are great, being proverbial in some parts of England. It always manages, as a rule, to keep on the other side of the tree from the observer; and while you are earnestly scanning the trunks in the direction from which the sound proceeds, the bird has quietly flown off to a distance, only to give vent to another laugh, which seems to be indulged in as if in derision at your non-success. It is impossible to mistake the cry of the woodpecker; but it is quite another matter to describe the same so as to render it recognisable to a stranger. Perhaps the nearest approach in the way of comparison is to liken it to the laugh of a horse on a subdued scale. In spring the missel-thrush makes a clucking sound, somewhat resembling that of the present species; but no practised ear can possibly be deceived by it, as there is a fulness and big-mouthedness about the cry of the woodpecker that stamps its individuality at once. The strangest feature about the *Picidae* is the length of their tongues, which, when in use, or when pulled out of a dead specimen, look like a long worm, this elongated member being, as is well known, hard and bony at the point—a wise provision on the part of Providence to

enable the birds to extract their food more readily from the crevices and holes in the bark.

The kingfisher, thanks in a great measure to the Wild Birds Protection Act, is not yet extinct, although a few years ago it seemed to be on the highroad to annihilation, from the craze among the vulgar of all classes to possess a stuffed specimen as a chamber ornament, but perhaps more so from the equally culpable desire on the part of the fair sex to add its brilliant plumage to the already numerous adjuncts brought into requisition in the manufacture of that wonderful work of art, the modern "bonnet." It is matter for great satisfaction, however, and, I venture to say, to no one more so than to all ladies of right feeling themselves, to learn that this cruel fashion is on the wane: let us hope it may die out so entirely as only to be remembered among the barbarities of the past. It would be unfair to put all the blame of its diminution on the shoulders of the two aforesaid classes, as naturalists themselves have been considerable sinners in that respect; but the extenuating circumstance in their case is that the birds are sought after chiefly in the interests of science, whereas this excuse cannot by any elasticity of conception be made in either of the former instances. Although not nearly so plentiful as formerly, yet a considerable number frequent the course of the Avon and its tributary streams, and on many of our own Lowland burns and rivers it appears again to be making headway. On the Tweed and its tributaries it is not by any means a chance straggler, as there are many parts it haunts regularly, and in bird-life there are few more interesting sights than to watch this gaudy-robed species darting up and down the stream, following every bend and turning, uttering from time to time its peculiar whistling note, reminding one to a certain extent of the water-ousel and common sand-piper, which also emit a shrill sharp whistle during the progress of flight. Curiously enough, the cognomen "kingfisher" is occasionally applied in Scotland to both of those birds, although quite erroneously. The species in question, notwithstanding its tropical costume, is a hardy bird, and would flourish excellently well on our rivers, if only the same privilege was accorded to it that our Roman Catholic brethren enjoy of "resting in peace." Those of us who have had the privilege of

being soundly thrashed at school into the mysteries of ancient mythology may have some recollection of the legend of Alcyone or Halcyone, daughter of Æolus, the god of the winds, and her husband Ceyx, who were changed into kingfishers, which circumstance gave rise to the belief that for seven days before and after the shortest day, during the supposed breeding-time of these birds, calm always prevailed at sea, rendering it safe for mariners to embark. This superstition is the origin of our familiar term "halcyon days."

The goldfinch was tolerably plentiful on the Snitterfield estate, numbers feeding daily in a garden adjoining the Park House in the village, and in some parts of the outlying bushes the pretty little song could be heard constantly. Next to the chaffinch, no bird builds a prettier nest, and in appearance it is not unlike that of the aforesaid, but considerably smaller, and is commonly placed in the fork of a fruit-tree wherever it builds near habitations. The zealous efforts of bird-catchers have done more to deprive us of the presence of this beautiful species than all other causes put together, although the greater cultivation of waste lands, and consequent eradication of thistles, groundsel, dandelions, and similar weeds, on the seeds of which they mainly subsist, has also had a disastrous effect. It is of a most trusting disposition, and easily snared by means of a call-bird, and, when once captured, with proper treatment is readily tamed—hence, probably, the demand for it as a cage pet. In most districts of Scotland it may practically be termed extinct—more's the pity, as it is a decided ornament and a welcome addition to our native fauna. As an instance in passing of how whole districts have been cleared, I may mention that about twenty to twenty-five years ago it was quite common in Glen Urquhart and the surrounding glens of Inverness-shire; but for one or two seasons a bevy of professional bird-catchers turned up, and, by dint of steady application, utterly decimated the country-side—so much so, that, unless my informant is deceived, the entire specimens observed since that deplorable period could be counted on the fingers of one hand. Its natural song is sweet, and the progeny produced by crossing with a canary seem to inherit the fine qualities of both species, and turn out excellent and powerful songsters—in fact, too much so for people of nervous temperaments, to whom the noise is anything but agreeable.

About the hawfinch a few words need only be said. I saw it on two or three occasions; but being on the verge of the incubating period, it was not so conspicuous as it would have been in autumn or winter, when it roves about in small flocks. Moreover, it is unusually shy, and seldom allows one to approach near enough to admit of more than a fleeting identification. A pair inhabited a thick grove of laurels bordering the roadside in the village; but so careful were they to conceal their persons, that it was only at rare intervals that even a glimpse could be obtained of them flying across the open field. This bird visits Scotland now and then, and one was killed a year or two ago quite close to Edinburgh, in the Corstorphine direction.

It was my original intention to append a list of the birds of Warwickshire to this paper, but in consideration of the fact that it has already exceeded the bounds as to length, I refrain from doing so—the more especially as this information can be gleaned from almost any standard work on ornithology, such as Yarrell, Morris, &c. Any further attempts in that direction, therefore, would be, to use a pet clerical phrase, “a mere work of supererogation.” In conclusion, let me only add that, in spite of bad weather, and consequent failure of the trip from an ornithological point of view, the few pleasant days spent in Warwickshire will always remain a green spot in my memory; and were it possible to repeat the same under better auspices, I feel confident a more satisfactory account of the feathered fauna could be placed before the members of the Edinburgh Field Naturalists’ Club.

VII.—*SOME PECULIAR OCCURRENCES IN NATURAL HISTORY.*

BY MR ROBERT STEWART, S.S.C.

(*Read March 28, 1888.*)

THE first “peculiar occurrence” to which I wish to call your attention to-night is in connection with the bird which I have here beside me. It is one of the terns or sea-

swallows, which was caught last summer in rather an odd way. While a party of gentlemen were out in a boat, fishing for sea-trout, some little way from the mouth of the river Findhorn, and near the village of the same name, the bird in question, which was passing the boat overhead at some little altitude, made a sudden swoop, and in a second rose again into the air carrying the line with it, having the hook attached thereto firmly fixed in its bill. The lure used was what is known as the india-rubber tube. Immediately all was excitement in the boat, as the bird made frantic efforts to break away, at the same time causing the line to run off the reel at a great rate. The fortunate or unfortunate fisher who made the unexpected capture played the tern in the most approved style, so that gradually the poor bird's struggles became weaker and weaker, until ultimately, on the line being bit by bit shortened, and pressure thus brought to bear on the captive, it sank exhausted into the boat, when it was found necessary to kill it before the hook could be extracted. At the time the bird was hooked there appeared to be no terns in the vicinity, but in response to the cry of distress uttered by the captive, scores of terns came from all quarters, so that when the bird was taken into the boat and killed, the operation had to be performed in presence of quite a "cloud of witnesses." The tube is used in fishing in much the same manner as the artificial fly, and is supposed to represent a sand-eel, but I have repeatedly caught trout and finnock with it, at portions of the river where the tide never reached, and where, consequently, sand-eels could not exist. I remember once, in the vicinity of the sandhills of Culbin, picking up a tern which had one of its wings injured, and taking it with us into the boat, when we left to cross to the other side of the bar. The bird was perfectly fearless, and ran about among our feet, from one end of the boat to the other. On nearing the pier we let down a line, with the intention of catching a few "podlies," or "queedies," as they are called in that district, and soon had one and then another in the boat. On looking round, we found that our friend the tern had bolted the first-caught "queedie," and to a certain extent had disposed of the other also, only there appeared to be a hitch somewhere, as the bird sat, apparently

quite content that it should be so, with the tail-half of the fish hanging gracefully out of its mouth. It is right to add, however, in the interests of the tern, that he had apparently not overrated his own powers, as in a few minutes, by a process known only to himself, he gradually prevailed upon the tail-half of the "queedie" to follow the head. Swallows and bats have been known repeatedly to take fly-hooks, and ducks occasionally take the worms on a night-line, to the horror of many an ardent young disciple of old Izaak, who, braving the discomforts of a raw spring morning, finds, on reaching the place where he set his line, that he has unwittingly been the destroyer of the pride of the neighbouring farmyard. Numerous sea-birds are often taken on the fishermen's lines, but it is quite a unique occurrence to capture a bird with a fishing-rod in the manner above described.

Some time ago we were walking along the beach between Granton Quarry and Cramond, when we noticed a group of rough-looking fellows, who were evidently enjoying what seemed to be sport of some kind. We thought the attraction must be a dog-fight, as the "yelping" of a dog was distinctly heard, but on coming up to the group we discovered that the combatants were—the one a rather large-sized Bedlington terrier, and the other a common crab. It was some little time ere we could realise that a fight was really in progress, as the odds at first sight appeared to be all on the side of the dog. But this was not so, for the crab, with pincers raised, and face to the foe, was manifestly all excitement, and warily watched every movement of the dog. The terrier had evidently in previous rounds felt the strength of the crab's pinch, and seemed rather inclined to shirk any further encounter, but his owner, with derisive laughter, hounded him on. After one or two feints he at last made straight for the crab, but we were glad to learn, by the yell which followed, that the Bedlington had caught a Tartar, and it was soon seen that the crab had got a firm hold of the dog by the nose, so that the latter had a good deal of difficulty in shaking himself free. The terrier evidently realised at last that in a fair stand-up fight he had met his match, and consequently he resorted to what may be termed the rough-and-tumble style. His mode of attack was from this time

most unfair, and consisted of springing suddenly forward and snapping viciously at the poor crab, which evidently had great difficulty in keeping its feet, and the prolonged struggle appeared at last to be telling severely upon it. In one of the attacks the crab got upset, and before it could recover itself the terrier had caught it gingerly in its mouth, and tossed it high in the air. It fell among the broken rocks, and was so stunned by the fall that the dog without difficulty munched it to death. After this the fraternity proceeded leisurely along the shore, looking apparently for a fresh combatant, and the time and place gave a new reading to the lines—

“ Where every prospect pleases,
And only man is vile.”

For the past few months a robin-redbreast has taken entire possession of what is called the “ Winter House ” at the Royal Botanic Garden. He has, so far as one can learn, no legal right to occupy the said premises; but not only does the robin keep and hold possession of the glass-house in question, but he refuses to permit any feathered friend to do more than pay him a passing call, and he chases and chastises without mercy any “ forlorn and shipwrecked brother ” who, constrained thereto by the late severe weather, desires to take advantage for a short time of the heat and shelter afforded by the Winter House. It has been left also to our friend to dispel another of the fond illusions of our youth, in that he has once and for ever reduced to the category of fables the beautiful stories which old country-folks delight to repeat regarding the loving character of the robin, and particularly with reference to his conduct to Jenny Wren when the little lady was in trouble, and of the wonderful care and attention which he in such circumstances lavished upon her. On two different occasions has this nineteenth-century tenant chased, captured, and killed wrens, who, trusting to the family traditions, called at the Winter House, expecting to receive food and shelter, but, alas! who only survived their visit long enough to realise that even among friends, when it comes to be a struggle for existence, the weakest must go to the wall. Mr Lindsay, the Curator, tells me that the gardener in charge of this particular house was on each occasion an eyewitness of the tragedy, and

found, on examining the victims, that the robin had pecked a small hole in the ladies' skulls. Wishing to make the acquaintance of the criminal, we at different times visited the Winter House, in company with a couple of friends. On the first occasion we were met at the door by the occupant, who appeared exceedingly pleased to cultivate our acquaintance, and did his very best to make himself agreeable; and though we also dissembled, the observant eye of the robin must have discovered our real sentiments regarding him, as on every subsequent call he made a point of being "not at home." We were quite aware, however, that this was only a fashionable fiction, and we knew well that on each visit he was quietly watching us from some remote corner.

VIII.—*OPTICAL PHENOMENON SEEN IN GLENURE.*

BY MR WILLIAM COATS.

(*Read March 28, 1888.*)

WHILE the Edinburgh Botanical Society's Camp was being held last August in Glenure, one of the detachments, consisting of three individuals—viz., Mr Grieve (our President), Mr Webb, and myself—had an opportunity of witnessing under very favourable conditions an aërial optical phenomenon somewhat rarely seen. A sentence or two at the outset regarding the locality of our camp may not be inappropriate.

Glenure is a wild, very slightly wooded glen, in the Appin district of Argyleshire, lying almost at sea-level, and surrounded on every side by high mountains whose bare summits are but seldom without a covering of mist. It is situated about sixteen miles from Connal Ferry, and three miles from the head of Loch Creran, an arm of Loch Linnhe. Its western extremity lies due south from Ballahulish about eight miles, while from its eastern end the head of Loch Etive can be seen distant about six miles. The name signifies "the glen of yew-trees," and tradition has it that at one time a large number of yews grew in the glen. This is to a small extent borne out by the fact that at the present time a tall, stately,

beautiful yew flourishes close to the house of Mr Mackay, the present tenant of Glenure sheep-farm, and in whose house the members of the camp had most comfortable quarters. Mr Mackay, who is now over 65 years of age, also informed us that about 40 years ago, when there were many more natives about Glenure and Glen Creran—an adjacent glen—than now, the young men of that day were seized with a mania for bagpipe-playing. In order to make their pipes, they cut down the yew-trees then existing, each one taking as much wood as would make two sets of pipes. This extravagance is accounted for by the fact that the wood for the second set formed the payment, or part payment, they made to a turner who lived at that time near the glen, and who made their pipes. Slowness of growth and sombreness of foliage are the persistent characteristics of the yew, and its extremely hard and singularly close grain must have answered their purpose admirably. But the times are changed, and there are now neither young men nor yew-trees in this wild district. That this must have been a beautifully wooded glen at one time is evidenced by two facts—the first, that the bleached stumps of many large trees yet remain about the mountain sides; the second, that there are to be seen in one or two places among the hills what resemble the remains of forts, but what are in reality ruins of buildings formerly used for making charcoal, which was afterwards taken to Bonaw and used in smelting the minerals brought to the district for that purpose. These buildings must have been erected where plenty of wood was close at hand.

On the morning of Wednesday, the 3d August, our detachment set out before 9 A.M. Dr Macfarlane and Mr Allan, the other members present, started before us in an opposite direction. Our intention was to botanise over Beinn Fhionnlaidh, a mountain 3139 feet in height. This height we had to climb, starting as we did from sea-level. There had been rain during the night, the morning did not look very promising, and mist covered the tops of the surrounding mountains, but by eleven in the forenoon the day had improved considerably. At the base of the mountain we separated, and soon lost sight of one another, each taking a different course in order to cover as much ground as possible, with

the intention of meeting on the plateau shown on the Ordnance Survey map at the 2000 feet level. This we ultimately did. At this time—about 2 P.M.—thin mist was covering the whole top of the mountain. We soon got into it without our progress being impeded. Above 2250 feet the ground was very rough, with large detached granite boulders, but very little vegetation of any kind. At 3.15 P.M. we gained the summit, and sat down to rest ourselves by the edge of a precipice overlooking a corrie of great depth. The mist had now nearly cleared away from the summit, but was being driven in large masses into the corrie far below. All at once we saw our shadows distinctly thrown by the sun on the mist away down in the abyss, in the centre of a brilliant triple circular rainbow, a small segment of which was cut off by the edge of the precipice where we were sitting. This phenomenon, which was new to all of us, appeared and disappeared at short intervals several times, after which the sun's light came out stronger than before, and it disappeared altogether. The movements made by the party were of course reproduced within this brilliant band of colour, the centre of which appeared to be from 40 to 50 feet in diameter. There was little wind at the time, but what there was, was blowing in a circular manner, carrying the mist over the summit in one direction, and up the valley leading to this corrie and over an adjoining neck in exactly the opposite way. We were, of course, considerably impressed with the spectacle, and noted all the points as carefully as we could. At our President's request I wrote a letter regarding this phenomenon to the 'Scotsman,' and also asking whether in the Highlands these occurrences were frequent. This letter appeared in the issue of the 6th August last, but no replies were forthcoming. I have been spoken to by a considerable number of people regarding this appearance, and have been told by most of them, that "it must be quite common;" but on asking the question, as I invariably did, "Have you seen such a thing?" have as often had "No" for an answer.

Phenomena of this nature are classed together under the name of *Anthelia*, from two Greek words meaning "opposite to the sun," in contradistinction to those phenomena termed *Parhelia*, meaning "near the sun." The most common of all,

coming under the former class, is the rainbow, which, speaking in a very general way, is due to the refraction and reflection of light on drops of water. Much more uncommon is the lunar rainbow, which doubtless many of us have seen. This comparatively rare but very beautiful phenomenon differs from the solar simply in the source and intensity of the light producing it; and being only visible at night, the distinction of colours is very difficult to make out, and unless the circumstances are favourable, little else is seen than a pale gleam of sickly white or yellow light. *Anthelia* proper are those appearances consisting of a shadow surrounded by coloured rings or bands thrown upon mist. Of these there are some which, to the inhabitants of mountainous regions, possess the characteristics of a supernatural intervention, and foster superstitious cravings. Even now, when the days of legend and superstition have passed away, and science has stripped these phenomena of their marvellous character, and left their names merely, *minus* their meaning, they are watched by the traveller and the scientist as closely as when they were attributed to a supernatural agency. The most widely known of these is that named the "Spectre of the Brocken." The Brocken is the highest mountain of the Hartz chain, running through Hanover. Its height is given as 3300 feet above sea-level. It is stated that a traveller named Hane ascended no less than thirty times to the summit before he contemplated the object of his curiosity. In 1862 a French artist, M. Stroobant, witnessed and carefully sketched this phenomenon. He reached the summit just as the rising sun enabled him to distinguish objects clearly at a distance. In his description he says:—

My guide, who had for some time appeared to be walking in search of something, suddenly led me to an elevation, whence I had the singular privilege of contemplating for a few instants the magnificent effect of mirage which is termed the Spectre of the Brocken. The appearance is most striking. A thick mist, which seemed to emerge from the clouds like an immense curtain, suddenly rose to the west of the mountain, a rainbow was formed, then certain indistinct shapes were delineated. First, the large tower of the inn was reproduced upon a gigantic scale; after that we saw our two selves in a more vague and less exact shape, and these shadows were in each instance surrounded by the colours of the rainbow, which served as a frame to this fairy picture.

The phenomenon witnessed by us is, to my mind, that which is known as the "Ulloa circle." It is so named after the Spanish traveller, Francisco Ulloa, who, accompanied by six fellow-travellers, first observed and described it. The following is his description:—

Suddenly each of the travellers beheld, in the opposite direction to where the sun was rising, his own image reflected in the air as in a mirror, about 70 feet from where he was standing. The image was in the centre of three rainbows of different colours, and surrounded at a certain distance by a fourth bow with only one colour. The inside colour of each bow was carnation or red, the next shade was violet, the third yellow, the fourth straw colour, the last green. All these bows were perpendicular to the horizon; they moved in the direction of, and followed the image of, the person whom they enveloped, as with a glory.

The most remarkable point here was, that although the seven spectators were standing in a group, each only saw the phenomenon in regard to his own person. The strangest point about the appearance seen by us, but upon which I can offer no explanation, was, that in one case the movements of our arms alone were visible, while our lower extremities remained stationary. This same phenomenon has often been seen in the Alps, and has also been observed by the Arctic navigator Scoresby in the Polar regions. The phenomena, however, observed two years ago by the Hon. Ralph Abercromby—one of the foremost meteorologists of the present time—at Adam's Peak, in Ceylon, seem to surpass everything hitherto recorded. The cone forming the summit of this mountain, which is over 7300 feet above sea-level, is a naked mass of granite, terminating in a narrow platform, in the middle of which is a hollow five feet long, having a rude resemblance to a human footstep. Mohammedan tradition makes this the scene of Adam's penitence after his expulsion from Paradise. He stood 1000 years on one foot, hence the mark! A condensed description of what Abercromby there saw is as follows: The party (himself and two scientific friends) reached the summit on the night of the 21st February 1886, amid rain, mist, and wind. Early next morning the fore-glow began to brighten the under surface of the stratus-cloud; patches of white mist filled the hollows, and occasionally masses of mist coming from the valley enveloped them with condensed vapour. At 6.30 A.M. the sun peeped through a chink in the clouds,

and they saw the pointed shadow of the peak lying on the misty land. Soon a complete prismatic circle of about 8° diameter, with the red outside, formed round the summit of the peak as a centre. This meteorologist, knowing that with this bow there ought to be spectral figures, waved his arms about, and immediately found giant shadowy arms moving in the centre of the rainbow. Two dark rays shot upwards and outwards on either side of the centre, and appeared to be nearly in a prolongation of the lines of the slope of the peak below. Three times within a quarter of an hour this appearance was repeated as mist drove up in proper quantities, and fitful glimpses of the sun gave sufficient light to throw a shadow and form a circular rainbow. In every case the shadow and bow were seen in front of land, and never against the sky. About an hour later the sun again shone out, but much higher and stronger than before, and then they saw a brighter, sharper shadow of the peak, this time encircled by a double bow, and their own spectral arms were again visible. The shadow, the double bow, and the giant forms combined to make this phenomenon a most remarkable one.

The question very naturally occurs, Are these phenomena frequent in this country? Their production evidently demands several atmospheric and physical conditions, not readily found in combination except in mountainous regions — such as sunlight; mist or fog; cloud (because this appearance has been beautifully observed from a balloon); a considerable elevation, such as a mountain-summit or a mast-head; a valley up which mist may be driven by a light wind to the desired height; and the necessary angle between the sun, the observer, and the shadow. All the records of this phenomenon I have seen give some or most of these conditions; and although ours is a mountainous country, in which one would expect the necessary conditions to be easily found, such phenomena do not appear to be frequently recorded—more from the want of observers, I believe, than from any other cause. We seem to be getting more and more content to look *at* our mountains, evidently satisfied that “distance lends enchantment to the view,” which in such a case it certainly does not, never dreaming of the glories to be observed on looking from their summits, when they have been actually climbed.

IX.—NOTE ON *EUCALYPTUS GLOBULUS*.

BY MR HUGH FRASER.

(Read March 28, 1888.)

THIS plant is one of some 150 species, all, or nearly all, natives of Australia, and belonging to the Natural Order of the Myrtaceæ. Australia is the headquarters of the genus. The majority of them are trees growing to an immense height, and having proportionately thick trunks. The whole genus supplies timber of a strong, durable quality, which is used very largely throughout the southern hemisphere in shipbuilding, implement-making, and engineering work. It is also cultivated extensively in the malarious regions of many of the warmer parts of the world, especially in the Mediterranean region and in some districts of Italy. It will be in the recollection of many of the members that it was very extensively planted a few years ago on the island of Cyprus, with a view to correct the malaria which was so fatal to Europeans, with, it is said, the most happy results.

The most valuable species of the genus is *E. globulus*, popularly known as the Blue-gum tree. It is abundant naturally, and is also extensively cultivated. Of late years it has become famous as a febrifuge, and a great many properties of a medical kind have been ascribed to the various preparations of the leaves, the oil from which is said to be antiseptic, while in a dried state, smoked in the form of cigars, they have been recommended as a palliative in asthma. This plant ranks among the fastest-growing and the tallest of all known trees. I have known young plants two years from seed attaining a height of 4 feet; and it has been known to reach the height of 120 feet, with a circumference of 9 feet in the trunk, in twelve years. Specimens have been found in its native woods 400 feet high.

What suggested this communication was the curious change which the leaves undergo in form and general appearance as the tree advances in age. In young plants the leaves are always opposite, destitute of footstalk, broadly ovate, and covered with a white dust on both surfaces. At a height of about 15 feet, however, a set of leaves of quite a different

character begin to develop themselves : these have long foot-stalks, and are lanceolate in form, with a smooth surface. When these two forms of leaves are placed alongside of each other, they are so dissimilar in appearance as almost to conceal their identity. Such instances of variation between immature and mature forms are very curious, and well worthy of investigation.

X.—*STOATS AND WEASELS: THEIR HAUNTS,
HABITS, AND PECULIARITIES.*

BY MR TOM SPEEDY.

(*Read April 25, 1888.*)

THE idea of writing on weasels suggested itself to me in consequence of my collecting and keeping a large number of these animals, with the view of sending them out to New Zealand, in order to form a natural check to the rabbits, which are there increasing in inordinate numbers. It is a never-failing law of nature that where animals which have a tendency to increase rapidly have been placed, checks are also found by way of counterbalance; but in the fauna of Australia and New Zealand, neither rabbits nor their natural enemies appear to have been included. Man, however, who sometimes presumes to be wiser than the Framer of natural law, has introduced rabbits into these countries, and with the most ruinous results. I am not aware when they were first imported into these colonies, but fifteen years ago they were confined to a small area of 20,000 acres in the extreme south of South Island, and were at that time taken little notice of. In Southland and Otago the ravages of rabbits became a serious matter about a dozen years ago; and, notwithstanding the appeals of the Crown tenants, the Provincial Government looked on with indifference, until those engaged in agricultural and pastoral pursuits were practically ruined. To illustrate the dimensions which the rabbit pest has assumed, I may mention that Mr Brydon, a friend of my own, who was examined before a Parliamentary Committee last year, stated that "on a run of 100,000 acres

in the Queenstown district he had spent £7000 in the two years 1884 and 1885 in rabbit extermination." The Parliamentary Committee referred to, in its report suggested that "the least expensive and most certain remedy is that provided by nature itself—viz., the distribution of the natural enemies of the rabbit throughout the infested country. . . . That stoats and weasels are extremely effective cannot be denied, as it has been proved in every case where they have been turned out that rabbits have been enormously reduced in numbers."

As the consequence of the above report, I was asked to cooperate in collecting a number of stoats and weasels to transport to the colonies referred to. To collect three hundred of these animals is no easy task, but where money is ungrudgingly spent, it can be accomplished. In my boyish days I often wondered how Samson caught the three hundred foxes he turned among the corn of the Philistines, when it frequently took the hounds of the Earl of Wemyss an entire day to catch one; and, in like manner, I at first thought that the collecting and transporting of three hundred stoats and weasels would be by no means a simple accomplishment. We, however, got the machinery set in motion. Advertisements were inserted in provincial newspapers, and circulars were sent to gamekeepers all over Scotland, offering five shillings each for every stoat or weasel forwarded alive. In due course they began to arrive, and we have now collected over a hundred. It will thus be seen that I have facilities afforded me for observing many of their habits and peculiarities which have hitherto been denied to the closest observer.

In writing on the weasel tribe, it is as well to state at the outset that there are several species in this country. We have the polecat and the marten, though these two are now so rare that it is useless enlarging on their characteristics, as only once has a living specimen of each come under my observation. The stoat and weasel are both still plentiful in all parts of the country, and as it is these two species I have been collecting, it is to them I wish now to direct your attention. The stoat and weasel are often confounded together, and by country people both are very generally designated "whaasels." These destructive animals have, as a rule, been always regarded as pests, and hitherto war has been universally waged against

them by gamekeepers and others. The Government of New Zealand, however, now regards them in a very different light, and is spending large sums in transporting them from this country.

An amusing conversation recently took place—so says one of our comic papers—between two Cockneys who had been reading an article on the exportation of stoats and weasels to New Zealand. “What,” asked one, “is the difference between a stoat and a weasel?” “That, I should think,” replied the other, “will not be so *weasily* explained.” “Oh yes,” remarked his friend, “the one’s *stotily* different from the other.” Though they differ from each other essentially, still it is true that an affinity exists between them, many of their haunts, habits, and peculiarities being identical. Weasels being smaller than stoats, their hunting-ground is in a much more limited area. Dry-stone dykes, cairns of stones, and hedgerows are their favourite habitats. Their staple food, where there is no young game, is mice. This I have clearly demonstrated by examining the contents of the stomachs of those I have shot in the vicinity of Edinburgh. Where young game is abundant, the destruction caused by weasels is incalculable. Gamekeepers who have had experience in rearing young pheasants are well aware of the havoc one weasel will commit if it should obtrude its presence in the locality. So destructive are the weasel tribe in their habits, that should one effect an entrance where rabbits or chickens are being reared, everything that partakes of life is ruthlessly destroyed. They are merciless tyrants, meaningless murderers, shedding blood from mere wantonness. In illustration of the bloodthirsty and ferocious character of the weasel tribe, I may mention that a neighbour’s boys had a pair of rabbits confined in a house, with a brood of eight young ones nearly half grown, and a second litter, seven in number, about ten days old. Hearing a noise about seven o’clock one evening in the rabbit-house, the boys went to ascertain the cause. On opening the door, a “whaasel” made his exit by a small hole and effected his escape. It was, however, discovered that the entire fifteen young rabbits had been cruelly slaughtered, the speck of blood behind the ear revealing the spot where the weasel tribe, with unerring accuracy, seize their prey and cut the artery, which in a few minutes terminates the sufferings of their victims. The noise which

attracted attention was caused by the old pair of rabbits defending themselves as they best could; but there is no doubt that, had attention not been attracted, they would have shared the same fate as their progeny.

A gruesome trait of the weasel tribe is their cannibalistic tendencies. When one is shot or trapped in a district they frequent, and is left lying about, it is quickly removed and eaten by its kin. I have also observed that if a couple are confined in the same box, the weaker is certain to be killed and eaten by the stronger, even though an abundance of food is in the box beside them. In their wild state nothing makes a better bait for trapping weasels than one of their own species.

Receiving information from those who had previously transported weasels that, irrespective of sex, three were put in each box, I, as a matter of course, adopted the same tactics. I soon discovered, however, that this method would be most unprofitable, as in every case two of them were killed, and generally the survivor died from his wounds. Acquiring knowledge by experience, I got boxes made, and confined them separately, with the most satisfactory results; and as I have kept them many weeks, evidently in a thriving condition, I see no difficulty whatever in transporting them to New Zealand, provided cleanliness and fresh water are punctually attended to. All carnivorous animals drink a large quantity of water.

It was also asserted, by those who are considered to be competent authorities, that live pigeons had to be shipped along with the weasels, in order to give them warm food, blood being deemed indispensable. This dictum I have also exploded, having fed them for weeks on cold meat and eggs, with the best possible results. In feeding them on pigeons, I discovered that, as a rule, the head and neck were the first parts eaten. I would therefore suggest, for the information of those transporting weasels, that a large number of the heads and necks of chickens, which can be got from poulterers at a nominal price, should be put in the refrigerators, and these, along with eggs, would constitute the best and cheapest food that can be obtained. In a consignment of three hundred weasels, fed on live pigeons, the expense is enormous. Allowing a couple of months to collect them, and a voyage of six or seven weeks' duration, many thousands of pigeons are neces-

sary, three weasels requiring one pigeon per day. It is thus easy to see that considerable expenditure would be incurred. There are, besides, the purchasing of the pigeons; the quantity of corn required to feed them; the freight of them on board the ship, and a man to attend to them.

Though both stoats and weasels are largely endowed with curiosity, the latter is much less shy than the former. I have frequently observed their footprints in snow round a box trap, and though they would run round it a good many times, in most cases weasels ventured in and were secured. It is otherwise with stoats. Known from their larger footprints and longer strides, they would also run round the trap, which they evidently regarded as dangerous, as in most cases they did *not* venture in. The stoat, although a comparatively small animal, is in the habit of travelling very considerable distances, and will settle down at a spot several miles away from his former dwelling-place. In such cases the first indication of his presence is some unlooked-for depredation which attracts the attention of the keeper. So recently as last year I was spending a few days shooting in a district in Forfarshire, from which stoats had been carefully excluded. One morning the keeper called my attention to an exceptionally large stoat which he, without hesitation, affirmed must have travelled several miles. Upon interrogation, he satisfied me as to the correctness of his surmise, for had it been otherwise he must have had previous indications of the animal's presence. Having my gun in hand, I stood waiting his coming out from a heap of stones, where unperceived he appeared to be amusing himself. To my surprise I shortly thereafter saw him about 150 yards in advance posting up the side of a stone wall with great speed. Knowing that he had not seen me, and had consequently no apprehension of danger, I was curious to know the motive by which he was impelled. I stealthily followed in pursuit, and was interested to observe that he occasionally raised his head in the air as if attracted by the scent of prey. Having apparently measured his distance, he again pressed on with increasing speed, as if impelled by some terrible instinct. Hitherto, although familiar with the movements of the stoat, I was not prepared for the alacrity with which he kept in advance. Latterly he seemed to become desperate

with excitement, when I was interested to discover a brood of partridges run screaming from the side of the old stone fence right across the field and over a knoll. This movement on the part of the partridges appeared to disappoint and surprise the stoat, who halted as if in a difficulty as to his future action. By this time I had got fairly within shot, as in his anxiety to get among his prey he was oblivious of my having been in pursuit. I fired, and no sooner had I done so than I felt I had made a mistake, as I should have liked to have seen how he would have met the unexpected contingency. As it was, on going forward I found him to be a very old stoat, who had doubtless done much mischief in his day: he was certainly the largest of the species I have ever seen.

Though, as I have already remarked, stoats and weasels resemble each other in many respects, there is a difference between them. I refer to the stoat changing his colour from dark brown in summer to pure white in winter, with the exception of the black tip on the tail, which never changes. We discover here how wisely nature makes provision for enabling some animals to capture their prey, and for others, such as the mountain hare, to elude their enemies. Why the weasel should form an exception to this law, so strikingly illustrated in the stoat, is a point which I confess myself unable satisfactorily to explain. In changing from their summer to their winter coats, or *vice versa*, stoats do not become white or brown all at once, but break out in white or brown patches or stripes, and at times have a piebald appearance. It seems strange that the stoat and weasel resemble each other in almost every other respect, and yet the latter retains its brown colour in winter as well as in summer. Mr Scot Skirving, in his excellent paper, contributed a few years ago to the Society, on "The Stoat or Ermine Weasel" ('Transactions,' vol. i. p. 130), states that he should like to try the experiment of subjecting a weasel to a cold of 30° below zero in order to see if it would turn white. My opinion is that it would not. "Can the Ethiopian change his skin, or the leopard his spots?" No device of man can change the colour of any animal, unless nature has willed it so. Weasels are not nearly so hardy as stoats, and I venture to affirm that if subjected to a temperature of 30° below zero, they would succumb in a few hours.

This is no mere speculation, as I have had it again and again verified that they die quickly from cold. In hard frosty weather, should one be caught in a wooden box-trap, it will very frequently be found dead, though the trap is looked regularly night and morning. If a wisp of hay be put in the trap, the animal will be found cosily curled up in it, evidently quite comfortable. In the spring of this year I had two stoats and two weasels in separate boxes placed in a large wire-net cage in front of my window, for the purpose of observing their habits. Knowing that they are by no means possessed of a social instinct, I allowed only one of them to run about the cage at once. As you are all aware, we had some sudden changes in the weather, and one night a fall of snow with hard frost was experienced. Notwithstanding that each animal had some hay to sleep in, I discovered in the morning that both weasels had succumbed to the cold. The stoats, however, seemed to be none the worse, but I took the precaution of having them removed into a stable, in order to protect them from further exposure. It may be asked, if weasels thus die from cold, how is it that they live and thrive in places of high altitude, such as Dalnaspidal in Perthshire, where the winters are long and severe? My opinion is, that weasels spend most of the time in hard weather in their nest, which is frequently in a hole deep down below a tree-root or under a rock. The nest is generally made of dried grass and lined with feathers like a bird's, where the winged tribe exist, and where they are included in the weasel's bill of fare. Even in confinement they make a similar nest, provided a pigeon or other bird is given them, from which they can pluck off the feathers, and in which they curl themselves up as simply and cosily as possible.

Weasels are frequently caught in traps set for moles, which indicates that they hunt for these animals. In one instance I knew of two weasels having met in a mole-run exactly in the trap, which secured them both. When quite a lad, while walking on the road at Ladykirk, in Berwickshire, a weasel crossed in front of me and disappeared in a bank at the side of the road. Going to the place, I saw the hole where it entered, and that there would be no difficulty in digging it out. Taking the precaution of pushing a stone into the hole, I went

to a cottage some distance off and borrowed a spade. Commencing to dig, I was not long in unearthing the vermin, and was fortunate enough to crush it with the spade when trying to make its exit. Examining it, I discovered that it was a female, and that she had been nursing. Excavating a little farther, I came upon the nest, which contained seven small, blind, slate-coloured creatures, apparently a few days old. I have stated that the creatures were blind, and it is perhaps worthy of note that the period of gestation in the weasel tribe is six weeks, and that the young ones are six weeks old before their eyes are opened. It is no unusual thing to see young ferrets out of their nest tearing away at a rabbit or other food before they can see. Why the young of the weasel tribe should be so long blind is difficult of explanation. I am not aware of the young of any other animal having their eyes so long closed. Rats are also born blind, but in fourteen days begin to open their eyes, and, as every schoolboy knows, this is longer than most animals.

Another peculiarity of the weasel tribe is a gland under the tail, in which is secreted a strong and offensive odour, which the animal emits at will when attacked by an enemy, or when fighting with each other. If one should be shot dead, or killed instantaneously by a trap, it has no smell whatever; but if trapped by the leg, or wounded by a gunshot, the strong effluvium is most disagreeable, and any person who handles it has a difficulty in getting rid of the smell. Mr St John, in his admirable book, states that the smell can never be got rid of, and that this renders the skins of stoats useless. This I cannot accept; and the fact of their skins, in the form of ermine fur, being so valuable, and worn not only by ladies of rank and by the Judges of the Court of Session, but even by royalty, thoroughly explodes this fallacy. In Norway and Siberia their skins make a valuable article of commerce; and it is a notable fact that those killed in this country are much inferior, having neither the thickness of fur nor the beautiful whiteness of those killed in Northern regions.

XI.—LIST OF PLANTS GATHERED IN
SWITZERLAND.

BY MRS SPRAGUE.

(Read April 25, 1888.)

IN the autumn of 1887 Mrs Sprague and party spent two months in Switzerland, travelling about from place to place, and noting the various plants observed by the way. An interesting account of the places visited was read to the Society; and there were also exhibited a collection of butterflies, several photographs of Swiss scenery taken by one of the party, and a number of herbarium specimens of plants. The following plants were gathered during the tour at Lucerne, the Righi Pass, Mt. Pilatus, the Brünig Pass, the Furca Pass, Mt. Chamossaire, Villars-sur-Ollon, Montreux, &c. :—

Achillea Clusiana.	Chrysanthemum alpinum.
Aconitum commutatum.	Circium spinosissimum.
" napellus	Colchicum autumnale.
" ranunculifolium.	Crepis aurea.
Adenostyles albifrons.	Cyclamen europæum.
Allium foliosum.	Dianthus atrorubens.
Althæa officinalis.	" frigida.
Anemone alpina.	" superbus.
" sulphurea.	" sylvestris.
Anthericum ramosum.	Digitalis grandiflora.
Aposeris fœtida.	" lutea.
Aquilegia atrata.	Epilobium rosmarinifolium.
Arnica montana.	Erigeron alpinum.
Aspidium Lonchitis.	Euphrasia minima.
Asplenium septentrionale.	Gentiana acaulis.
Aster alpinus.	" asclepiadea.
Astrantia carniolica.	" bavarica.
" major.	" " alba.
" minor.	" campestris.
Biscutella lævigata.	" ciliata.
Bupleurum longifolium.	" cruciata (?).
" stellatum.	" imbricata.
Calamintha alpina.	" lutea.
" officinalis.	" nivalis.
Campanula barbata.	" obtusifolia.
" latifolia.	" punctata.
" rhomboidalis.	" purpurea.
" rotundifolia.	" verna.
" Trachelium.	Geum montanum.
Carlina acaulis.	Globularia cordifolia.
Centaurea montana.	" vulgaris.
Cerastium arvense.	Gnaphalium dioicum.

Hepatica triloba.	Pyrola uniflora.
Hieracium alpinum.	Ranunculus aconitifolius.
Homogyne (Tussilago) alpina.	Rhododendron ferrugineum.
Impatiens noli-me-tangere.	" hirsutum.
Lathyrus heterophyllus.	Salvia glutinosa.
" sylvestris.	" pratense.
Lilium Martagon.	Saxifraga aizoides.
Linaria alpina.	" aizoon.
" " concolor.	" cæsia.
" minor.	" cuneifolia.
Lonicera alpigena.	" cotyledon.
" cœrulea.	" rotundifolia.
" nigra.	" stellaris.
Maianthemum (Smilacina) bifolia.	Scrophularia Hoppii.
Mulgedium alpinum.	Sempervivum tectorum.
Narcissus poeticus.	Silene acaulis.
Orchis ustulata.	" rupestris.
Orobus luteus.	" saxifraga (?).
Paris quadrifolia.	Soldanella alpina.
Phyteuma orbiculare.	" montana.
" scorzoneraefolium.	" pusilla.
Polygala Chamæbuxus.	Spiræa aruncus.
Prenanthes purpurea.	Swertia perennis.
Primula auricula.	Tofieldia calyculata.
" commutata.	Trifolium alpinum.
" farinosa.	Trollius europæus.
" spectabilis (?).	Verbascum blattaria.
Pulmonaria angustifolium (?).	Veronica saxatilis.
" montana.	Vincetoxicum officinale.
Pyrola rotundifolia.	Viola calcarata.
" secunda.	" grandiflora.

XII.—*FUNGUS FOLK-LORE.*

BY MR A. B. STEELE.

(Read Dec. 28, 1887.)

THE science of folk-lore, as defined by an American writer, is "the comparison and identification of the survivals of archaic beliefs, customs, and traditions in modern ages." Although the study of the subject has long been looked upon as a mere pastime, and as likely to be fraught with no useful results, it is one which is rapidly increasing in general interest. In many instances it is a valuable, if not the only, means of obtaining an insight into the prehistoric period in the life of nations, and

may yet supply ethnologists and archæologists with material for writing the unrecorded history of the various peoples of the earth.

Fungi have given rise to a not uninteresting, though comparatively small, contribution to folk-lore. The most common form of fungi is the mushroom, in connection with which much folk-lore is associated. Mushroom was formerly spelt "mush-rump," and is said to be derived from the Welsh *maes*, a field, and *rhum*, a knob or little head; the French analogue, *champignon*, being similarly compounded of *champ*, a field, and *pignon*, a little head. It is also said to be derived from *mousseron*, the popular name in France of *Agaricus prunulus*, because it grows in moss or grass. Dr Prior thinks that it comes from the old French *mousche*, a fly — the fly-killing *Agaric* being called *mouscheron*, from which our word mushroom is derived. The proverbial expression, "to come up like a mushroom," is as old as the days of Bacon. "Such as are up-starts in state," he says, "are called in reproach mushrooms." Lytton uses the word in a similar sense when he speaks of "a certain mushroom usurper who had bought out this old, simple, hospitable family." Dwight, an American theologian of last century, says, "The origin of man, in the view of the atheist, is the same with that of the mushroom" — expressing the popular belief of the origin of the plant in his time. Gerarde calls mushrooms "earthie excrescences"; and the Greeks called them earth-born plants, under the belief that the seeds came direct from the earth. In Worcestershire, mushrooms are called Abrahams, probably from a band of licensed beggars so called, in imitation of whom so many impostors sprang up that, like mushrooms, it was difficult to distinguish the genuine from the false. Country folks regard a plentiful crop of mushrooms as indicative of rain; and among mushroom-growers there is a curious belief that they are more abundant when the moon is waxing than when it wanes.

The origin of the name Toadstool is self-evident. In England generally toadstools are called Toads' hats or caps; in Scotland, Paddock or Puddock stools—

"May sprout like simmer puddock-stools in glen or shaw;"—

in Lancashire, Toad-paddock; in Berkshire, Toad's cheese; in

Dorset and Isle of Wight, Toad's meat; in Northampton, Frog's seat; in Holland, Toadstool (*Paddle stoël*); in Germany, Toad fungus (*Kröten schwamm*); in France, Frog's bread (*Pain au crapaud*); and in Belgium, Toadstool (*Padden stoël*). The idea that toadstools were used as seats by toads is of ancient origin—

“The grisly toadstool grown there mought I see,
And loathèd paddocks lording on the same.”

There is a very old myth about the “snayle that crept out of her shell, and was turned eftsoones into a toad, and thereby was forced to make a stoole to sit on, disdainng her own house.” It is said that the name arose from a belief that all fungi were produced from the excrement of toads. In Wales, however, these plants are named Fairy tables, and in Cornwall and Devon Pixy stools. In Yorkshire they are called Cockstools. That fungi have long been associated in the public mind with fairies is proved by the names which have been given to the different kinds, such as Fairy tables, Fairy baths, &c. What is popularly known as fairy rings or circles has given rise to many curious beliefs and sayings, and their marvellously rapid growth has struck the uncultivated as a supernatural phenomenon. The prevalent belief was that they were caused by the midnight dancing and revelry of the fairies; and Shakespeare speaks of the elves

“Whose pastime
Is to make midnight mushrooms.”

In the west of England these rings are called Hags' tracks. In the myths and folk-lore of Sweden they are said to be enchanted circles made by fairies. The elves perform their midnight *stimm* or dance, and the grass produced after the dancing is called *ailfexing*. A belief prevails in some parts of this country that any one treading within the magic circles either loses consciousness or cannot retrace his steps. Many absurd theories have been propounded as to the cause of these rings. Aubrey, who wrote the ‘Natural History of Wiltshire’ in the 17th century, said that they were “generated from the breaking out of a fertile subterraneous vapour which comes from a kind of conical concave, and endeavours to get out at a narrow passage at the top, which forces it to make another

cone inversely situated to the other, the top of which is the green circle." Another remarkable theory by a writer, quoted in Captain Brown's notes to White's 'Selborne,' attributed these rings to the droppings of starlings, which, when in large flights, frequently alight on the ground in circles, and are sometimes known to sit a considerable time in these annular congregations. It was also thought that such circles were caused by the effects of electricity, and for this belief the withered part of the grass within the circles may have given foundation. Priestley was a strong advocate of the electric theory, and was supported by many eminent men of his time.

" So from the clouds the playful lightning wings,
Rives the firm oak or prints the fairy rings,"

says Dr Darwin, and appends a note that "flashes of lightning, attracted by the moister part of grassy plains, are the actual cause of fairy rings." Archæologists suggested that they might be the remains of circles formed by the ancient inhabitants of Britain in the celebration of their sports or the worship of their deities. Naturalists of that period came to the conclusion that the rings were caused by the underground workings of insects. In the 'Transactions of the Woolhope Club,' a few years ago, a writer tries to prove that they are the result of the underground workings of moles; and in the same 'Transactions' for 1870, Professor Buckman lays down the axiom that "anything which may tend to kill a given area of grass may be the beginning of a fairy ring." Several kinds of fungi form rings, but the meadow rings are almost invariably formed by the species *Marasmius oreades*, commonly known in England by the name of Champignon or Scotch bonnets. St George's mushroom, which sometimes forms rings, is called Champeron in Berkshire and Champilion in Cheshire—both names apparently corrupted from the French. This mushroom is believed to be a special gift from St George—a belief no doubt arising from its making its appearance about the time fixed for the celebration of that saint. Bluet or Blewit, the popular name of *Agaricus personatus*, has puzzled etymologists. It is supposed to be a corruption of blue hat, but why it should be called so when its stem only is blue, raises a difficulty. The *Boletus* is the toadstool *par excellence* of the English, who call

it the Devil's cushion. The Romans compared it to the food of the gods; and in Holland it is called Devil's bread, from a superstitious belief that that individual gets the best of everything in this world.

Among the group popularly called Sapballs, the best known is the Dry-rot. This name originated from its converting the wood which it attacks into a dry powdery mass. Dr Prior, however, thinks that the name is more probably derived from *tree*, wood—A.S. *treow*—and rot. Like the fairy rings, a great many strange reasons have been assigned as the cause of the dry-rot in timber. It was supposed to be caused by a plant like the vine, and wherever this fell plant touched it poisoned the wood, and hydra-like sprouted when deemed dead. Last century a writer stated that he had seen the leaves growing on the plant. "They appear," he said, "dead for many years, and some crumble into dust, but fresh wood attracts a fresh growth from the root." In the 'Gentleman's Magazine' last century it was seriously asserted by a correspondent that dry-rot was the Jewish leprosy in houses; and another held that it was the result of putrefactive fermentation. A well-known species of this group, and much esteemed as a food on the Continent, is the Vegetable beef-steak, so called from a supposed resemblance to a piece of fresh beef. It has other popular names, such as Liver of the oak, Ox-tongue, or simply Tongue. It is so like a tongue in shape and general appearance, that in the days of enchanted trees it was never cut off for fear the knight to whom it belonged should afterwards come to claim it. A species which attacks the Canadian pines is an object of some curious beliefs among the Indians of Lake Huron. They believe that it lives and cries like a child, that it bleeds when wounded, and does not fall unless killed. The famous Fungus-stone, *Pietra fungaia*, of Italy, is regarded by the Neapolitans with superstitious wonder. Parkinson quaintly describes it as growing naturally among certain stones in Naples, and that the stones being dugged up and conveyed to Rome, where they set them in their wine-cellars, covering them with a little earth and sprinkling a little warm water thereon, mushrooms are produced within four days. The stone is simply a ball of hardened earth impregnated with the spawn of *Polyporus tuberaster*. Another much-prized Continental species has the

popular name of the Hen-of-the-woods or Breeding-hen, from a fancied resemblance to the female of the grey grouse sitting on eggs. In Italy, rackrented tenants send specimens of this fungus as surprise presents, by way of inducing the landlords to reduce the rent.

Among the group which gets its name from the tremulous gelatinous appearance of several species, there is some curious folk-lore. It is their strange appearance which has given rise to the many curious traditions about them. They are known as Star-jellies or Fallen-stars, from a superstitious belief that they were the remains of fallen stars. In Sweden they are called Sky-falls. Dr J. Russell Lowell, commenting on one of Lovelace's poetic images, says it is based on the belief that stars shooting from their places fell to the earth and turned to jellies. Jamieson's *Scottish Dictionary* explains Shot-star as the meteoric substance often seen to shoot through the atmosphere, or appearing in a gelatinous form on the ground. The '*Statistical Account of Scotland*' also explains the substance called Shot-stars as "nothing else than frosted potatoes. A night of hard frost in the end of autumn, in which those meteors called falling-stars are seen, reduces the potato to the consistence of a jelly or soft pulp, having no resemblance to a potato except when parts of the skin of the potato adhere below undissolved. This pulp remains soft and fluid when all things else in nature are consolidated by frost, for which reason it is greedily taken up by crows and other fowls when no other sustenance is to be had, so that it is often found by man in the actual circumstance of having fallen from above, having its parts scattered and dispersed by the fall, according to the law of falling bodies. This has given rise to the name and vulgar opinion concerning it." A great many other curious sayings exist about fallen- or shot-stars, but they have reference more particularly to an alga which was at one time classed among the fungi. The term Witches' butter or Fairy butter is often generally applied to the yellow gelatinous species, but most country folks, when they refer to Witches' butter, mean a blackish fungus which feels on the under side like black crape. In Atkinson's '*Glossary of the Cleveland Dialect*,' it is stated that the belief is quite common in York-

shire that fairies or witches make butter during the night, and scatter it about on the ground. In Sweden there is a similar belief; and it is said that the witches milk the cows during the night and make butter, or *troll smör*, as it is called. There is also a belief in that country that if nine kinds of wood be heaped into a pile, and some of the *troll smör* be thrown into it, those who have been justly suspected as witches are involuntarily compelled to admit it.

Another species, the Jew's ear, as it is commonly but incorrectly called, was an object of superstition in the middle ages. It is evidently a corruption of Judas's ear. Rabelais calls it Judas's ear, and says it is a form of fungus issuing from old elder trees. There is a well-known tradition of the middle ages that Judas hanged himself upon an elder tree, and that the fungus sprouted out in consequence.

“Judas he japed
With jewen silver,
And sithen on an eller
Hanged hymselfe,”

says Langland in his ‘Piers Plowman.’ Coles also mentions the elder as “being supposed that whereon Judas hanged himself, and that ever since these mushrooms like unto ears have grown thereon.” Gerarde, however, says that the *arbor Judæ* is thought to be that upon which Judas hanged himself, and not upon the elder, as it is vulgarly said. The tree called Judas tree, known also in France and Germany under that name, is a corruption of Kuamos tree (*Cercis siliquastrum*), the Leguminous or Bean tree of the East, and the corrupt name has probably given rise to the tradition that it was upon that tree that the arch-traitor hanged himself. The old herbalists believed that the virtues possessed by this fungus were inexhaustible. For sore throats it was a never-failing cure. An allied species in New Zealand is exported annually in large quantities to China, where it is highly valued for its supposed curative powers. It forms one of the principal ingredients of their favourite soup, on account of its gelatinous properties and its rich delicious flavour.

Among the next division of Fungi, the most popular family

is the Puffballs—a name which needs no explanation. Puck or Pouk fist, by which it was anciently called, and is still commonly known by in some districts of England, is not so self-evident. In Gloucester it is called Puckfoust; in Norfolk, Bulfer and Bulfist—a corruption, perhaps, of the German *Bofist*. The Irish name is Cos-a-phouka or Pouka's foot; the Saxon is Pulker-fist. The name Puckfist may be derived from Puck—Robin Goodfellow, the celebrated fairy—and fist, a corruption of foot. In Icelandic, however, Puck or Puke means a wee devil; in Swedo-Gothic, the ancient language of Sweden, it also means a devil; and in old English the devil is called the pouke. Hence may have arisen the popular family nickname of the Devil's snuff-boxes, given to puffballs. Gerarde informs us that it was a common belief that the snuff from the Devil's box was injurious to the eyes; and Parkinson affirms that if the seeds are brought near the eyes, they will cause blindness—a belief which has originated the names Blindman's ball, Blindman's bellows, and Blindman's een.

Another group in this division has attracted popular notice by its fetid odours. It is most likely to one of its members, called the Common Stinkhorn, that the Poet Laureate refers in the line—

“As one that smells a foul-fleshed Agaric in the holt.”

In Yorkshire it is called the Devil's stinkpot; in Cumberland, Powcat or Polecat; in Norfolk it is called Devil's horn; and in other places, Wood witch and Stinking polecat. A Continental species, by its insupportable odour, has occasioned the superstition among the peasants of the Landes that it produces cancer. It gets the name of Cancer on that account, and they cover it carefully over lest some one should chance to touch it and become infected with that terrible disease. In the west of England the name Canker is applied to poisonous fungi; and in China and the Cape of Good Hope, species allied to the French Cancer are employed as external applications for cancerous sores. A member of this group, bearing some resemblance to the last-mentioned plant, is a native of New Zealand, where at one time it was economically of some im-

portance. The Maoris call it Thunder-dirt, a name apparently derived from some savage superstition regarding its origin—a superstition which can be traced back to the time of the ancient Thracians, who named species of this group as if they were produced by thunder. There is a remarkably interesting group of little fungi also belonging to this division, quite curiosities in their way, and popularly known in some places as Bird's nests, from their resemblance to a small nest with eggs. One species is found plentifully on bracken stems, but the neatest and prettiest kind is seen growing on the ground, mostly in stubble-fields, in spring. At the first glance they represent miniature open purses filled with silver coins. In England they are called Pixies' purses, and in Scotland, Siller cups. Scottish country-folks who chance to light upon these fungi on their way to work or market, consider it a lucky omen of the day's success.

Among the other divisions of fungi, folk-lore is almost confined to a small group whose striking appearance has attracted popular notice. They are called Fairy cups, and the loveliest and most striking of them, if not of all the fungi, is the Scarlet cup, Fairy bath, or Whooping cup, as it is variously called throughout the country.

XIII.—REMARKS ON THE GENUS *AULACODISCUS* EHRB.

By JOHN RATTRAY, M.A., B.Sc., F.R.S.E.

(Read April 25, 1888.)

I RESPECTFULLY beg to submit the subjoined observations on the genus *Aulacodiscus* Ehrb. to the members of the Edinburgh Field Naturalists' Society, in the belief that not a few of the working microscopists who have already found at once pleasure and much material for reflection in the flinty micro-organisms so abundant in every fresh- or salt-water pool, on the

surface of the ocean waters as well as in their most profound depths, may be induced to prosecute their observations still more assiduously in this ample domain, to co-operate in the earnest if humble attempts of the many home and foreign workers now endeavouring to elucidate the story of their life, their minute structure when alive or after death, the still unknown mechanism of their movements, and the riddles of the endo-parasites to whose ravages they, in common with the highest of living organisms, are at all times exposed.

The genus *Aulacodiscus* embraces some of the most elegant forms among the Diatomaceæ. Marine in its habitat, its species are in part met with in fossil deposits only, but they are also occasionally found in the vicinity of land—continental or insular—in tropical or temperate waters. Among deposits its representatives are to be found in that of Mors, Jutland; of Simbirsk and Sysran, Russia; of Barbadoes; of Monterey, Santa Monica, Santa Marta, and Santa Maria, California; of Szent Peter, Szakal, and Kékkö, Hungary; of Richmond and Petersburg, Virginia; of Calvert County, Nottingham, and Piscataway, Maryland; of Augarten; and of Oamaru, New Zealand. From oceanic deposits specimens have been procured in the Pacific by the Challenger, and in the Indian Ocean by the Gazelle. Guanos from Bolivia, Peru, Ichaboe, San Filipe, Patos Island, Patagonia, and South Africa, may also be examined with success. The shores of Great Britain and of the European continent have yielded but a small harvest hitherto, but many recent elegant valves have been procured from New Zealand, New Caledonia, Sumatra, Java, Samoa, Celebes, Japan, the Sandwich and Philippine Islands, Ceylon, Labuan, the Nicobar Islands, King George's Sound, California, Peru, San Francisco, Sierra Leone, the river Congo in W. Africa, Teneriffe, and other localities. It thus appears that whilst deposits afford the most accessible hunting-ground, ballast of ships trading with foreign ports may frequently be examined with a good hope of discovering some of the choicest gems in this department of research.

I must refer the members to the monograph which I have recently had the privilege of submitting to the Royal Microscopical Society of London for a systematic description of the

at present known species of the genus; in this, too, will be found a guide to the relevant literature and to the synonymy—here, fortunately, with few exceptions, less perplexing than in some other genera; and I would also direct attention to certain singularly instructive abnormalities which have been published in the April (1888) issue of the 'Journal of Botany.' But by way of supplement to, and extension of, these papers, it has seemed to me desirable to present you with a tabular view of the species as a guide to their natural affinities, and as facilitating the identification of forms when used with discrimination, in conjunction with the artificial key that will be found in the first-mentioned paper. As explanatory of this Table, I would point out that the forms have a discoid shape, are sometimes almost flat or slightly convex towards the centre, which may be depressed, and are often provided with surface elevations, on the top of which, when present, the large processes of very variable shape are placed. The markings are generally absent from a small central area of variable outline, but often circular, and outside of this are round or polygonal areolæ arranged in substraight radial and often secondary oblique decussating rows, resembling the markings on the back of a watch. Double rows—the primary rays—of often more evident markings proceed from the central space towards the border, but stop short of the latter, and for the most part terminate in large and very elegant processes, which vary in shape from a truncated cone to that of an hour-glass, or even a round-headed staff. The markings are often of the most exquisite pearly lustre, or constitute a faint delicate tracery of marvellous regularity, and between them are frequently found interspaces either of unornamented silica or bearing minute mammillations, by the presence of which the colour and lustre of the valves are often most pleasantly varied, and sometimes greatly enhanced. To the forms possessing within certain limits—depending on the judgment of the observer—modifications of all or some of such characters the specific names are attached; but it must be pointed out that here, as in other departments, there is no absolute fixity of characters within a species. In other words, no two valves from different frustules will be found exactly the counterpart of one another,

and thus it comes about that the species merge insensibly into one another, through forms to which we may sometimes, for convenience of reference, affix a varietal name (or the name of a *forma*), and which may be associated with one or other of two allied species, according to the "taste" of the observer, without violating any law of natural relationship. The same is applicable, too, to the case of allied genera. Such forms as simple discs, devoid of primary rays or processes, to which we give the name *Coscinodiscus*, seem at first sight far removed from these *Aulacodisci*, but in the latter processes are sometimes wanting, and so too are primary rays and inflated areas, whilst the former may have a central area without markings (or, like some *Aulacodisci*, a central rosette), and even submarginal processes of considerable size, as in specimens of the so-called *Eupodiscus jonesianus*, which is associable with *Coscinodiscus concinnus* *W. Sm.* as var. *jonesiana*, and in *Coscinodiscus doljensis*, *C. odontophorus*, *C. odontodiscus*, *C. Rothii*, and specimens belonging to the *Cestodiscoid* section of *Coscinodiscus*—that is to say, to the old genus *Cestodiscus*. Similarly, no sharp boundary lines can be drawn between forms associated with the genus *Auliscus* and those that now rank among the *Glyphodisci*, *Pseudaulisci*, or even *Eupodisci*; and so for other genera.

In the construction of the Table, the guiding principle is that of transition from the simple to the more complex. Thus a flat or almost flat disc, such as *Aulacodiscus suspectus*, *A. exiguus*, *A. apedicellatus*, occupies a lower position in the scale than others provided with inflations like *A. Petersii*, *A. caruthersianus*, *A. Janischii*, or with elevated ridge-bearing zones like *A. Lahusenii*, or with coarse or delicate reticula like *A. Argus*, *A. Thumii*, and *A. Grunowii*; specimens without distinct primary rays are less evolved than others in which these are sharply defined—contrast in this respect *A. suspectus*, *A. Beeveriaë*, with *A. quadrans*, *A. margaritaceus*, or *A. sollittianus*; valves with processes are higher than others devoid of these—for example, *A. formosus*, *A. spectabilis*, *A. orientalis*, as against *A. suspectus*, *A. apedicellatus* (in which they are absent), or *A. exiguus*, *A. barbadensis*, *A. cellulosus*, *A. septus*, *A. probabilis* (in which they are small); large coarse markings

indicate a lower position in the scale than delicate ones—for example, compare *A. gracilis*, *A. polygonus*, and *A. scaber*, with *A. cinctus*, *A. concinnus*, *A. mammosus*; whilst the polygonal outline of *A. polygonus* is an advance upon the simple circular of *A. umbonatus*, *A. lucidus*, *A. aucklandicus*, and the majority of other species. It is important to point out that within a single species extensive modifications may occur: the primary rays may be absent or well developed, or a single ray may have divided and be replaced by two now contiguous and normally straight or regularly curved rays, as in *A. Kittoni*; the circular form may be replaced by the lobate, as in *A. Petersii*; surface depressions typical of a species may be wanting from the areas where their presence would naturally be looked for, as in *A. excavatus*. A central clear area may become eccentric, with an association of modifications dependent directly on this variation, or geminate valves may be met with, but I have seen none having a triple arrangement of its central spaces or primary rays: this genus seems not to yield triplets, though twin forms are not uncommon among recent West African specimens of *A. Kittoni* var. *africana*, and in recent Pisaguan or Vera Cruz gatherings.

The known species range themselves naturally into the following sections: (1) *COMPLANATI*, embracing *A. suspectus*, *A. Beveriæ*, *A. simplex*, *A. probabilis*, *A. parvulus*, *A. Browneii*, *A. Comberi*, *A. hyalinus*, and *A. minutus*; (2) *TENERRIMI*—*A. exiguus*, *A. barbadensis*; (3) *RADIATI*—*A. kirkellyanus*, *A. decorus*, *A. spectabilis*, *A. quadrans*, *A. dispersus*, *A. angulatus*, *A. rotulus*, *A. grevilleanus*; (4) *AREOLATI*—*A. apedicellatus*, *A. cellulosus*, *A. elegans*, *A. radiosus*, *A. crux*, *A. margaritaceus*, *A. scaber*, *A. secedens*, *A. compactus*, *A. patens*; (5) *SEPTATI*—*A. septus*, *A. Schmidtii*; (6) *MIRABILES*—*A. archangelskianus*, *A. superbus*, *A. attenuatus*, *A. anthoides*; (7) *SPECTATI*—*A. polygonus*, *A. amœnus*, *A. oregonus*, *A. intumescens*, *A. affinis*, *A. pulcher*, *A. orientalis*; (8) *INFLATI*—*A. gracilis*, *A. formosus*, *A. inflatus*, *A. mammosus*, *A. Janischii*, *A. carruthersianus*, *A. aucklandicus*, *A. Wittii*, *A. cinctus*, *A. Petersii*, *A. macraeanus*, *A. excavatus*, *A. acutus*; (9) *ORNATI*—*A. Huttonii*, *A. Lahusenii*, *A. Sturtii*, *A. radiatus*, *A. pallidus*; (10) *RETIFORMES*—*A. reticulatus*, *A. Grunowii*, *A. Rogersii*, *A.*

Argus, *A. Thumii*; (11) BLANDITI—subsection α —*A. concinnus*, *A. prominens*, *A. Kittoni*; subsection β —*A. Rattrayii*, *A. sollittianus*; (12) SPECIOSI—*A. neglectus*, *A. umbonatus*, *A. lucidus*, *A. coronatus*.

The most natural and sharply circumscribed of these groups are the Septati, Tenerrimi, Complanati, and Spectati. The Areolati and Blanditi meet one another at *A. radiosus* and *A. concinnus*; the Inflati and Mirabiles at *A. macraeanus* and *A. archangelskianus*; the Speciosi and Spectati at *A. umbonatus*. The entire series of forms may be regarded as springing from the simplest form of the Complanati, namely, *A. suspectus*, and through this directly from the Coscinodisci.

The specimens connected by the bars in the annexed list (see Table) are those that must be looked upon as most nearly of equivalent value in the evolutionary grade. In young frustules of *A. affinis* and *A. margaritaceus*, the modifications in the convexity and proximity of the markings may be studied with considerable ease, but no mathematical law is determinable by which one may predict what the progeny of a given mother-frustule may be as regards the number of primary rays, processes, or markings in a given space (say .01 mm.), since the opposite valves of a single frustule are found to vary in these respects, and so all the more may valves resulting from fissiparous division vary, and yet more those that are the product of conjugation.

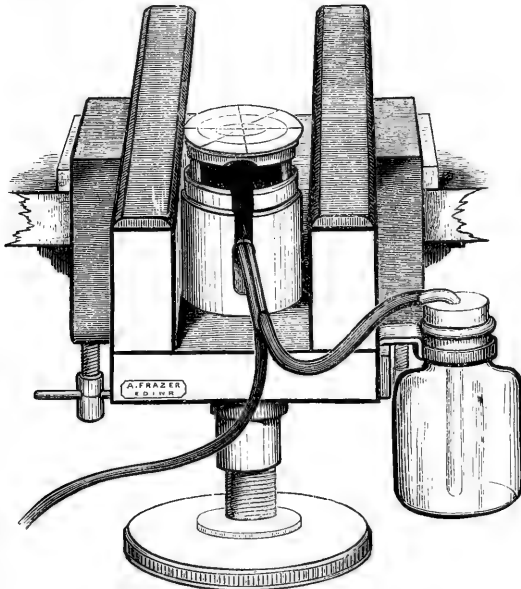
The living frustules of this genus, though sometimes gathered, remain undescribed, and in many instances quite unknown. A wide field thus remains open for the fortunate observer who chances to meet such forms. Young frustules, though found occasionally, are for most of the species also still enshrouded in darkness, and the getting at the history of the evolution of their markings may be the reward of the careful worker in this region. Fissiparous division is but inadequately understood, and conjugation has never been seen. There is thus in this small department still ample work to be accomplished, and the same is applicable to most of the genera of this extensive department of Botany.

XIV.—A NEW FORM OF FREEZING AND EMBEDDING MICROTOME.

By MR ALEX. FRAZER, M.A.,
SCIENTIFIC INSTRUMENT MAKER.

(Read April 25, 1888.)

THIS instrument differs from the original Cathcart microtome in the following points: (1) The principal screw is of larger diameter than in the old form, and has a head of considerably greater size; (2) the wooden frame is now made with a projecting part, by means of which the instrument may be



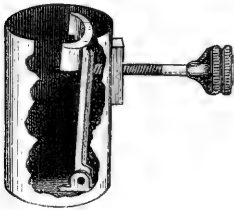
clamped on *both* sides, and two clamps are now supplied; (3) the freezing-plate is now made of circular shape, is supported on three pillars, and is provided with a ledge to prevent the ether getting to the upper side of the plate; (4) the construction of the instrument has been so modified that it may be

used both for specimens frozen in gum and those embedded in paraffin or celloidin.

The increased size of the screw gives a more steady movement than was possessed by the older and smaller microtome, while the greater circumference of the screw-head enables an operator to impart a finer movement to the screw. The relation between the pitch of the screw and the circumference of its head is such, that if the edge be moved forward a quarter of an inch, an object will be raised one-thousandth of an inch; and if it be moved an eighth of an inch, the object will be raised a two-thousandth of an inch.

It is found that, when the instrument is clamped on both sides, less pressure need be applied at either side; and the tendency which the instrument had to turn upon the point of clamping, as on pivot, is quite done away with.

In the original instrument, the plate was supported on two pillars, in order that as little heat as possible might be conveyed to the freezing-plate from the body of the instrument. In the new instrument, the size of the three supporting pillars



and screws is so much reduced that the conducting surface is not greater than in the old microtome. The arrangement for cutting embedded sections consists of a tube which fits the principal well of the microtome, and within which fits a hinged part similar to an ordinary vice. With the instrument are provided the means of

preparing paraffin blocks for embedding sections.

When it is intended to use the microtome for embedding, the ether spray, spray bellows, and ether bottle should be removed, and the freezing tube, having been raised as far as possible by means of the principal screw, should then be withdrawn from the well. The embedding tube is now placed in the well, and, having been pushed down until it rests upon the point of the large screw, it may be lowered to a convenient height by working the large screw backwards.

The following are Mr Cathcart's directions for freezing:—

1. Place a few drops of mucilage (1 part gum to 3 parts water) on the zinc plate,

2. Take a piece of the tissue to be cut, of about a quarter of an inch in thickness, and press it into the gum.

3. Fill the ether bottle with anhydrous methylated ether, and push the spray points into their socket. All spirit must, of course, have been previously removed by soaking for a night in water. The tissue should afterwards be soaked in gum for a like time before being cut.

4. Work the spray-bellows briskly until the gum begins to freeze; after this, work more gently. Be always careful to brush off the frozen vapour which, in a moist atmosphere, may collect below the zinc plate. If the ether should tend to collect in drops below the plate, work the bellows slower.

5. Raise the tissue by turning the milled head, and cut by sliding the knife along the glass plates.

6. After use, be careful to wipe the whole instrument clean.

7. Should the ether point become choked, clear by means of the fine wire which is sent with the instrument.

8. The instrument is intended for use with methylated sulphuric ether.

9. In clamping the instrument to a table or other support, care should be taken that the zinc plate is in a horizontal position. If the plate be not horizontal, the gum will tend to run to one side.

The following are the directions for embedding in paraffin:—

1. Pieces of tissue, or other objects to be cut, should be freed from water; this may be effected by dipping an object to be embedded into spirit, and then allowing it to dry.

2. The dried object should be dipped for a moment into melted paraffin which is only slightly heated above its melting-point.

3. After paraffin has been poured into the metal moulds, and has begun to solidify, the tissue with its adhering layer should be pressed into the cooling paraffin, and held in the position desired till the paraffin cools around it.

4. During the process of "casting" the paraffin blocks, and embedding the objects to be cut, the brass tubes should be placed upon a piece of glass or other substance to which paraffin will not adhere.

5. When a paraffin block is quite cold, it should be expelled from the brass tube by placing the tube into one of the holes in the wooden rest, and driving it (the block) out by means of the wooden rod.

6. When the block is placed in the vice which holds it in the well of the instrument, undue pressure should not be applied by the clamping screw; for if the block be held too tightly, the outer tube will tend to lose its shape.

7. Full instructions in the methods of embedding both in paraffin and celloidin may be found in the text-books which deal with the methods of Histology. The above directions are only intended to explain a process which may be conveniently followed in using this microtome.

MEETINGS OF MICROSCOPIC SECTION.

THE work of the Microscopic Section during the past Session consisted of a series of weekly meetings, which were held from November till March. In the first part of the Session a short course of six lectures was delivered by G. F. Scott Elliot, Esq., M.A., of the Royal Botanic Garden, on "The Life-History of a Plant, as shown by the Microscope." In connection with these lectures, which were profusely illustrated by specimens and diagrams, demonstrations were given by the aid of a number of microscopes. The lectures were much appreciated by the members of the Society who attended them, and Mr Scott Elliot has been awarded a hearty vote of thanks by the Council for his labours in connection with them.

During the months of January, February, and March of the present year (1888) the study of Huxley and Martin's 'Biology' was undertaken by several members of the Biological Section, when a considerable portion of this book was carefully gone over, and the accompanying laboratory work carried out.

At some of the monthly meetings of the Society, papers were read and apparatus exhibited bearing on the subject of microscopy. Thus, Mr Penman read a paper, illustrated by diagrams, on "Polarised Dark-ground Illumination," which will be found in the 'Transactions' for the present Session (*ante*, p. 127). Mr A. Frazer, M.A., Secretary of the Microscopic Section, read a paper "On the Testing of Microscopic Objectives: Part I., Low Powers." This communication is still unfinished, and will be printed in the 'Transactions' when completed. Mr Frazer also read a paper explaining the subject of "Microscopic Measurement and Magnification," and described a "New Form of Freezing and Embedding Microtome." The latter communication will be found at p. 189 of the 'Transactions' for the present Session. Mr Frazer also exhibited and explained the following—viz., "A simple form of injection apparatus," "Swift's new fine adjustment," and "Möller's Diatomaceen Typen-Platte."

In lieu of the Annual *Conversazione*, a social meeting of the members of the Society was held in the Society of Arts

Hall on the evening of the 11th April. At this meeting a considerable number of interesting micro.-preparations were exhibited, these being confined to "the work of the members themselves." The preparations included animal and vegetable tissues, parts of insects, rock-sections, crystals, diatoms, &c. About one hundred members of the Society were present.

In connection with the social meeting, it may be here mentioned that Mr Symington Grieve, President, who occupied the chair, delivered an address on the History of the Society, from its foundation in June 1869 to the present time. Want of space has unfortunately prevented this interesting address from being included in the 'Transactions' for the current Session.

ANNUAL BUSINESS MEETING.

THE Annual Business Meeting of the Society was held on the evening of the 24th October 1888, in the Hall, 20 George Street,—Mr Robert Stewart, S.S.C., one of the Vice-Presidents, in the Chair.

The Secretary, in submitting his Annual Report, stated that during the past Session there had been in all 16 meetings (not including the meetings of the Microscopic Section), of which 6 were indoor and 10 were field meetings. The number of field meetings was much smaller than usual, inasmuch as, although the usual number had been arranged for, the wet and inclement weather prevented several of them from being held. The indoor meetings were, as usual, well attended, but, with one or two exceptions, the field meetings were poorly attended—no doubt, in consequence of the cold and late summer. The following list gives the dates and localities of the meetings—viz.:

INDOOR MEETINGS: (1) *Ordinary Evening Meetings*, 1887—November 23, December 28; 1888—January 25, February 22, March 28, April 25. (2) *Social Meeting*, April 11, 1888.

FIELD MEETINGS: 1888—May 5, Craigmillar Castle; May 12, Hawthornden to Polton; May 19, Hailes Quarry; May 26, Beeslack; June 2, no excursion; June 6, Restalrig; June 9, no excursion; June 16, Dalmahoy Crags; June 20, Caroline Park; June 23, Driving Excursion to Loganlee; June 30, Caribber Glen; July 4, no excursion; July 7, no excursion; July 14, Driving Excursion to Gullane; July 18, Blackford Quarry; July 21, no excursion.

The Financial Statement showed that, including a balance of £16, 8s. 9d. from last account, the income had been £73, 18s. 9d., and the expenditure £64, 10s. 11½d., leaving a balance in favour of the Society of £9, 7s. 9½d.

The election of Office-bearers for Session 1888-89 was next proceeded with, when, after the vacancies were filled up, the complete list stood as under:—

President.

Dr WILLIAM WATSON.

Vice-Presidents.

ROBERT STEWART, S.S.C. | GEORGE BIRD. | WILLIAM FORGAN.

Council.

JOHN ALLAN.	Dr J. M. MACFARLANE.	ARCHD. CRAIG, jun.
J. D. MURRAY.	JAMES TERRAS.	TOM SPEEDY.
JOHN LINDSAY.	F. G. PEARCEY.	D. E. YOUNG.
WM. PENMAN.	WILLIAM COATS.	JOHN TAIT.

Secretary and Treasurer.

ANDREW MOFFAT.

Auditors.

HUGH H. PILLANS; JOHN PAIRMAN, S.S.C.

During the past Session 31 names have been withdrawn from the roll, and 21 new names added, making a decrease of 10, and giving at the close of Session 1887-88 a total roll of ordinary members of 223. During the year two members have died—viz., the Rev. R. F. Colvin, President of the Society from 1877 to 1879; and Alexander Dickson, M.D.,

F.R.S.E., Professor of Botany in the University of Edinburgh. At the meeting in January, Mr Symington Grieve, President, paid a fitting tribute of respect to the memory of these two honoured members of the Society.

On the recommendation of the Council, it was unanimously agreed to that Rule VIII., as far as it relates to the number of the field meetings, be abolished, and that it be left in the hands of the Council to make arrangements annually for the field meetings, in respect both to their number and dates of meeting. The Meeting also unanimously adopted a recommendation of the Council to the effect that a Special Fund be instituted for the purpose of assisting in the publication of the 'Transactions'—subscriptions for that purpose to be handed to the Treasurer.

A unanimous vote of thanks was accorded to the retiring President, Mr Symington Grieve, who had so ably filled that office during the past three years, as also for the stirring and interesting addresses delivered to the Society, and which have helped to enrich the pages of our 'Transactions' from time to time.

At the first excursion of the Society for the season—viz., to Craigmillar Castle, on May 5—Thos. Ross, Esq., of Messrs M'Gibbon & Ross, Architects, read a paper giving an account of the history of the castle, and of the various events of which it has been the scene, for several centuries past. The architectural features of the building, in particular, were carefully described, and the different structural alterations which have been made from time to time were noted. In illustration of this part of the paper, a large number of drawings and plans were exhibited on the walls. Mr T. A. D. Wood, F.S.A.Scot., also read a paper bearing more especially on the archæology of the castle. Both Mr Wood and Mr Ross received a hearty vote of thanks from the large company who had gathered to listen to their valuable and interesting papers. It should also be mentioned here that, by the kindness of the proprietor, Robert G. G. Gilmour, Esq. of Craigmillar, and of Mr and Mrs Speedy, the members were afterwards supplied with refreshments in the "Queen Mary Room" of the old pile. Before separating, the company was photographed in front of the castle.

At the excursion to Hailes Quarry, on May 19, Mr John Henderson, F.G.S., the leader of the party, explained the geological features of the district, as well as of the strata exposed at the quarry, in a lucid and interesting manner, thereby earning the thanks of the members who accompanied him.

It may finally be mentioned, in connection with the outdoor meetings, that at Gullane, to which a number of the members drove on July 14, Mr and Mrs Clapperton entertained the party to tea on the lawn in front of their house.



LIST OF PAST PRESIDENTS.

Dr ROBT. BROWN, 1869. Mr R. SCOT SKIRVING, 1869-1874. Mr WM. GORRIE } 1874-1877. (deceased),		Rev. R. F. COLVIN } 1877-1879. (deceased), Mr JOHN WALCOT, 1879-1882. Mr A. B. HERBERT, 1882-1885. Mr SYMINGTON GRIEVE, 1885-1888.
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ANDREW MOFFAT, JOHN LINDSAY.

Secretary and Treasurer.

ANDREW MOFFAT.

Auditors.

HUGH H. PILLANS; JOHN PAIRMAN, S.S.C.

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 GRIEVE, DAVID, F.R.S.E., 1 Lockharton Gardens, Slatford.
 HENDERSON, Prof. JOHN R., M.B., C.M., The College, Madras.

Corresponding Members.

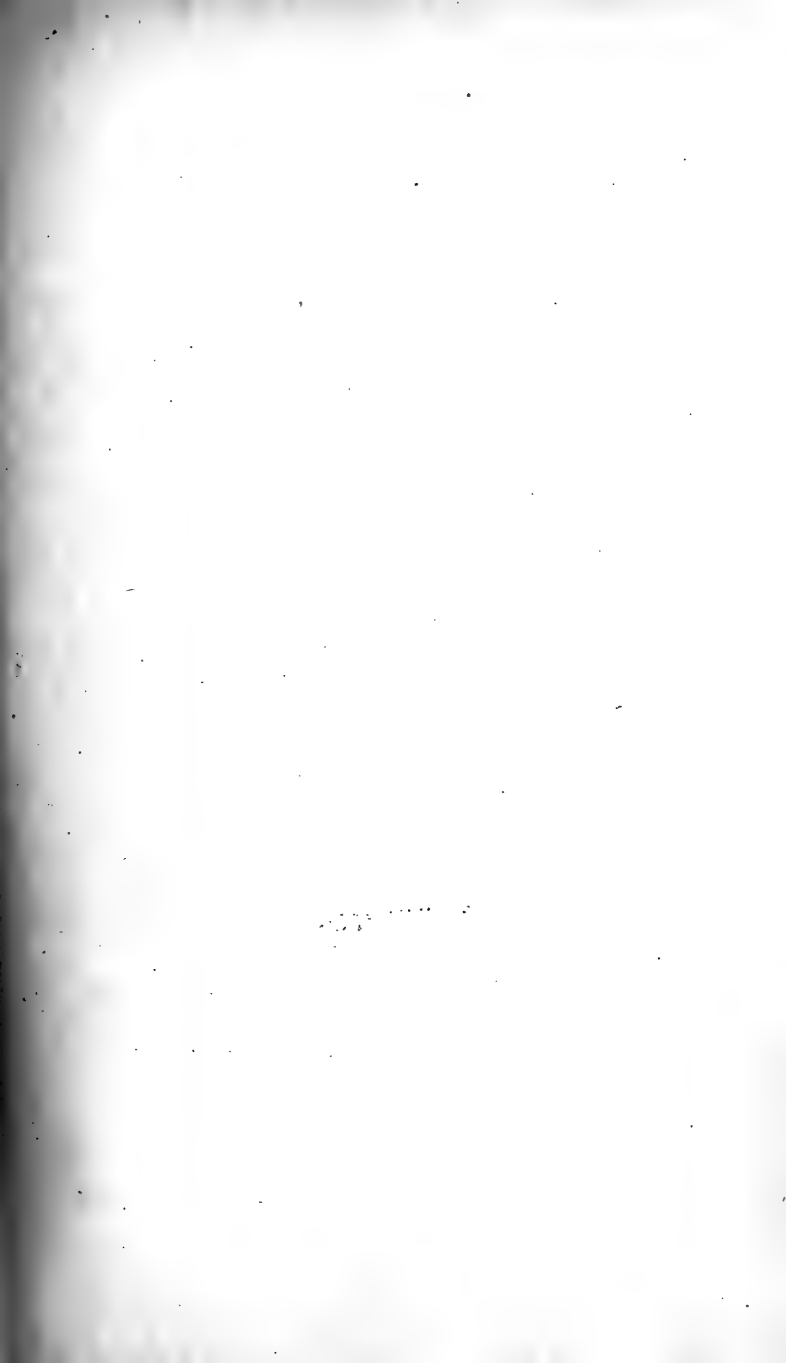
ARCHIBALD, STEWART, Carroch, Kirriemuir.
 BROTHERSTON, ANDREW, Kelso.
 CRUICKSHANK, T. M., South Ronaldshay.
 HOBKIRK, CHARLES P., Huddersfield.
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 THOMSON, JOHN, Stobo.

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- Adams, William, Royal Bank, St Andrew Square.
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- Archibald, Jas., 13 Clifton Terrace.
- Arthur, Charles, Royal Infirmary.
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- Bashford, W. T., Argyle House, Portobello.
- 10 Bathgate, John, 8 Wardie Avenue.
- Bell, John M., W.S., 55A Grange Road.
- Bird, George, 24 Queen Street.
- Black, Wm., S.S.C., 117 George St.
- Boa, Peter, 119 George Street.
- Bonnar, Wm., 8 Lauriston Park.
- Brodie, J. A., Bonnington Iron Foundry, Leith.
- Brown, Thos., 1 Gillespie Street.
- Bryden, Mrs, 72 Great King Street.
- Bryden, Miss, 72 Great King Street.
- 20 Burn, C. M. P., Prestonfield House.
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- Carter, A. E. J., 9 Argyle Crescent, Portobello.
- Carter, Wm. Allan, M.Inst.C.E., 5 St Andrew Square.
- Clapperton, Mrs Wm., 9 Strathearn Road.
- Clark, Alex., S.S.C., 80A Princes St.
- Clark, William, Greenside Cottage.
- Coats, William, 21 Nelson Street.
- Cooper, James, 31 Howe Street.
- Cotton, Miss Maria, 26 Mayfield Ter.
- 30 Cowan, Alfred, 19 Rutland Square.
- Cowan, Charles Wm., Valleyfield, Penicuik.
- Coyne, R. A. F. A., 21 Archibald Pl.
- Craig, Archibald, jun., 16 Blacket Place.
- Crawford, Wm. C., M.A., 1 Lockharton Gardens, Slateford.
- Crichton, George, 30 Restalrig Terrace.
- Cuthbertson, Wm., 23 Dublin St.
- Denson, E., 9 West Catherine Place.
- Deuchar, Mrs, Harlaw, Hope Ter.
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- 40 Dobbin, Mrs Leonard, 4 Cobden Road.
- Dowell, Mrs, 13 Palmerston Place.
- Dowell, Miss, 13 Palmerston Place.
- Duncan, Esdaile, Dean Public School.
- Dunn, Malcolm, Palace Gardens, Dalkeith.
- Eld, Thos. W., 50 South Bruntsfield Place.
- Elliot, G. F. Scott, M.A., Royal Botanic Garden.
- Ewart, James, 1 Dundas Street.
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- Farquharson, Thos. Ker, Roseville, St Catherine's Place, Grange.
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- Forgan, William, 3 Warriston Cres.
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- Fraser, Charles, 13 Greenhill Place.
- Fraser, Mrs, 13 Greenhill Place.
- Fraser, Hugh, Leith Walk Nurseries.
- *Fraser, P. Neill, Rockville, Murrayfield.
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- 60 Galloway, James, St Fillans, Trinity.
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- Gloag, David, 9 Barnton Terrace.
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- Grant, James R., 12 Howard Place.
- Gray, Jos. T., M.A., Parkside.
- Grieve, Miss Amelia, Salisbury View, Dalkeith Road.
- Grieve, Somerville, 159 Dalkeith Road.
- Grieve, Symington, 1 Burgess Terrace.
- Grieve, Mrs Symington, 1 Burgess Terrace.

- 70 Grosert, Robert, So. Oswald Road.
Groves, Charles H., M.D., 36 Inverleith Row.
Guthrie, Mrs, West Grange.
Hardie, William, 49 Morningside Road.
Hart, James, M.A., Dean Public School.
Hately, W., 12 Bruntsfield Place.
Heggie, John, 1 Greenbank Terrace.
Henderson, John, 10 Salisbury St.
Henderson, Miss Jessie, 17 W. Preston Street.
Herbert, A. B., 13 Polwarth Terrace.
- 80 Horne, Oswald, 21 Leith Street.
Hoyle, W. E., M.A., M.R.C.S., F.R.S.E., Chiswick.
Hume, William, 1 Lothian Street.
Hunter, James, 7 Melgund Terrace.
Hurry, Miss, 56 India Street.
Hutchison, Robert, F.R.S.E., 29 Chester Street.
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Jamieson, P., Natural History Laboratory, University.
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Johnstone, Alex., 38 Lady Menzies Place.
- 90 Johnstone, J. A., 30 Haddington Place.
Johnstone, Miss Annie, Eskhill, Roslin.
Keith, Sydney, 69 So. Clerk Street.
Keith, Miss Catherine, 16 Mentone Terrace.
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Kilgour, Thos. W., 4 East Brighton Crescent, Portobello.
King, J. Falconer, Minto House.
King, Mark, 120 Pitt Street, Leith.
Knight, Donald, 33 Regent Place.
- 100 Landels, W., 5A Devon Place.
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Law, Miss, 41 Heriot Row.
Lee, William, 15 Craiglea Drive.
Lennie, Joseph C., Rose Park, Trinity Road.
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Lindsay, John, 43 James St., Pilrig.
Livingstone, Matthew, 108 Gilmore Place.
- Lockie, John, C.E., 39 Restalrig Ter.
- 110 Lorimer, Miss, 16 Mayfield Terrace.
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M'Craith, Miss, 26 Haddington Pl.
MacDougall, W., Woodburn, Morningside.
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M'Glashan, D., 12 West End Place.
M'Glashen, Robert L., 1 Brandon St.
M'Intosh, James, 42 Queen Street.
Mackay, Miss, 69 Northumberland Street.
M'Laren, J. R., M.A., 9 Gt. King Street.
- 120 M'Kean, James, 3 Warrender Park Terrace.
M'Kean, Miss J., 1 Inverleith Ter.
M'Kean, Miss Minnie, 1 Inverleith Terrace.
M'Kechnie, Campbell, 60 Northumberland Street.
Macpherson, C. E. W., C.A., 28 St Andrew Square.
Macpherson, John C., 3 Warrender Park Terrace.
Marshall, Hugh, B.Sc., 1 Lorne Ter.
Marshall, Ralph, 1 Lorne Terrace.
Maxwell, John, 125 George Street.
Melvin, Alex., 40 Warrender Park Road.
- 130 Methven, John, 6 Bellevue Crescent.
Millar, R. C., C.A., 8 Broughton Pl.
Millar, Thomas John, M.A., 8 Broughton Place.
Miller, Rev. Robert, M.A., Canaan Lane.
Miller, R. K., 13 Lennox Street.
Moffat, Andrew, 5 Scone Gardens.
Mossman, Robert, 10 Blacket Place.
Muir, John, 115 Warrender Park Rd.
Murray, Chas. G., 68 Haymarket Ter.
Murray, J. D., 68 Haymarket Ter.
Murray, Wm., 8 Clifton Terrace.
- 140 Naismith, R. T., 2 Ethel Terrace.
Nash, W. S. (*present address unknown*).
Neill, John, 3 Sylvan Place.
Nelson, W. F., Salisbury Green.
Nesbit, John, 162 High Street, Portobello.
Nisbet, Miss, 28 E. Claremont St.
Norfor, Robt. T., C.A., 47 So. Bruntsfield Place.
Ogilvie, Miss, 18 Buckingham Ter.

- Oliphant, J. C., M.A., 23 Charlotte Square.
- 150 Oliver, Chas. M., 9 S.-E. Circus Pl.
 Oliver, G. E., 4 Mostyn Terrace.
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 Peach, Mrs, 13 Dalrymple Crescent.
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 Pearcey, F. G., 37 Raeburn Place.
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- 160 Philip, James, 5 Argyle Place.
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 Pillans, Miss, 12 Dryden Place.
 Purves, Samuel, 70 Haymarket Ter.
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 Robertson, George, Lothian Road Public School.
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- 170 Scott, Alex., 27 Heriot Row.
 Semple, Andrew, Deputy Surgeon General H. M. S., Caledonian United Service Club.
 Shaw, John O., Beauly, Victoria Park, Trinity.
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 *Skirving, R. Scot, 29 Drummond Pl.
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 Smith, Rupert, 7 Leopold Place.
 Smith, Walter A., Falcon Lodge, Murrayfield.
- 180 Somerville, Alex., B.Sc., F.L.S., 34 Granby Ter., Hillhead, Glasgow.
 Speedy, Tom, The Inch, Liberton.
 Sprague, T. B., M.A., F.R.S.E., 29 Buckingham Terrace.
 Sprague, Mrs T. B., 29 Buckingham Terrace.
 Steele, Adam B., 10 Comely Bank.
- Steele, Miss, 16 Upper Gray Street.
 Stewart, James R., 10 Salisbury Rd.
 Stewart, Miss, 53 Lothian Street.
 Stewart, Robert, S.S.C., 21 Warriston Crescent
 Stevenson, Miss, 2 Albert Place.
- 190 Storrie, James, 5 Bowhill Terrace.
 Summers, Miss Maggie, 32 Craigmillar Park.
 Sutherland, John, 12 Caledonian Rd.
 Tait, John, High School, Leith.
 Tait, John Scott, C.A., 8 Claremont Terrace.
 Taylor, William, M.D., 12 Melville Street.
 Terras, James, 34 Findhorn Place.
 Thomson, Mrs, 6A Bruntfield Place.
 Thomson, Thos., 16 Glen Street.
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- 200 Turnbull, George, 16 Thistle Street.
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 Watson, Mrs, Lockharton, Slateford.
- 210 Weir, James Lind, 3 Beechwood Ter.
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 Wilson, Geo. A., 46 Queensferry St.
 Wilson, T., 121 George Street.
 Wilson, James T., Restalrig House.
 Wilson, Miss Katie, 2 Archibald Pl.
 Wood, Alex., 4 Avondale Place.
 Wood, T. A. D., Viewforth, Brunstane Road, Joppa.
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- 220 Wright, Hilda, Ravensrood, Craiglockhart.
 Wright, Thomas, 6 Greenside Place.
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TRANSACTIONS

OF

The Edinburgh Field Naturalists' and
Microscopical Society

SESSION 1888-89



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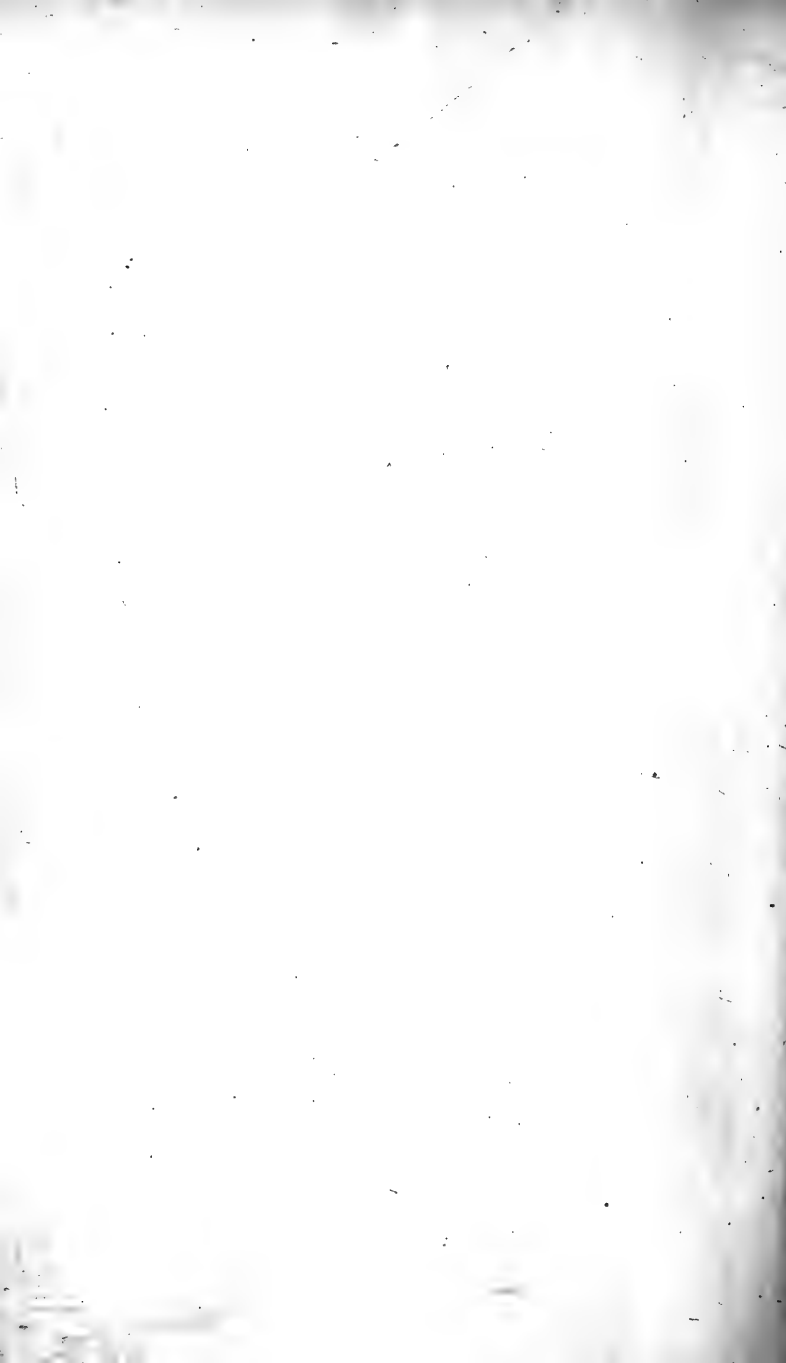
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MDCCLXXXIX



I.—NOTES ON NATURAL HISTORY IN INDIA.

BY DR WILLIAM WATSON, PRESIDENT.

(Read Nov. 28, 1888.)

I HAVE to thank you for the honour you have done me in electing me as your President. My claims to the honour are slender. They principally consist in my having more leisure than other members of the Society—not a very important qualification in itself, but it has apparently had some weight with your Council. I have accepted solely for that reason, believing that as I am probably the only member of your Society who has absolutely nothing to do, I am in that respect, at least, the fittest person to undertake the onerous duties of President. With regard to a presidential address, I have had some difficulty; but as the only subject I know much about is India, I have resolved to give you a brief sketch of that country, from a natural history point of view. There is additional propriety in my choosing this subject to-night, inasmuch as our late President, Mr Symington Grieve, is sailing at present to “India’s coral strand,” and by this time will have passed Ceylon, with its “spicy breezes,” as Bishop Heber puts it, where—

“The heathen in his blindness
Bows down to wood and stone.”

All this, by the way, may be beautiful poetry, but it is not altogether correct, from a natural history point of view. In the first place, the shores of India are alluvial or volcanic, *not* coral. Next, “spicy breezes” do *not* blow over Ceylon; and when breezes do blow, they certainly do not, as a rule, blow softly. Lastly, whatever the people of India may do, the Singalese, or inhabitants of Ceylon, certainly never “bow down to wood and stone.” It is the very last thing a Buddhist would do, more especially a Buddhist of the Southern sect, to which the people of Ceylon belong—a sect which has always protested

against the slightest approach to idolatry. All the same, Bishop Heber's 'Travels in India' is the most interesting book which has ever been written on that country, and I would advise every one to read it. The only man of greater genius who has written on India is Colonel Sleeman; but his books are addressed to the Anglo-Indian resident, not to one who has never seen the country.

To return to Science,—India is made up geologically of four great provinces, very unlike each other: (1.) The southern volcanic table-land, of which the most common rock is basalt, often capped with laterite. Below the basalt lies stratified sandstone, and still lower, granite; but these are only exposed in a few places. (2.) The great alluvial plains along the courses of the Indus and the Ganges. This is not the largest division, but it is by far the richest and most important, and when people talk of India, it is generally the Indus or Ganges valleys they are thinking of. All the common descriptions of India are only true of these great alluvial plains. (3.) The waterless district of Rajpootana, a barren wilderness of sand. (4.) The Himalayan mountains, of crystalline schists, limestone, and granite. These mountains are inhabited nearly up to the snow-line, which on the southern face, where the air is moist, is about 13,000 feet above the sea. On the northern face, where the air is dry, perpetual snow is not found till you ascend to nearly 16,000 feet. This is the very reverse of what one would at first thought expect. It seems strange that the south aspect, turned to the equator, should be colder than the north aspect, turned away from the equator. But the amount of snow is determined more by the amount of moisture than by the temperature. The south face is always the moist one, owing to the hot winds blowing up from the plains. Not only does more snow fall on the south side in winter, but less melts in summer. Another peculiarity of the Himalayas is, that the lower hills are generally well wooded on the north face, but bare and sterile on the south face. This is owing partly to the fierce winds blowing up from the plains, but partly also to the continual changes of temperature killing plants. On the north face, the climate is much less variable. We have thus four regions: 1st, The basalt table-land; 2d, The alluvial plains; 3d, The Rajpootana desert; and 4th, The Himalayan

mountains. Botanically, they may be characterised by the staple food of the inhabitants. In the largest province, the southern table-land, the inhabitants live chiefly on various species of millet. Millets are grasses belonging to the genus *Panicum*, or some of its near allies. *Panicum* is characterised by having rigid cartilaginous paleæ investing the seed, but not adhering to it. The chief millets are—*Panicum miliaceum*, *P. italicum*, *P. frumentaceum*, *Paspalum scrobiculatum*, and *Penicillaria spicata*. Another grass seed is also eaten, *Sorghum vulgare*, belonging to quite a different botanical family, but popularly classed as a millet. The nourishment afforded by these millets is poor compared with that afforded by wheat, or even barley; but they grow better on barren, rocky soil. The second region is the alluvial plain, but this region it is necessary to divide into two, owing to the difference in the amount of rainfall, not to the nature of the soil. The west side of India has very little rainfall, in some places not more than two or three inches annually. The east side is perhaps the wettest country in the world. In the Cossya hills the rainfall is 600 inches annually. The difference of rainfall determines the nature of the plants cultivated for food. In the dry west there are wheat and barley; in the damp east, rice. The whole of the Indus and the upper part of the Ganges valley belong to the wheat country; the lower part of the Ganges valley to the rice country. With regard to the third region, that of the Rajpootana desert, no cereals grow there, and the people import their vegetable food from other provinces. In the fourth region, that of the Himalayas, and in the higher parts of that region especially, the common plants grown for food are two: *Eleusine corocana*, a grass of the Chlorid family, characterised by a cluster of secund spikes; and *Fagopyrum*, or buckwheat—not a grass at all, but a plant allied to our native *Polygonum*. With regard to the population using these articles, it may be said generally that about sixty million are millet eaters, sixty million rice eaters, sixty million wheat and barley eaters, and three or four million *Eleusine* and *Fagopyrum* eaters. Of course, it must be understood that these statements are only true in a vague and general way. It is often necessary to content one's self with a general outline of a subject, without filling in all the details, and this is all I aim at giving you.

It is much as if I were to describe the north of Scotland as being geologically a primary country, Ireland a secondary one, and England a tertiary one; or were to say that in the eighteenth century the Scotch lived on oatmeal, the English on wheat, and the Irish on potatoes. This is, of course, not the case now, since the repeal of the corn laws; but it was essentially true when I was a boy, and there may be other old people still alive who remember the time when the Scotch lived on oatmeal. I rather regret the old days, and believe that if the Scotch of the present day lived, like their ancestors, on oatmeal and home-brewed beer, instead of tea and white bread, they would have better teeth, and more correct religious and political opinions. Samuel Johnson, in the first edition of his dictionary, defined oats as "the food of horses in England and of men in Scotland." Most Scotchmen know Lord Eli-bank's commentary on this, "And where will you find such horses or such men?" There is a German proverb, "What a man eats, that he is;" and I would warn the Scotchman who, instead of taking oatmeal porridge to breakfast and a gigot of mutton to dinner, eats, like an Englishman, ham to breakfast and roast-beef to dinner, that he is simply turning himself into an Englishman. We—those of us who are Lowlanders, at least—are English by descent and language; difference of diet was the only real difference between us. Bruce and Wallace fought and conquered, that oatmeal-eaters should not be ruled over by beef-eaters. It is true the people of the county of Aberdeen have always lived on beef, but they have always been Episcopalian and anti-Presbyterian in their sympathies. In a county fitted for rearing cattle, and not for rearing sheep, they could not be anything else.

Having given this sketch of the botany and geology of India generally, I propose to take up one county and describe it more in detail. Of course, I must take a county with which I myself am acquainted; and of these, the county of Banda, on the south bank of the Jumna, is, on the whole, best suited for my purpose. I may mention that British India is divided into counties, each governed by an English magistrate. Thus, the great province known by the name of the North-West Provinces and Oudh, which has a population of 44 millions, is divided into 49 counties; so that each county has, on an

average, nearly a million of inhabitants. The county of Banda is about eighty miles long and thirty miles broad, and consists of two distinct tracts. The southern part of the county belongs to the southern uplands, and the northern part of the county to the alluvial plains; but both present exceptional characters. With regard to the southern part, as it belongs to the southern uplands, the surface rock should be basalt, and so no doubt it once was; but all the basalt has been removed by denudation, and what one now sees is granite, covered by a thin layer of sandstone. Nothing can be more picturesque than the scenery at the point where the southern upland passes into the alluvial plain. The upper thin layer of sandstone is scarp'd as if cut perpendicularly with a knife, while the granite beneath slopes down to the plain like the glacis of a fort. The alluvial plain itself, near the point of junction, is dotted all over with enormous boulders of granite, often piled one on the top of another. Many of the outer hills are natural strongholds, and were utilised as such in the troubled times, before the British conquest. One of the most famous of these, the ruined hill-fort of Callinger, is in the county of Banda. It is a detached rock, syenite at the base, sandstone above, and is now overgrown with custard-apple—a plant not indigenous to India. The alluvial part of Banda county is also peculiar. Generally speaking, the alluvial plains of the Indus and Ganges are composed of substances washed down from the Himalayas—that is to say, granite, mica-schist, and limestone. The Banda part of the alluvial plain is essentially composed of basalt from the southern uplands. The Himalayan alluvium forms a light-coloured soil, admirably adapted for cereals and sugar-cane. The basalt alluvium suits cereals well, but it suits cotton and the pulses better. Sugar-cane it does not suit at all. This basalt alluvium is of a black colour, and very retentive of moisture. In dry weather it splits up into lumps, which are very hard, and when force is used, break with a conchoidal fracture. It is generally named the black cotton soil, because it is so well suited for growing cotton; but it might also be called the black lentil soil. The surface is everywhere furrowed by deep ravines, running north and south from the southern hills to the river Jumna, and forming the drainage system of the

country; but all the land not occupied by the great transverse furrows is, at most seasons of the year, a sea of cultivation. In October or November the following plants are sown: wheat, barley, *Cicer arietinum*, and *Ervum lens*. The wheat and barley are almost identical with those grown in Britain. *Cicer arietinum* is a low herb with pinnate toothed leaves. The pod contains one or two seeds, which are fancifully compared to a ram's head. *Ervum lens* is the *ervalenta* and *revalenta* of the shops. It also is a herb, but has pinnate leaves ending in a tendril, and two or rarely three seeds. Both are much eaten in India, Italy, Greece, and Palestine. They are mentioned together in 2 Sam. xvii. 28—"Beans, and lentiles, and parched pulse." In India they are grown to perfection in Banda county, and large quantities are exported across the Jumna to districts where the alluvial soil is of Himalayan origin, and therefore better suited for cereals than for pulses. In the Banda district the crops mentioned above—wheat, barley, pulse, and lentils—are reaped in April. Sometimes a crop of cucumbers is taken from the ground in May and early June; but in all cases, as soon as the autumnal rains begin, which fall in July, August, and September, advantage is taken of the first temporary break to sow cotton and the millets, which are reaped at varying periods from September to February, the last reaped being *Penicillaria* in February. Both in spring and autumn the cultivation is a sight for a farmer. Not a weed is ever to be seen: not even East Lothian wheat is as clean as are all the crops in Banda. No manure is required, and no irrigation is obtainable. If, as now and then happens, the autumn rains are deficient, the result is famine. In reaping the wheat and barley, the farmers of Banda do not cut it like farmers in Europe, or in the rest of India. They do not shear the corn—they merely cut off the ears, and leave the stalks to wither. They then burn the stalks, and plough them into the land. This is the only manure given to the soil. Very frequently two plants are sown together, in Belgian fashion—generally wheat and pulse, or barley and pulse. They are supposed not to interfere with each other's growth, and thus to enable the land, in the same season, to yield two crops instead of one. The most conspicuous crop of Banda has not yet been mentioned—the

pigeon-pea (*Cajanus flavus* or *C. bicolor*). This is a leguminous shrub, growing sometimes ten feet high. It is sown in June, and not reaped till March or April, so that it is nearly the whole year in the ground. The twigs are used for making baskets, and the seeds of the pod are much eaten. Each pod contains four or five spotted seeds. All through the winter, fields of this tall shrub, with its brilliant yellow flowers, are conspicuous on the Banda plains. Another plant extensively cultivated is the *Sesamum orientale*, mentioned in the story "Open Sesame" in the 'Arabian Nights.' This is generally sown along with cotton. It is a herb with a white irregular flower and many small seeds. These seeds yield an oil nearly equal to olive-oil. They are also eaten scattered on bread or made into sweetmeats. Sugar-cane, one of the most important crops in most parts of India, is not cultivated in Banda. Perhaps the soil is not suitable for it, but more probably the objection to its cultivation is the deficiency of water, or the number of white ants. As far as I know, rice is not cultivated at all. I never saw a single field of it in Banda.

The uplands in the southern part of Banda are very different from the plains in the north of it. The sandstone plateaux are almost entirely covered with magnificent forests; but here and there there are clearances in the forest where *Paspalum scrobiculatum*, *Panicum miliaceum*, and *Lathyrus sativus* are cultivated. If the seeds of the last-mentioned plant are much eaten for any length of time, paralysis is apt to occur. This observation has been made both in Greece and in India. In India I have myself seen hundreds of cases. One strange circumstance connected with this disease, which has never been explained, is that males undoubtedly suffer more than females. Judging from my own experience, I should say that the male paralytics were, to the females, about five to one. The cultivated ground in the uplands is, however, of small extent compared with the forest and moorland. The forests are composed of tall, noble trees, especially the *Nauclea*, a sacred tree in Hindi mythology, the *Pentaptera*, the *Allangium*, the *Schrebera*, and the ebony tree. Then there is the *Bassia* tree, from the flowers of which an intoxicating drink is made, very nasty to the taste, but very cheap and very intoxi-

cating. A man in my time could easily get drunk on a pennyworth. Perhaps the price is higher now, when the British Government has put a duty on intoxicating drinks. Another tree is the *Buchanania*, the flesh of whose fruit is delightful, and the kernel of whose stone is as good as pistachios. The native name of this fruit is "chirongee," and this is about the most common name of a girl in the Banda county, it being presumed that she is as nice and sweet as the fruit of the *Buchanania*. The forest stretches for miles north, south, east, and west, and one can ride the whole day under dense shade, only every now and then coming to a deep ravine formed by a water-course. Each water-course has a waterfall somewhere, for the water has to get down from the uplands to the alluvial plain. Originally these waterfalls must have been at the very edge of the upland, where it joined the plain; but centuries of erosion have now carried them far back into the very heart of the forest. The waterfalls are, on an average, about 300 feet high, and the deep sunless ravine below the fall is luxuriant with ferns and mosses and fungi. Of the many falls I have seen, the two most beautiful were those of Keuti and Galrampore. Here and there, in the forest itself, there is an open space green with grass, or blue with *Evolvulus alsinoides*, a plant allied to *convolvulus*; or one may come on a little lake or tank covered with *Nelumbium speciosum* (the lotus),—the flower emblematic of India, peculiar to it, and one of the most beautiful of its many flowers. Herodotus mentions it as growing in the Nile, but it certainly does not grow there now, and it is not found among the flowers preserved in the tombs of the early Egyptian kings. Most of these flowers have been identified, and there is plenty of *Nymphæa cærulea* and *N. lotus*, but no *Nelumbium* has ever been found. It is almost certain, therefore, that the later Egyptian kings had it brought from India, and that it was cultivated there, when it was seen in the Nile by Herodotus. It must have died out when the Egyptian monarchy fell. That Herodotus saw it, there is no doubt. No other plant answers his description—"a lily like a rose, growing in the water, the fruit like a wasp's nest, and containing edible seeds the size of olive stones." Even in India it is not a very common plant. It is not found in Western India, owing to the frosts in winter. It

does not thrive in any place where the winter temperature falls below 32°. Two other trees may be mentioned—*Butea frondosa*, which in April is leafless, but covered with scarlet blossoms; and the *Albizzia speciosa*, with fragrant white flowers. Altogether, Southern Banda is a botanical paradise, but there are botanical evils even there. The worst one is a grass, *Heteropogon contortus*, with a long, twisted, barbed awn, which it sends through the trousers of the passer-by into his legs. Then there are the carpels of *Sterculia urens* and *Mucuna pruriens*, covered with stinging hairs, which cause the most intolerable itching. But as these last grow on trees at some height from the ground, they are only troublesome to inquisitive botanists or to the lower animals—they do not annoy the ordinary European traveller. The grass, however, torments all three—botanists, tourists, and beasts.

With regard to animals in the Banda district, we may commence with *bimana*. As the people are vegetarians, they are, compared with Europeans, a weak, short-lived race—the latter even more decidedly than the former. That the shortness of life does not depend mainly on the heat of the climate is shown by contrasting the Indians with the Chinese, who are physically the strongest and longest-lived race in the world. But then they eat not only beef, mutton, and pork, but also dogs, rats, and lizards. With much practical wisdom, they never touch fresh milk, butter, nor cheese, though a preparation of milk and sugar, curdled with vinegar, is greatly appreciated by them.¹ In India itself, the Mohammedans, who occasionally eat animal food, are certainly longer lived than the purely vegetarian Hindoos. That they are stronger as young men, I am not prepared to assert or deny positively; but they are certainly longer lived. It is strange that the modern Hindoos should be such strict vegetarians, for their ancestors, the old Aryans, when they first came from Afghanistan into India, were beef-eaters. The total change of diet is strange, but the same change occurred in ancient Greece, though not to quite the same extent. The Homeric Greeks were beef-eaters; the Greeks of Pericles' time, fish and vegetable eaters, rarely touching butcher-meat.

With regard to the lower animals, the tiger is rare in

¹ See Miss Gordon Cumming's 'Wanderings in China,' p. 155.

Banda, having of late years retired to the denser forests farther south ; but leopards, hyenas, and wolves are very common, and very destructive. Wild pigs are also exceedingly common. Of the deer tribe, the two most common species are the Indian antelope and the gazelle ; but spotted deer and the magnificent elk of Southern India are occasionally met with. Then the nilghau, a splendid animal, half deer and half cow, is common. The male is of a beautiful blue colour, and is called the blue bull by Europeans. Of the quadrumana, only two species are met with in Banda—the blackfaced, black-handed, Entellus monkey, with a very long tail ; and the Rhesus monkey, with cheek-pouches, red callosities, and a moderately long tail. The number of individuals, however, more than makes up for the small number of species. Many thousands are met with in Banda. The sacred town of Kirwee, and the sacred groves of Chitterkot, in the Banda county, are monkey paradises. Thousands of worshippers come from all parts of India to feed the sacred monkeys of Chitterkot. The Hindoos of the Vaishnav sect have a legend, that when their supreme deity, Rama, was incarnate on earth, he was banished from his native city, Ajudya, by his father and his step-mother. He retired with his wife to the Chitterkot woods, and there his wife was stolen from him by the demon-king of Ceylon. The god had no human armies to help him, but the monkeys of Chitterkot at once offered their services, and at the head of a monkey army the god marched to Ceylon, conquered the island, killed the demon-king, and recovered his wife. Ever since then Chitterkot has been one of the holiest places in India in the eyes of all Hindoos of the Vaishnav sect, and no more pious deed can be done than feeding the descendants of the monkey army which fought under the orders of the god Rama.

With regard to other mammals, hares, porcupines, ichneumons, rats, and mice are all very common. To describe the birds would take hours. There are no pheasants, but the trees swarm with peacocks, and thousands of cranes, of three species (the European, the Demoiselle, and the Sarus), plunder the fields, assisted in winter by many species of geese, which go in summer to breed in the Thibet lakes. The species of ducks seen in the Banda lakes are also

innumerable. They, too, go to breed in summer in Thibet. Then in every pool there are storks, herons, and egrets, the characteristic birds of India. It is hardly possible to walk a mile in Banda, and indeed in any part of India, without seeing vultures feeding on carrion, especially dead cows, eagles on the outlook for hares or lizards or mice, and black-eyed falcons or yellow-eyed hawks on the outlook for small birds. I do not know if it is the case in Britain, but in India the dark-eyed falcons generally decapitate their prey, while the light-eyed hawks strangle it—in both cases, of course, catching it first with their feet. Of all the raptorial birds, the one I noticed oftenest in Banda was the harrier (*Circus Swainsonii*), with the solitary exception of the kite (*Milvus govinda*), which, however, is hardly a true bird of prey. It is named in India the scavenger kite, as it has taken to frequenting towns and living on refuse and offal. It is assisted in this useful employment by the scavenger vulture (*Neophron perenopterus*). The latter, also, is one of the commonest birds in India. After these, I think the most common raptorial bird is the white-eyed buzzard (*Poliornis Teesa*). The song-birds of Banda are not equal to those of the Himalayas, or those found south of the Nerbudda. The best singing-birds I heard in Banda were the *Leucocerca albofrontata*, a flycatcher, which whistles very distinctly a descending diatonic scale, but only six notes, not seven; and three warblers, the *Copsychus saularis*, the *Thamnobia cambaiensis*, and the *Carpotacus erythrinus*—which last says very distinctly, “Nubbi ji bhejo,” meaning in Hindostanee, “Send the holy prophet.” Larks are also very common, especially the *Alauda gulgula*, which has a note exactly like our British lark. Other larks found are the *Mirafra cantillans*, very common in Banda; and the *Galerida cristata*, a crested lark which is a splendid mimic, but its own natural note is not nearly so fine as that of the common lark. In the early May mornings I sometimes heard a beautiful note, which I believed to be the breeding note of the king-crow (*Dicrurus macrocercus*), which, as its ordinary note, repeats every now and then, all day and often all night, a somewhat monotonous “thakur ji,” meaning “Respected sir.” This bird, though only twelve inches long, is exceedingly combative, and often attacks crows

eighteen or twenty inches long, or kites twenty-five inches long. It is a shrike, and feeds chiefly on grasshoppers and crickets.

Banda is inferior to the Himalayas and the south of India in its number of pretty common birds, just as it is in its number of sweet-singing birds. In Banda, the prettiest are the bee-eater (*Merops viridis*) and the roller (*Coracias indica*), a near ally of which has lately been shot in Mull, and a paper on it was read at the last meeting of the Physical Society. The bird shot in Mull, the *Coracias garrula*, is common in Western India. It is not found in Banda. The common Indian species, *Coracias indica*, is a sacred bird all over India, for the following reason: Once on a time the earth was covered all over with some poisonous fluid. The great god, Mahadao, assumed the form of a *Coracias indica*, which up to that time was a bird of ordinary plumage, and drank up all the poison. The only inconvenience that resulted was that the bird became of a blue colour, which colour it still retains. One of the most meritorious actions a Hindoo can do is to buy one of these birds from a bird-catcher, and let it loose in honour of the god Mahadao. Birds for this purpose are generally for sale in most large towns. It is very lucky to see this bird when you are out walking, unless it crosses your path.

With regard to reptiles, snakes are exceedingly common—more so than in any part of India I have ever visited. I have myself killed in Banda many cobras, one carpet viper, and one keeled viper, the last allied to the British adder. Lizards and frogs are exceedingly common. With regard to insects, mosquitoes and flies are abundant at all times; and every year or two a flight of locusts comes from Rajpootana, and lays waste all the fields where they happen to alight. Silkworms are found in the southern uplands. The true silkworm, which feeds on mulberries, is not met with, but there are four other species of silk-making caterpillars: (1) the Atlas moth caterpillar; (2) the Ailanthus-feeding caterpillar; (3) the Castor-oil tree caterpillar; (4) the Terminalia tree caterpillar. This last yields the tussar silk, which is much imported into Britain. It is stronger than true silk, but it does not dye well. Of myriapods, the centipede, and

of arachnides, the scorpion, are both common. Their stings are exceedingly painful, but never, I think, fatal to a healthy adult.

I shall end with the story of a centipede. One evening, when I was sitting at dinner in Banda at the regimental mess, a centipede made its appearance on the table. In spite of my warning, the doctor of the regiment, a young and healthy man, seized hold of it by the middle of its body. It managed to screw itself round, and drove its many legs into his hand. Of these many legs, the two front ones contain a virulent poison. My friend did not utter any sound, but it was a strange sight to see his face. In an instant all the colour had faded out of it, and it was as pale and ghastly as the face of a corpse. I crushed the centipede with the candle-snuffers, which lay convenient, and then scarified the sting wounds in my friend's hand, and applied ammonia and laudanum; but he never slept a wink that night, and was not himself for many days, if not weeks. So Banda contains worse things than even spear-grass.

II.—*A SPORTING TOUR IN NORWAY.*

BY MR TOM SPEEDY.

(*Read Dec. 26, 1888.*)

I SAILED from Leith for Norway, with a small and select company of naturalists, on the s.s. *Sverre Sigurdsson*, on the 24th of August last. After passing the Isle of May, we proceeded to steer our way into the North Sea, the dread of all seafaring men, and even of tourists during the summer months. After a voyage of over thirty hours, memorable for nothing but that horrible sensation of sea-sickness, which, for the time being, renders all earthly considerations—wife and children, and even life itself—to be of small account, we got into smooth water, and sailed up the *Hardanger Fjord*, an ever-varying panorama of mountain and lake scenery, till we dropped anchor

at Odde. As it was Sunday, I was interested in watching boats filled with men and women rowing to and from the church. The variegated attire of the girls, generally with blue or white skirts and bodices of bright red, had a pleasing and picturesque appearance. I observed that women were adepts at rowing as well as men. At Odde, the principal place of interest is the Folgefond glacier — an enormous expanse of snow, covering an area of forty miles by ten, and rising from 3000 to 5000 feet in height. The remarkable thing about this glacier is its growth. In 1870 it advanced 260 feet, and in 1871 it grew twelve feet in a week, forcing itself down the glen. On intimating our desire to visit this glacier, we were informed that the snow was of a blue colour. This interested me much, as in all my experience I had never seen blue snow. On approaching the ice mountain, however, I soon discovered the cause of this strange phenomenon. What is called eternal snow is simply ice, which, as is well known, is of a blue colour. With some difficulty I scrambled close to it, and with my knife cut out a piece, which I can testify to being hard ice. From the fact of its very frequently getting fresh coats, it has in the distance a white appearance, but on close inspection it, as already indicated, is like blue snow. This is explained by the severity of the intense frost, which transforms the snow into hard granite-like ice, as one coating continues to descend upon another for six months in uninterrupted succession. A river of considerable size rises no one knows where, but emerges from beneath the glacier, and rumbles down its rocky bed till it flows into Sandven lake.

Norway, as is well known, has long been regarded as the angler's paradise. Having had the precaution to take with me a fishing-rod, I was anxious to have a few hours' angling. As a beautiful river flows down the glen, through Lake Sandven, and empties itself into the fjord at Odde, a number of us started full of anticipation of filling our baskets. The result was that one trout, half a pound in weight, was the entire catch, the luck not being mine. No one who saw the clear limpid stream and the white chalky bottom, with a blazing sun overhead, would require an explanation for the utter lack of success. There was in this case a real valid excuse, only too potent to be questioned. Had our visit been

preceded by a day's rain, and the water somewhat swollen and coloured, we had evidence sufficient, from the large number of fish discernible, that the efforts of even the most inexperienced of our party would have been crowned with a well-filled basket. I was much struck with the absence of bird life. With the exception of birds of prey, ryper, wagtails, and a few other species, birds are by no means numerous. The first named are in great abundance, hoodie-crows and magpies sitting on the tops of the houses apparently quite tame. It is therefore not to be wondered at that the smaller birds are scarce, as, notwithstanding the Norwegians putting artificial nests in the trees, and doing everything they can to foster and encourage them to breed, they do not seem to understand that the eggs and young are destroyed through the predatory instincts of the birds of prey referred to. Ryper, a species of grouse, are found in all parts of the country, and contribute largely to the food of the people. I learned that red grouse had on more than one occasion been introduced from this country, but in consequence of the severity of the winters they very soon disappear. It must not be supposed that they succumb to the weather, as our grouse are the most hardy of the feathered tribe; but their dark plumage, during the protracted snowstorms peculiar to Norway, attracts the attention of every passing bird of prey. It is otherwise with the native ryper, as they, like the ptarmigan, change their plumage with the season, which vies with the snow in whiteness.

Weighing anchor again, we sailed up the fjord, calling at Eide. Four of us went on shore here, put up at the hotel for the night, and crossed the country for a distance of fifty miles, joining the steamer again at Gudvangen. The drive took us through some of the wildest and most picturesque scenery in Norway. Reaching Stalheim Hotel after dark, in a downpour of rain, we staid there for the night. As it had rained for twenty-four hours, we found, after breakfast the following morning, that the Nærødal river was rather high for fishing. Still, we resolved to try our luck. For myself, I had determined to have a cast for a salmon, and to test the defensive capabilities of a fish in the Norwegian waters with that of the silvery model salmon on the waters of the Tweed or Tay. Walking down the river a couple of miles ahead of my com-

panions, I commenced to fish, and tried for a time without the slightest shadow of success. Coming to a splendid pool close to the road, I cast in, and at once succeeded in hooking a fish of enormous size. I distinctly saw his tail, which was nine or ten inches across, indicating a thirty- or forty-pounder. Here was a predicament, as I had neither gaff nor assistance, and at a most difficult place to land a fish. Knowing, however, that my tackle was good, and having abundance of line upon my reel, I felt I was on equal terms with my adversary. With rod bent almost double, I hung on to him till my shoulders ached, and the perspiration flowed from every pore. Three-quarters of an hour passed without making any perceptible progress, when a *stolkjærre*, containing two of our fellow-passengers from the steamer, came forward. It turned out that all the passengers, as well as those from other two steamers, left the ships at Bergen, took the train to *Vossevangen*, and then drove to join the steamers at *Gudvangen* in carriages, *stolkjærres*, and vehicles of a nondescript character, some of them being of a crude and primitive description. As each party drove up, they were obliged to stop, the road not being wide enough at the place to admit of passing, till a train of fifty or sixty vehicles accumulated, those coming up in the rear thinking some accident had occurred. Very soon I was surrounded by an excited crowd, which, in spite of remonstrances, packed so closely around me that I scarcely could get elbow-room. Among the passengers were tourists from England, Scotland, Ireland, and France, with their Norwegian drivers, and very soon well-meant but stupid suggestions were shouted in different languages from dozens of different throats, till the "hue-and-cry" would have rivalled the builders of Babel. By this time another half-hour had passed, and the fish for some time having coursed up and down the pool, went into deep water and "sulked." For about ten minutes I pulled at him as hard as I could without breaking my tackle, changing my hands alternately in order to give them a rest, but could not induce him to move. I eventually asked one of the onlookers to throw in a stone a little below the fish, and in response fifty stones were thrown below, above, and all around him, fortunately without breaking the line. This, however, had the desired effect, as off he

darted across the river, but gave unmistakable signs of going down the rapid to the pool below. This was a serious business, as a number of high alder bushes overhung the bank, and the great depth of water rendered wading impossible. Holding the rod as high as I could in the air, I tried to carry the line over the tops of the trees, but, alas! it caught on the first one. Calling out for some one to try and break the branch, a Norwegian sprang up, knife in hand, and cut the top, allowing the line to pass over. Following his example, numbers of willing hands seized the remaining eight or ten trees, breaking and bending them so as to afford facilities for getting the line safely over. With a sigh of relief I again got into open ground, and speedily wound up the line, the fish being so accommodating as to come within a few feet of the bank. My companions, who had been fishing higher up the river, had arrived by this time, and one of them, gaff in hand, waited for the fish to show himself. The excitement among the onlookers was intense, as they peered down into the depths, vainly endeavouring to get a view of the fish. I was by no means sanguine of success, as, though an hour and three-quarters had elapsed since the fish was hooked, I felt I had no more control over him than I had at the beginning. I also viewed with apprehension the rapid at the bottom of the pool, and the tall trees that overhung the bank, their branches spreading far into the water, rendering pursuit impossible should he go downwards. After taking a few short runs, he got into the middle of the current, and I feared my apprehensions were to be realised. Slowly but surely he went downwards, allowing himself, however, to be pulled towards the side into the deep water. We were now close upon the trees, and I felt the testing moment had arrived. On he went below the branches, the music of the reel indicating that the end could not be far off. Standing with one leg on the bank and the other on a stone, up to the knee in water, I glanced hurriedly at the reel, and saw that the climax had come. For a moment I felt like a culprit at the bar on sentence being about to be pronounced, when the reel stopped, the rod was pulled straight down-stream towards the fish, and with a "twang" the gut gave way, and the captive had escaped. When the top of the rod sprang straight, and struck up

among the branches, I experienced that bitter moment of inexpressible disappointment which none but the genuine disciple of Izaak Walton can understand. Turning round, I glanced at the blank look on the faces of the tourists, some of whom gave vent to their disappointment by indulging in language more expressive than parliamentary. Getting into their respective vehicles, the crowd speedily dispersed; and as the river was rapidly rising, putting an end to any further chance of success, I also wended my way to join the steamer.

Sailing through the narrow Sognefjord, with high, precipitous, rocky mountains on each side, I was much interested with the wild grandeur of the scenery. Waterfalls poured over the sides of precipices thousands of feet in height, which, augmented by the recent rains, were truly magnificent. High up on the almost perpendicular sides of the mountains, which appeared from the stream to be totally inaccessible, small hamlets were discernible, where I was informed the hardy inhabitants live the entire year. I was also informed that children born and brought up in these dangerous places have, when they first run about, to be tethered like goats to a stake, lest they should fall over into the fjord below. Cannons were here fired from the steamer, in order to let the passengers hear the reports, which reverberate from one mountain-side to the other for a very considerable time. Having gone below to change my boots, I hurried up in my slippers, and ran along the deck to see the fun. It had been raining, which made the boards very slippery, so my feet went from me, and I fell with great violence on my right shoulder. I was lifted, taken below, and stripped, my shoulder being much swollen, and so painful that I could not move my arm. The captain very kindly stopped the steamer at a village, and sent ashore for a doctor. He stated there were no bones broken, but that I had received a severe contusion and rupture of the muscle-fibre, and to use a gun or fishing-rod for three weeks or a month was simply out of the question. Imagine my feelings! Here was I in the land of wild beasts, with a gun, rifle, and no end of cartridges; and what I anticipated would be an interesting chapter in my life's history was now converted into pain, annoyance, and disappointment.

My shoulder was so painful that we thought it prudent to go ashore at Molde, in order to have it properly attended to at the hospital. The two doctors there only corroborated the opinion of the first, that it would be several weeks before I would be able to shoot or fish. During our sojourn at Molde, news came in to the village that sixteen sheep had been killed, and a bear with two cubs had been seen a few miles distant. A party went off in pursuit, and it was with feelings of the deepest regret I was unable to accompany them. Bruin, however, was too wide-awake, and had evidently left the district.

Molde is a beautiful place, its environs being among the most picturesque in Norway. What interested me most at this place was the leper hospital, which stood in close proximity to the one I attended. This most terrible of all diseases was at one time very common in our own country. Thanks, however, to medical science and sanitary laws, this dreadful malady has been almost eradicated in Britain; and even in Norway it is disappearing, there not being half the number of cases that there were thirty years ago. Through the courtesy of the doctor, I was permitted to see through the leper hospital, and a more repulsive or distressing spectacle I never witnessed. I was informed that when persons are first seized the pain is acute, but after the disease is fully developed the patient suffers very little, and could have his leg or arm taken off almost without feeling it. Leprosy is quite incurable, but in no way contagious if proper precautions are taken. Some persons assert it is only prevalent on the west coast of Norway, in consequence of the peasants living almost exclusively on fish. Be that as it may, it is at Bergen, Thronhjelm, and Molde, on the west coast, that the leper hospitals are.

As I was quite able to walk about with my arm in a sling, we set sail for the island of Hitteren. Reaching Havn, we staid over night, and the following day drove across the island. It took us seven hours to drive twenty-one miles, the road reminding me of a switchback railway. Arriving at our destination, where we were kindly and hospitably entertained, we spent the night there, a messenger having been despatched some miles for a hunter to pioneer us over the mountains, my

special mission being to explore the suitability of the island as sporting-ground. Being from home, the guide did not turn up till the following afternoon, when we at once started for the hills. Though shooting was out of the question, I asked our courier to carry my rifle, as I thought it possible with a lean to try a shot off my left shoulder. After walking about an hour and a half, the hunter—"Donald" I called him—informed the courier that he saw a deer. Getting my telescope drawn out for me, I leant it over a rock, and saw a splendid stag lying about 400 yards off, the cups on the tops of his antlers indicating a "royal." I at once forgot all about my shoulder, and became "eager for the fray." I never saw any one in such a state of excitement as the courier; so ordering him to sit down and not to move till he heard the shot, I started with "Donald" for the scene of action, and had no difficulty in getting behind a small rock within 130 yards of his majesty. "Donald" loaded the rifle for me, and signalled me to shoot. I shook my head, and by signs indicated that I would wait till the stag rose and began to feed. He took in the situation, whispering "Ja, ja," and nodding assent. We sat down with our backs against the rock, and "Donald," putting about a finger-length of tobacco into his mouth, began diligently to chew. Looking to where we had first spied the deer, what did I see but the black turban of the courier over the light-coloured rock, moving up and down, and finally bobbing out of sight! I sprang to my feet and looked for the stag, but he was gone. I, however, got sight of him a little farther off, taking what I thought a last look at the movements of the black cap on the rock. I threw up the rifle, hurriedly aimed as I best could, and fired, but without any apparent result other than making the stag scuttle off at a rapid pace. The courier came running forward in a state of great excitement, shouting in half English, half Norwegian, denouncing me for having "missed ze buck." It will scarcely be credited, but I kept my temper. I did not even indulge in the unparliamentary language that crowded to my lips. I merely suggested that, as the day was far spent, we had better go home. My reputation as a sportsman was on the wane, for had I not missed a stag within 150 yards, and lost a salmon under the gaze of a hundred eyes? Determined, however, to retrieve my

laurels, I started with "Donald" the following morning at peep of day. As I could not use the telescope with one arm, I left matters entirely in his hands; and as we were unable to converse, I walked behind in silence. In due course we sighted deer, and after a deal of manœuvring crawled to a moss-covered rock within a hundred yards of a stag, which was feeding on a patch of green. "Donald" laid the rifle on the rock, and I prepared to shoot. Keeping the points of the antlers in view, I looked through the sights of the rifle, but felt so awkward with the left hand that I resolved to try the right. I thereupon got "Donald" to remove the sling, but found I had to use the left hand to bring the right one to the trigger-guard. This accomplished, I raised myself a little higher, and saw the noble animal quietly feeding quite unconscious of our presence; so, drawing a bead upon his heart, I pressed the trigger. I was then called upon to pay the penalty of my indiscretion for disregarding medical instructions. The recoil of the .500 Express was too much for my injured shoulder, and I nearly fainted. Strange to say, the stag never moved off the spot, but I could hear the blood gurgling in his throat, and knew that the messenger of death had done its work. Motioning my companion to take the rifle and despatch him, he went up and terminated his sufferings. After performing the usual obsequies, we wended our way towards home, which we reached in time for breakfast, and for once in my life I felt that I had had enough of deer-stalking. Spending a couple more days on the island, I saw numbers of deer, but did not take the rifle.

Innumerable flocks of eider-ducks breed round this island, and in fact all round the north-west coast of Norway. Norwegian law very properly protects these birds, as from them the eider-down of commerce is obtained. The eider-duck plucks the down from her own breast to line her nest, and about a quarter of a pound of this valuable product is found at each nest. Strange to say, if the birds are shot and the down plucked off, it has not the same elasticity, and is consequently not so valuable, as when removed by the bird itself. To such an extent is eider-down used in Norway, that during my sojourn in that country I never once had a blanket to cover me, blankets being entirely superseded by eider-down quilts.

Leaving Hitteren, we took one of the coasting-steamers and sailed to Thronhjelm, which is so far north that it is on a line with the south coast of Iceland. After visiting the cathedral, erected in the 12th century, and other places of interest, we took the train *en route* for Sweden. On this line we stopped at a station with a name familiar to us all. As we proceeded I was engaged perusing the pages of a "Baedeker," and at p. 220, where the route is described, I read, "The train now passes through a short tunnel, and reaches Hell." I must confess I thought it strange to see HELL printed in large letters on the station-house, and to hear the porter in a distinct voice calling out the name as he passed the cars. Having some time to wait at this station—as was the rule, indeed, at many stations—I despatched a post-card to a friend at home, beginning thus: "My dear friend, you will see from the post-mark where I have got to at last!"

Reaching Storlien, where we staid for some days, a party of us arranged to cross the mountains, a journey of five hours, in order to visit a Lapp village. Obtaining a guide, and starting at daybreak, we ascended the hill, wading through bog and morass till we reached the fjeld above. We then pursued our course in a northerly direction, through barren wastes, for a couple of hours, till we came to a small lake from which a flock of wild geese took their departure when we appeared in sight. On some soft mud by the side of the lake we saw what we thought was the track of a large dog, but on getting his eyes on it our guide ejaculated "stor wolf," meaning large wolf. It appears that wherever there is a Lapp village, with their large herds grazing on the surrounding fjelds, a pack of wolves frequent the district, the gravid reindeer and the feeble calf falling victims to their rapacity. In these circumstances the Lapps, wrapped in skins and accompanied by their dogs, are obliged to stay out at nights in all weathers for the protection of the herd. When the wolves make an attack, the Lapps on watch are apprised by the violent ringing of bells, a number of the deer having them secured round their necks. Guided by the sound, the Lapps hurry with their dogs to the rescue, and in this manner protect in a great measure their deer from the depredation of wolves. Pushing on, we ascended another hill, and crossed some large patches of eternal snow. By this time

I could tell by my nasal organ that we were now getting near the village. It was situated on an elevated position in a birch wood, and, with the exception of seeing smoke issuing from among the trees, there were no indications of people in the district. The objects in having their camp on a knoll are, in order that they may have a view of their deer, and to avoid being drifted up with snow. As we approached we heard a peculiar snorting, like the grunting of pigs, and soon discovered this was caused by about a thousand deer being milked in a kraal. The kraal, which was fenced with birch trees about six feet high, covered an area nearly the size of Royal Circus Gardens, in Edinburgh. When the wood had been cleared off it, stumps were left three and four feet high, to which the deer are tethered while being milked. It is a popular notion that the deer are tame, and that they are milked like cows in this country. This is not so. The men throw a lasso over their antlers, and drag them to one of the stumps referred to. They then put a twitch on their nose, which in many cases cuts into the flesh, causing the blood to trickle down. Were such cruelty practised in this country, the perpetrators would very soon have a visit from the officers of the Society for the Prevention of Cruelty to Animals. The women then milk the deer with one hand, while with the other they hold the most primitive wooden bowl, in which they catch the milk. Each deer, I observed, gives only a small quantity. They strain the milk through a sieve made of rushes or dried grass. They make cheese of the milk, but not butter—for the reason, I presume, that they have no bread to put it on! Their staple food is all got from the deer—flesh, blood, milk, and cheese. Most of the other necessaries of life—and even death—are derived from the same source. Their clothes, their beds, their blankets, their cradles, and their coffins are all made of deer-skins. One of our party, who had visited the encampment a few days previous, informed me that a sick child was lying in a small deer's skin, suspended by the four corners from the rafters of the wigwam. On my visit I found that the child was dead, wrapped in a skin, and stuck up in a tree. This, of course, was only a temporary arrangement till the body was buried.

When the grass and reindeer-moss become scarce in a

district, the Lapps change their quarters to fresh ground. This, I was informed, they do thrice a-year, their grazing extending to a radius of eighty or ninety miles. As the ground is of so sterile and barren a character, it necessarily requires a large area to feed the deer, the herd in question numbering between 3000 and 4000. Lapps never change their quarters in summer, in consequence of their being unable to travel on the soft and uneven ground. In winter it is otherwise, as they drive their sledges on the snow; and as the lakes are all frozen, they travel as much as possible on ice. The Lapps are a diminutive race, none of them being much over five feet in height. As already observed, their clothes are made of deer-skin, the hair being worn inside. Men and women both use trousers, wearing them tight like leather leggings. They are the dirtiest creatures I ever beheld—so much so, that I was of opinion they never wash themselves at all! Both men and women are inveterate smokers, and my companions supplied them copiously with tobacco to fill their pipes. As I do not indulge in the “weed” myself, I could not offer them tobacco; but I was of opinion that a present of a liberal supply of soap would be much more suitable. Should I ever revisit them, I shall keep this in mind!

Returning to Thronhjelm, we travelled by rail to Koppang, and visited Messelt, in the centre of Norway, where we were the guests of a large proprietor, who kindly offered us reindeer and elk shooting. We rode ponies many miles up into the mountains, and spent a few days in a sæter, in the hope of getting a shot at reindeer. In consequence, however, of the mildness of the weather, and the migratory habits of the deer referred to, we failed in getting a shot, and left the sæter, turning our attention to elk shooting.

To the lover of the canine race, nothing can be more interesting than following a well-trained elk-hound and watching the skill and sagacity displayed, as it sometimes for many hours dogs the tracks of the object of its pursuit. Accompanied by an excellent Norwegian sportsman, with his two dogs, “Nor” and “Bjune,” we started at five o’clock in the morning, and shortly thereafter were, as I supposed, lost in the labyrinths of a large pine-wood. Carrying a pocket-compass, I took bearings before starting; but this, I was informed,

was unnecessary, as Helge, the keeper, who had spent his life in the district, was thoroughly conversant with the geography of the wood. For several hours we proceeded, the walking being most difficult, in consequence of the uneven character of the ground, and large trees with upturned roots frequently obstructing our passage. But for coming across tracks of elk, our walk was becoming tiresome and monotonous, though none of these were fresh enough for the dogs to take up the scent. At last Nor put down his nose, pulled in his harness, and, whining in an excited manner, gave unmistakable signs that he had discovered a fresh spoor. The character of the ground at the place, which was rock and dry moss, prevented our seeing the footprints—the only means by which we could form an idea of the size of the animal. I had already indicated that I would not shoot a cow or a small bull, but only a large-sized one, and consequently it was most desirable that we should see the track as soon as possible. We were at a considerable altitude, and the ground unfavourable for seeing footprints, so that we had no alternative but to follow the dog, which was pulling in his harness like a steam-engine. Bjune was kept “to heel” till we determined that the tracks were those of a bull. Coming to a bit of marshy ground, we were chagrined to discover that the spoor was that of a cow, the round shape with the hoofs close together differing from those of a bull by the hoofs usually being a little separate. This was disappointing; but we were fortunate soon after in finding the tracks of a bull, the dimensions of the hoof-prints indicating an exceptionally large animal. Now we were all excitement, as Nor took up the scent, and pulled the keeper onward at a rapid pace. Before finding the track, I was beginning to feel tired, but this feeling was soon forgot in my eagerness to press onward. Sometimes the spoor was uphill, downhill, across rocky boulders, or over fallen trees, all of which rendered walking most difficult. It would be impossible to determine the pace at which we proceeded, but of one thing I have no doubt, that it was as fast as we were able. Though the thick wood protected us from the blazing sun overhead, there was not a breath of air; so, panting with fatigue and wet with perspiration, we struggled onwards. We were now going downhill, and the roar of a foss indicated that we were

near a river. Here the Elden is of considerable size, and as the tracks led forward to it, there was nothing for us but to plunge in. Helge crossed first with Nor, I following; and though the water was about three feet deep and very rapid, we got safely across. The dog at once took up the tracks again, and we pushed on as before. Bjune was let loose and sent on, but returned in about ten minutes, indicating that the elk was far ahead. After crossing the river the spoor led us uphill, which took the breath out of us; and as we had breakfasted at 4.30, I felt very hungry and much fatigued. Coming to a streamlet, we halted, secured Nor to a tree, and the keeper in a few minutes kindled a fire. Unpacking his knapsack, I was surprised to see him turn out a small brass tea-kettle, which, after emptying of its varied contents, he filled with water and put on the fire to boil. In a Norwegian forest there is always an abundance of decayed wood admirably adapted for fuel, and in a short time tea was made, which we enjoyed to the full. After a refreshing lunch, not forgetting the dogs, we started with renewed vigour, and followed on the trail. How long, I wondered, was it going to last? Surely even an elk must get tired, and halt to rest, so that we might be able to get near him. Still there were no indications of his having eaten anything or lain down, and for several more hours we followed on, Nor sticking to the trail with amazing accuracy. As the sun had disappeared, and the shadows of the mountains were creeping over the landscape, we abandoned the chase, and wended our way homeward, which we reached at eight o'clock, after fifteen hours as hard walking as I ever indulged in. Daylight was breaking the next morning when a knock at my bedroom door announced that it was time to get up; and, stiff and wearied as I was, it required a considerable amount of self-denial on my part to respond to the call. After a hurried breakfast, we crossed the Glommen—the largest river in Norway—and at once got into a wood which, I was informed, was the habitat of elk. For an hour we ascended the mountain, frequently seeing old tracks; and so wearied was I with the toils of the previous day, that I felt walking uphill most difficult. Very soon, however, I forgot all about being tired, as Nor suddenly wheeled at right angles, put down his nose, and pulled in his harness, the

result of crossing a fresh spoor. I need not again describe the hunt, further than to say that we observed the elk had been feeding from side to side, tearing off the leaves of birch and mountain-ash as he had passed, and that in a short time we came to the bed where he had lain down for the day, and where no doubt we had aroused him in his slumbers. The spoor indicated a large bull, and as he had crossed some wet ground, we saw that the water was still muddy in his tracks. Knowing, therefore, he could not be many minutes in advance, we slipped Bjune, who went off in pursuit at a rapid pace. As we were going upwind, Nor, now with his head in the air, pulled the keeper on, as if impelled by some irresistible instinct. Following on for half an hour, we heard in the distance the pleasing music of Bjune, and knew that at last the elk was at bay. Loading my rifle, and guided by the sound, we ran on as fast as we were able, leaving Helge to follow the trail with Nor. Fortunately it was downhill, and the ground not being very rough, we were able to proceed at a rapid pace. When within a few hundred yards the elk broke bay and made off, though, judging by the barking of the dog, only at a walk. By this time we were going up an incline, and, panting with fatigue, we hurried on as hard as our limbs and lungs would allow. Fortunately the chase continued little over a mile, when we knew by the altered bark of the dog that he again had the elk at bay. Getting near, great caution was necessary, as if the elk got sight of us, or heard the snap of a stick beneath our feet, he would again break, and possibly add miles to the chase. Observing that Bjune barked for about twenty seconds, then stopped to take a breath and began again, we took advantage of his noise, and stealthily approached. Anticipating his becoming quiet, we stood motionless till the noise again began, and in this manner got within about a hundred yards of the object of our pursuit. Peering through among the trees, for the first time in my life I got my eyes on a living elk in his native solitude. What a monster! He reminded me of Jumbo, and I could not but admire him. "Shoot, shoot!" whispered my companion, and I silently cocked the rifle. With heaving chest, occasioned by the long run, I put the rifle to my shoulder and tried to take an aim. The dog was right between the elk and me, and

I could not get a shot except at his head, which I specially wished to avoid striking, as already I anticipated with pride showing it to my friends as an ornament in my lobby! I could not help observing how difficult he was to see, so closely has Nature assimilated the colour of his skin to his natural surroundings, the trunks of the trees. Turning his head to the side to keep off the dog, which was barking round in front of him, he exposed his neck and shoulder, and I took aim. To hold steady after such a run was impossible, but I brought the rifle slowly up, and when passing the broadest part of his neck, pressed the trigger. I could not tell the result, and ran to the spot as fast as I was able, but no elk was to be seen. Surely I could not have missed such a mark. Impossible! Still, a fear crept over me that, after such a terrible run, and perhaps a slight attack of elk fever, it *was* possible. I hardly knew what to think, when the barking of Bjune a few hundred yards off made it clear that the elk was again at bay. "He is all right," shouted my companion behind me, and again I hastened to the scene of action. Having reloaded the empty barrel, I ran on with the rifle at full cock, but did not get sight of the elk till within forty yards of him, when I observed he was on his knees. Directly he saw me, he got on his feet, and was making off; but as he was broadside on, I sent a bullet through his heart, and he dropped dead. Running forward utterly exhausted, I threw myself on the body of my victim till I regained my breath. Helge soon came up with Nor, and we lost no time in returning home, in order that men, ponies, and a sleigh might be sent to bring back the trophy. It was dusk before the men arrived with the elk, when it was found that it weighed 960 lb. Getting the head and skin, I started the following morning for Christiania, when I sent them to a stuffer to be preserved.

After viewing the principal sights of the Norwegian capital, I set sail for Bergen, which I reached in three days; my companions leaving me at Christiansand, *en route* for England. Reaching Bergen in a downpour of rain, I travelled by rail to Vossevangen. Though only a distance of sixty-five English miles, the train passed through fifty-five tunnels between these places, many parts of the line being cut out of the solid rock. Staying all night at the Vossevangen Hotel, I started the

following morning with two hunters for a mountain sæter some ten or twelve miles distant—the surrounding mountains being the well-known haunts of reindeer. After leaving the road, we clambered up a mountain-steep in order to reach the sæter on the fjeld above. No time was lost in getting unpacked, and with my rifle and telescope I took a walk in the hope of being able to see some deer. In this I was disappointed, but saw numerous fresh tracks, and anticipated good sport the following day. Returning to the sæter, my companions, Ole and Sjur, had supper ready, of which we partook, and prepared to go to bed. Small preparations, however, were necessary, as after divesting myself of my boots only, I turned in. There were no down quilts here, my only covering being my waterproof and rug, and my bed some dried grass and birch leaves. I could have put up with that, but my bed, which was a wooden one, was only five feet long, and as I stand six feet in my stockings, I was by no means comfortable. To make matters worse, I had not been long in bed when I made the discovery that I had companions; and I strongly recommend any who purpose visiting Norway, and have any chance of sleeping in a mountain sæter, to take with them a packet of Keating's insect-destroying powder. As a naturalist, interested in the study of insect life, I may say that I have no animosity or unkindly feeling towards these creatures; but on that occasion, at least, I did most solemnly protest against the means by which they obtained their supper. Starting as soon as we could see, in the hope of discovering deer, we wandered over rocky mountains and patches of eternal snow, but returned to the sæter at dusk without ever having spied one. The second and third day passed with similar results, and our provisions ran done. Having seen large numbers of fresh tracks, I was very unwilling to leave without getting a shot, and we arranged to take a last look the following morning before returning to the village. A pound-tin of salt beef and some tea was all we had for supper, after travelling a long day on the mountains; so I opened the tin, and divided it equally into three, and for hungry men it was a scanty enough repast. It must not be supposed that we had bread along with it, as we had none—not even milk or sugar in the tea. Starting breakfastless the

following morning, we again saw numerous fresh tracks; and, full of anticipation, we pushed forward. For long weary hours we travelled over rock, snow, and barren wastes, till that terrible hunger-craving warned me in unmistakable language to retrace my steps towards the sæter, and thence back to the village. Still we persevered till after mid-day, and were circling round the summit of a rocky mountain to make straight for the sæter, when, far down below us, I got my eyes on some moving objects, which, on applying the telescope, I discovered to be deer. Fried liver and venison steak were uppermost in my mind, and no time was lost in stalking them. The wind was by no means steady; but we managed to get within two hundred yards, when I perceived that they became uneasy, some of them getting up and looking suspiciously around. The remainder were quickly on their feet, sniffing in all directions, evidently suspicious of the presence of enemies. They seemed unable to discover in what direction the danger lay, but they made off, and I prepared to shoot. Picking out the largest I could see, I brought the rifle to my shoulder and quickly fired. Not having the proper use of my right arm, I unintentionally let both barrels off at once, but the stag kept on. The killing of a deer was, under the circumstances, a work of necessity, as I was now feeling weak with hunger; so, opening the breech of the rifle, I quickly reloaded, and on looking up saw two large stags, which, hitherto unperceived, had risen from behind a knoll, and were galloping past me broadside-on at a distance of eighty or ninety yards. Never in all my previous experience did I get such a chance, and I was fortunate in rolling them both over. With a grateful heart I ran up, admiring the dimensions of the antlered heads. My two companions also running forward, exclaimed, "Stor bocks!" or big bucks. In a trice one of them got out his knife, and thrust it into the chest of one of the stags; and the other, taking from his knapsack a metal cup, caught the blood as it gurgled out, and drank it off. Both of them drank several cupfuls; but I must confess that I felt a sort of sickening sensation, and, hungry as I was, could not brook the idea of tasting warm blood. Turning away, I got my eyes on the retreating herd of deer, now far up the mountain-side, and one a long way behind the

others, hardly able to crawl. Starting in pursuit, I was not long in getting sufficiently near, and despatched him with another shot. We soon skinned and cut them to pieces; and after tying bits of paper with string to the antlers, which flutter in the breeze and prevent birds and beasts of prey from approaching, we hurried to the sæter with a lump of venison. The stove was quickly lighted; the flesh, which was never allowed time to get cold, was put into the pot; and, long before it was even underdone, we had it out and commenced supper. We had no tablecloth, no knives and forks, no bread, potatoes, or salt. Carrying a bit on a pointed stick outside, in order that it might cool quickly, and seasoned by a splendid appetite, I made a hearty though somewhat unceremonious supper. Leaving my companions to bring home the deer, I walked back to the village in the morning, when I was glad to get a wash and change of linen. The hunters turned up in the evening in two stolkjærres, and after getting the heads and skins, I made them a present of the venison, of which they seemed immensely proud. Returning to Bergen, I learned that the summer boats had ceased running, and that I would be unable to return to England for a week. I therefore had an opportunity of seeing Bergen, the Natural History Museum interesting me very much. Rather than wait longer, however, I soon made arrangements with the captain of a cargo steamer, who was returning empty to Sunderland; and getting on board, I reached home in due course.

This paper might very properly be regarded as imperfect were I to fail in indicating, however briefly, some of the leading features in the character of the Norwegians. During my sojourn amongst them, I found them in many respects a most likeable people, resembling, in many of their features, the more remote of our own Celtic race. Large numbers of them are living in comparative seclusion, far away from the forces of civilisation. They exhibit human nature in its unsophisticated condition, and form a striking contrast to the poor and neglected in the "civilised" cities of our own country. They are just in all their transactions, kind and considerate in their relations to each other, and accommodating and courteous to strangers, there being an utter want of that suspicion

and distrust which unfortunately prevails so largely among our civilised communities. They are at the same time a religious people—religious not in a formalistic manner, but in the highest sense of the word. As an example of their strict honesty, I may relate an incident from my own experience. One day, while out angling, I left my book, with a large number of most expensive casts and flies, upon the bank of a river. It was only on stepping on board the steamer that I, for the first time, discovered my loss. Just as the anchor was about to be raised, a Norwegian peasant was discovered rowing in haste towards the steamer. It turned out that but two hours had elapsed since he had found my missing fly-book on the bank of the river, and knowing that it must belong to one of the anglers on board, he had crossed the country, a distance of six miles, to return the lost property. The honesty of this humble peasant is the more strikingly exemplified when we remember that, living as he did on the banks of the river in question, the temptation to retain the book, with its splendid stock of tackle, was very great. On consulting the captain, I rewarded him for his honesty, but he took the sum with reluctance, on the ground that it was “too much.” Now for the contrast. Some seven or eight years ago I had accepted an invitation from a gentleman for a day’s salmon-fishing on the Tweed, near Coldstream. On leaving for the station, I was, as I thought at the time, fortunate enough to catch the ’bus at the end of the road, just opposite my own house. I sprang up to the front, and had got comfortably seated, but had not proceeded many hundred yards until I discovered that my fly-book, with hooks and tackle worth several pounds, had dropped from my ulster pocket. I lost not a moment in hurrying back, but found that, notwithstanding the brief period that had elapsed, it had been picked up by some passer-by. I advertised in the local newspapers, offering a handsome reward; and although my name and address were also printed on the book in large letters, there was no response, and I have never seen it again. My only regret is that it was not picked up by some Norwegian tramp, instead of by one of the more intelligent of my own locality—I shall not venture to say, of my own parish!

Norway I found to have been at one time sadly cursed, in its more populous centres, by excessive drinking. By firm and beneficent legislation, the traffic in drink has been extensively prohibited, and the craving for liquor among the natives has now, to a large extent, become a thing of the past. Latterly, however, British and German traders have been working sad havoc among the Norwegians, more especially at their seaports, by the introduction of their own drinking habits. It would be well if those by whose praiseworthy efforts the Gospel has been so largely disseminated in Norway were to keep in view the fact that, by the discouragement of the traffic in drink, the local government has contributed immensely to the sobriety and elevation of their people, and they ought to do nothing which would tend to counteract the good that has thereby been accomplished. While the English-speaking race, especially, is able to confer great and inestimable blessings, by commerce and otherwise, upon the Norwegian people, I cannot conclude without saying that, for industry, honesty, and virtue, they may in return find much that is worthy of imitation among that hospitable and interesting people who constitute the Scandinavian race.

[In illustration of the above paper, a large number of lime-light views were exhibited on the screen by Mr Geo. A. Wilson.]

III.—*KINTAIL AND GLENELG, WITH NOTICES OF THE BROCHS.*

BY MR ARCH. CRAIG, JUN.

(Read Jan. 23, 1889.)

THE picturesque village of Dornie is our headquarters; and the purpose of the following remarks is—*firstly*, to glance briefly at the amenity of this most romantic part of Scotland; and, *secondly*, to devote the remaining and larger portion of the paper to a description of those curious and interesting stone

buildings known variously as Brochs, Duns, Burghs, and Pictish Towers.

Dornie is situated in the parish of Kintail, Ross-shire, and lies on a flat strip of ground, almost at the point where Loch Alsh loses its identity by merging into the wilder Loch Duich, which in turn throws off another offshoot in the shape of a sinuous arm of the sea, called Loch Long. Accurately speaking, the village is built on the eastern shore of the latter loch, and consists of a long row of substantial houses, some slated, others thatched, but displaying on close inspection a more or less decayed and battered look, that seems to betoken departed greatness. In a measure this is correct, as in the palmy days of the Loch Duich herring-fishing Dornie was a bustling, thriving little township; but since these erratic inhabitants of the deep have vanished Dornie's prosperity has gone likewise, and now both village and inhabitants show unmistakable signs of having run to seed. The main and in fact only street lies between the houses and the sea-shore, but bordering the latter are plots of garden-ground, protected from the rising tide by strong, roughly built stone walls; and immediately behind the dwellings little irregular patches of cultivated ground, alternately green or yellow according to the crop, and reminding one of a badly made chess-board where no two squares are the same size or shape, fill up the gap between the village and the base of steep mountains that rise to a considerable height, and gradually swell into immense masses that culminate in the giant peaks of Ben Attow, Scour Ouran, and the Five Sisters of Kintail. At the east end stands the handsome Roman Catholic convent, chapel, and priest's house, built by the Duchess of Leeds, principally from stone quarried in Wales—a circumstance that strikes one as savouring slightly of absurdity, considering the vast quantity of equally serviceable material that is to be had in the vicinity. At intervals along the shores of Loch Long, which is narrow and tortuous, are scattered little fishing and crofting townships, most of them, from their tumble-down, weather-beaten appearance, objects of interest to the artistic eye. Carelessly-kept scraps of vegetable gardens, with here and there a few flowers and trees scattered in desultory fashion; small fields of oats and potatoes, divided by broken-down, overgrown dykes; great rows of

lythe and other fish hung up to dry, and festooning the walls of the huts; tall, scraggy-looking frameworks of sticks, upon which the nets are stretched; outhouses formed of dry-stone walls, with an inverted boat for a roof,—these and many other signs are sufficient to indicate the various occupations of the inhabitants, who by turns are fishermen, crofters, or labourers, according to the season and the exigencies of existence. Several miles inland from the head of Loch Long, above Kilelan, are the famous Falls of Glomach, 370 feet high, the gorge into which the cataract descends being in many parts fully 500 feet of sheer precipice, and probably the wildest and most savage bit of scenery that Scotland can produce. To give anything like adequate delineation of this wonderful locality would, however, necessitate a paper solely devoted to the subject, so mere mention of the name must suffice.

Within a short distance of Dornie, on a little rocky islet, approachable at low tide from the eastern shore, stands the ancient castle of Eilan Donan, long a stronghold of the Mackenzies of Seaforth, and the arena of many stormy and oftentimes bloody deeds. This historical structure, which forms so striking an object in the landscape, is now in a sad state of dilapidation, and consists of long, gaunt, isolated pieces of masonry standing erect on the summit of the rock, which bear a resemblance to the decayed teeth of some old witch-like Highland beldame, whose curses and prognostications of evil were such a potent source of dread in days gone by. While clearing out a large well lately inside the building, the workmen discovered several memorials of the past in the shape of swords and two old cannons; and I myself saw in a cottage at Dornie a curiously shaped cutlass-looking implement that was evidently the remains of one of those quaint-fashioned short swords, such as seamen carried in the olden times. This relic was picked up on the shore of Loch Duich, and may not improbably have belonged to some member of the Spanish troop that figured in the skirmish of Glenshiel during the abortive rebellion of 1719. It is strange to think that Spaniards found their way into this outlandish district; but if we consult history we will find that many years prior to this episode the same race appeared on the *tapis* in even more out-of-the-world localities farther north, and under much more disastrous cir-

cumstances, when the ill-fated Armada was, providentially for Great Britain, broken in sunder by the stormy elements. Those interested in the Spanish nation may even yet have an opportunity of making the acquaintance of one individual of that sunny land, as the ghost of a victim still haunts the neighbourhood of Glenshiel, to the evident disquietude of the superstitious native. The mention of Glenshiel may bring to the recollection of some the amusing incident in the Tour of Dr Samuel Johnson and Boswell, 1773, when the former, jaded and tired out by the long day's ride from Glenmorrison to Glenelg, especially when having to cross the wonderful but hilly road of Mam Rattachan, allowed his temper to fairly master him, and in the most childish way quarrelled with his faithful companion, who at all times was willing to grovel in the very dust before the great man,—this outburst of spleen originating in the simple circumstance that poor Boswell desired to ride ahead in order to secure accommodation at the inn. The great Doctor showed up badly on this occasion; but he seems to have been ultimately consoled for all his fatigues and deprived of his bad humours by the present of a bottle of rum and some sugar, sent to him at the wretched hostelry by a Mr Murchison, factor for Macleod of Glenelg. If report speaks truth (but on this point I have no accurate information), this "good Samaritan" was an ancestor of Sir Roderick, the eminent geologist, who, as is well known, was connected with the district of Loch Alsh, close at hand.

From a scenic point of view, the most magnificent part of this truly impressive region is Loch Duich. Here the mountains are higher, the outlines bolder, the little clachans more picturesque, and altogether there is a charm about this inland sea that inclines one to assert that no prospect on the varied west coast of Scotland can vie with it, and this is saying a great deal, considering the marvellous scenery of which it can boast. What, perhaps, is the main feature of Loch Duich, is the stupendous appearance of the mountains that encircle the upper waters, and form a sort of cup-like hollow, known as the Fold of Kintail. The southern side is not so bold as the northern, the hills sloping upwards from the former, and being grass-covered and tamer altogether; but on the north rocky promontories jut out into the loch, and their ruggedness of

contour is continued to the summits of the ranges whose bases they form. Here and there along the coast are little townships scattered in promiscuous order, or rather want of order, as if they had been dropped at haphazard from the heavens, or kicked into position by a giant foot that might have adorned the person of Fingal or some other equally powerful member of his phantom fraternity; and intermingling with these are trees of varied kinds, clinging tenaciously to the clefts in the rocks wherever foothold is attainable.

In a mountainous region like this, the effects of light and shade, cloud and sunshine, rain and mist, constantly transform the picture, and therein lies its greatest attraction. At one moment you have a brilliant blink of sunshine that burnishes the surface of the water, and plainly reveals every gully and fissure, but at the same time dwarfs the height of the mountains: presently a cloud creeps slowly across the sky, darkening the landscape while increasing its solemnity,—the hills seem vaster, the valleys deeper and more awesome, and before the storm fairly bursts and obliterates every outline, the prevailing stillness is intensified, so that every sound forces itself on the ear with greater prominence. The rustling of the leaves on the trees, or the sighing of the brawling burns that run down the distant glens, unheeded before, suddenly claim our attention by contrast with the death-like silence that precedes the blast. When the squall swoops down in real earnest and churns the sea into foam, you can see the mist driving along the hill-face at a furious rate, obscuring the view entirely, until some cross-current of wind, tearing down a gorge, scatters it for the time being, and unmaskes the rocks that, blackened by the wet, look more gigantic and grim proportionately to the short time they are visible. In late autumn such atmospheric vagaries can be witnessed a dozen times a-day, but in many instances the brilliancy of the concluding sunset more than compensates for the disturbed state of the elements. To attempt a description of a gorgeous West Highland autumnal sunset, with its rapid change of colours and varied phases, is about as hopeless a task as converting a Jew, and I for one would not insult you by trying. My advice is to go and make acquaintance with one, and you will

be brought face to face with the finest thing in nature. From the top of a hill above Ardintoul, Loch Alsh, there is an almost uninterrupted view of the Skye coast from Raasay to the point of Sleat; and far beyond that the island of Eigg with its wonderful "Scur," and Rum with its peaked mountains, are plainly visible on a clear day. Right in front the dark mass of Ben-na-Caileach in Skye, dipping down towards Kyle Akin and its ancient Castle of Moil, rises from the shore of the narrow Kyle Rhea strait, and behind it again tower the majestic Coolins, with their long line of jagged summits, that look in the setting sun like a huge saw from which teeth had been broken by long use and decay. The subject of Highland scenery is capable of such extension that, once a commencement has been made, the difficulty of condensing one's remarks into anything like reasonable compass is probably as great a tax upon the writer as his lucubrations are upon the patience of the audience; so fearing lest that dictum may be applied to the present case, enough has probably been said to give you a rough idea of the country. Therefore, without further digression, permit me to call your attention to the Brochs.

Within an easy day's journey of Dornie there are four examples of brochs, three of them being in Glenbeg, a lovely little valley near Glenelg village, Inverness-shire; but before touching upon these, I should like to bring under your notice another, situated within half a mile of Totaig, just at the junction of Loch Alsh and Loch Duich. Locally designated "Caisteal Grugaig" (see Plate No. 1), this edifice is certainly worthy of more than passing notice, and scarcely deserves to have been so much ignored by writers on prehistoric remains as has been its fate. True, indeed, a concise account of its principal features has been given by Dr Joseph Anderson, in his fascinating work, 'Scotland in Pagan Times'; but with that exception, few other detailed notices have been published, which must be the excuse for going into the matter more minutely than would otherwise have been deemed necessary. Lying on the southern shore of the loch, almost at the foot of a green hollow, whose edges are lapped by the tide at its flow, and down the centre of which rushes a noisy little stream, at a distance the tower seems to be part and parcel of a huge



No. 1. CAISTEAL GRUGAIG. LOCH DUICH, ROSS-SHIRE.



disordered mass of broken rocks fallen from the hill above. The latter rises abruptly to a considerable height, for the most part tree-covered save where the bare and rugged face is too precipitous for even those hardy tenants to obtain a footing. The view commanded is most comprehensive, but we have no reason for supposing that the founders of the broch selected the site for any other purpose than that of security, scenic advantages not being likely to bulk largely in the minds of a rude people whose existence was probably a daily struggle; yet to our modern notions, the old building is all the more interesting when combined with this adjunct. At the present day, what with the ravages of time and the assiduous efforts of a vandalistic farmer, who found in the ancient relic an easy quarry from which to filch material for dyke-building, the tower has suffered severely. But much yet remains of interest; and were a small sum of money expended judiciously in removing the fallen *débris*, clearing out the chambers, and ridding the interior of the trees and earth that have accumulated therein, a most valuable relic would yet be preserved to link the present generation with a race about whose very origin, manners, and mode of living absolutely nothing is known, save what may be conjectured from the meagre remains of their handiwork that have survived the tumult of centuries. The masonry of this broch is of a larger type than those in Glenelg, but the design is virtually the same. Portions of several chambers still exist, but the upper galleries are gone, as at no point does the height of the outside wall exceed 9 feet. The wall itself, as measured in several places, shows a thickness of a little over 11 feet; the diameter of the interior space, about 33 feet; and the outside circumference, taken 6 feet from the ground, as accurately as the broken-down parts and surrounding obstacles of trees, &c., would permit, proves to be roughly 180 feet. From these measurements it will be inferred that in its original state the broch was a large and substantial structure, many of the unhewn blocks imbedded in its walls being of great size, none more so than the massive triangular stone placed over the doorway that faces the north-east. This lintel is a marked feature in its construction, and measures 3 feet 2 inches from the apex to the base, 3 feet 6 inches on one of the sides, and

4 feet on the other. It tops an entrance of about 4 feet 8 inches in height, although originally this may have been more, as soil and rubbish have largely collected since it became a ruin; moreover, a short distance in, the height is 6 feet 6 inches. The width of the entrance-passage until the door-checks are reached is barely 3 feet, but widens on the interior side of those to 4 feet 3 inches. The length is 12 feet 6 inches, being about a foot more than the thickness of the wall, but this may be accounted for by a large flag which projects from the roof of the passage into the interior. The door-checks, consisting of two upright slabs, are placed at a distance of 4 feet from the exterior, and immediately behind these are two small spaces which in all probability were used as sockets to admit the ends of a strong bar (generally supposed to have been of wood), with the view of securing a door which may have been of the same material, although in the opinion of competent authorities stone flags are conjectured to have been applied to this purpose. At a distance of 7 feet 6 inches from the outer doorway, on the left-hand side as one enters, occurs a small opening, 2 feet 7 inches in height by 18 inches in breadth, which was a means of entrance into the guard-chamber formed in the thickness of the wall. This chamber, 10 feet 6 inches or so in length, with a width of 4 to 5 feet, is considerably destroyed, a part of the roof having collapsed, and several of the large binding-stones removed: still, enough exists to show the original formation and substantial character of the fabric, though, in reality, the tower is a mere wreck of its former self. Of the lower chambers on the ground-floor four portions are apparent, with an average width of 3 feet 3 inches, or thereby, one of them tolerably perfect, and showing, in a marked degree, that peculiar mode of overlapping the stones whereby the builders, to whom the arch was evidently unknown, brought the two walls close enough together at the top to admit of their being spanned by immense flat beam-like slabs that formed the roof of the lower chambers and the floor of the gallery above. On the north-east and west sides the tower is most perfect, that facing the north-west being most dilapidated, as this was the point last assailed by the dyke-building boor. All traces of the interior windows have long vanished, but from the position of some of

the binding-stones, I am inclined to assume that they represent a fragment of the original stair which served as a somewhat rude means of communication between the various galleries. This supposition would, however, require the confirmation of an expert in archaeological matters.

It will readily be assumed that an erection like this could hardly exist in a district where superstition was of yore, and is yet to a certain extent, rampant, without being the subject of many traditions and anecdotes, and Grugaig forms no exception to this hypothesis. The bulk of these are of the usual silly and unreliable type, and indeed are barely worthy of record, save as showing to what depths of imbecility some folks can descend. The following will suffice as an example. The word "Grugaig" in Gaelic is said to mean "a surly or ill-conditioned woman," and the broch derived its cognomen from being at one period of its history the residence of a cankered old female, who, from all accounts, must have been anything but a desirable neighbour—in fact, quite the reverse. It seems to have been the custom of this ancient party to lie in bed rather late in the morning—a habit not unknown or uncommon even in modern times—and on those occasions having by her sloth allowed the fire to become extinguished, she calmly stepped across the loch to Ardelve, a distance of more than a mile, helped herself to a lighted peat from the fire of some more provident housewife, and returned to the tower in the same fashion. Another version of this veracious tale does not even give her credit for so much activity, but states that she merely turned in her couch and stretched her arm across the sea, thus abstracting the peat with a maximum of ease and a minimum of exertion. The only incongruity that seems to impair the truth of this tradition—at least, to us benighted Sassenachs—is the marked discrepancy between the size of the broch and its inmate. If her limbs were of such an unusual length as to be capable of stretching more than a mile at will, the question naturally arises, how did she dispose of these in the narrow galleries of the tower? Unless she had powers of expansion and contraction such as are possessed by that hideous creature the octopus, it is difficult to understand how they were stowed away. Strange to say, a detracting circumstance like this never seemed to militate

against a firm belief in the legend ; but we can hardly wonder that a rude illiterate people believed such a tale, when in the present enlightened age there are those who will credit anything, however absurd, so long as it is tinged by superstition or surrounded by a halo of the supernatural.

Adverting to the better known examples in Glenbeg, several miles to the south of Grugaig, and over the borderline of Inverness-shire, let us glance for a moment or two at some of the earlier records of these. The furthest back of any great importance appears to be that of Gordon, who, in his 'Itinerarium Septentrionale,' published in 1727, gives a full description of two, and a casual mention of four. Two of these, even in his time, were almost totally demolished, the third half fallen down, and the fourth was comparatively perfect. Since then the latter have been still further destroyed, and one only lives in tradition, as I failed to find it anywhere, and can discover no description of it in any more modern work than the above. The third and farthest up Glenbeg still exists in a dilapidated condition, but, curiously enough, has been totally ignored by succeeding writers, such as Pennant, Cordiner, Macculloch, and Dr Anderson, although for picturesqueness of site it throws the others completely into the shade. Gordon transmits the local names of these strongholds (or "stupendous fabricks," as he calls them), which are as follows: Caisteal Chalamine or Malcomb's Castle, Caisteal Chonil, Caisteal Tellve, and Caisteal Troddan;¹ and those designations he learnt from scraps of Gaelic poetry recited to him by an old Highlander, who said they were built by a mother for her four sons. This latter piece of information does not seem to have impressed him either with much faith in its truth or respect for Celtic lore, as he characterises it and the other verses by the epithet of "barbarous Irish rhymes," and in illustration of the latter he appends a Gaelic stanza of which the translation is as follows:—

" My four sons, a fair clan,
I left on the strath of one glen ;
My Malcomb, my lovely Chonil,
My Tellve, my Troddan."

¹ Logan, in his work, 'The Scottish Gaël,' spells the names as follows: "Calman," "Conal," "Telve," "Troddan."

The theory propounded in this literary gem must be received with great caution, and indeed is quite untenable. Macculloch, in his caustic style, scouts at the very idea, and suggests that "it is just as likely that Fingal built St Paul's,"—a flight of imagination that will hardly find a corroborative echo in the breast of the most ardent stickler for Celtic importance. A Gaelic name applied to these brochs is "bathaichean," meaning "byres"; but this appellation, when contrasted with the great antiquity of these buildings, is evidently of comparatively modern date, and probably refers to a time when, the original function gone, the towers, more or less ruinous, may have been used as shelters for cattle. But that they were primarily intended for such an object is absurd, the mere fact that the only external opening was too low to admit of the passage of cattle being sufficient of itself to condemn the assumption.

Gordon's account is a careful one, but much too long to transcribe here. Only one other remark he makes strikes me as important, and is contained in the following sentence: "There are several of these fabricks in the north parts of Scotland, particularly two in the same valley with the barracks of Glenelg." Now, if this is correct, there must have been other two brochs in the neighbouring valley of Glen More; but of these only slight traces seem to be left. If we include Grugaig in the category, no less than seven were within an easy day's walk of each other, which clearly points to the fact that at one time those buildings must have been very numerous in the north, as indeed their remains are even at the present day, according to Dr Anderson's elaborate statistics. It is very difficult, indeed, to get any reliable information from the natives on the subject; but one old man at Dornie, who had a considerable interest in antiquities, told me that he distinctly remembered seeing some years ago the remains of one in Glen More, which proves that Gordon's statement was true. If I mistake not, the foundation outline can still be seen not far from the school-house in Glenelg. This same individual instanced another near Arnisdale, Loch Hourn, but, owing to the great distance, I had not time to explore that locality, so cannot verify his statement. Old Highland traditions, as exemplified in the usual dim and hazy rumours, strike one as being analogous to the thoughts that rush through our brains

when in a state of dreamy sleep,—there is such a want of coherence and substantiality about them, no two narrations agreeing in the particulars, although the main features of the anecdote may pervade the whole and be not dissimilar; but this may no doubt be accounted for by their being to a great extent handed down orally, and not in a written form.

When Pennant visited Glenelg in 1772, a considerable amount of damage had been done to the Tellve and Troddan towers, and he seems to have taken for granted that the other two were entirely demolished, although he repeats all the legends concerning the mythical mother and her four hopeful sons, with the addition that he says the brochs were known as “Caisteal Teilbab,” or the Castles of Teilba. Among later writers, Macculloch’s description is perhaps the most interesting and independent; but it is scarcely necessary to recapitulate any more of these accounts, as many are evidently transcripts of Gordon or Pennant. It will be more to the purpose to give a rough sketch of what these ancient monuments are like at the present day.

Passing up Glenbeg, at a distance of a mile or so from Eilan Reoch House, the first ruin observed is “Caisteal Tellve” (*see* Plate No. 2), which, along with Troddan, is now preserved by Government under the Ancient Monuments’ Act, so that further spoliation on the part of vandals will be attended with risk to themselves. Owing to its insecure condition, it was found necessary to prop it up with huge beams, and these, while certainly not adding to its picturesqueness, may be the means of conserving the fabric for the gratification of future generations. About a third of the circle is left, and this contains the doorway, which is extremely low, and was so in Gordon’s time as well, necessitating his crawling in on hands and knees: now it is even lower, owing to the accumulation of fallen rubbish. Part of the guard-chamber is still in existence, and portions of four galleries remain, but owing to the subsidence of the concentric walls in some parts, entrance is unsafe. Close to what is now the top, though the tower must once have been much higher, is a series of projecting stones, running round like a cornice. At first sight this seems to be accounted for by the binding flags being too long, and jutting out in consequence of the gradual convergence



No. 2. CAISTEAL TELLVE. GLEN BEG, INVERNESS-SHIRE.



of the two walls; but as both Gordon and Pennant take particular notice of this coping-like arrangement, and the latter states his theory of its use, it is pardonable to suppose that some definite purpose was intended by the builders. Upon what this was it would be imprudent to speculate. It may be as well to mention, however, a suggestion often made, that those stones were the supports of a temporary roof; but as our most eminent archæologists seem now to be pretty well agreed upon the point that those buildings never had a top covering, probably the first-named theory may be correct, especially as the upper parts would be considerably strengthened by such a disposal of the flags. Two rows of internal window openings for the admission of light and air into the galleries are still visible, and the complete circular foundation may yet be traced. There is a popular notion that part of this broch was utilised to build the neighbouring barracks of Bernera, erected by the Hanoverian Government in 1722 to quell the Jacobite clans,—whether true or not would be hard to say.¹ The statement seems open to doubt, as plenty material could be got nearer hand; but on one point there need be no dubiety—viz., the stones must have been purloined for some object, as they are not found in a fallen state close by, and considering the compact and solid nature of the structure, there was little chance of its crumbling away if left unharmed. In neighbouring cottages, dykes, drains, and probably in road-metal, we may seek for the stones that were once incorporated in this ancient erection. About a quarter of a mile farther up the glen, on a slight eminence close to the road, stands “Caisteal Troddan” (*see* Plate No. 3), more interesting perhaps than the other from its being in better condition, and strong enough to admit of passage through the three galleries. The part containing the doorway and guard-chamber has disap-

¹ Logan, quoting the “learned Mr Grant of Corrimony,” perpetuates this tale, but there seems to be confusion on the point, as the two which he says were destroyed for the purpose would seem to be Chalamine and Chonil, the first and last in order, so that the builders of the barracks put themselves to a deal of unnecessary trouble in passing two other towers to lift material from Chonil, the most inaccessible of all. If there is any truth whatever in the account, it is more than likely that, in addition to Chalamine, the supposed one in Glen More supplied the masonry, its proximity to the site of the barracks being too tempting to be overlooked.

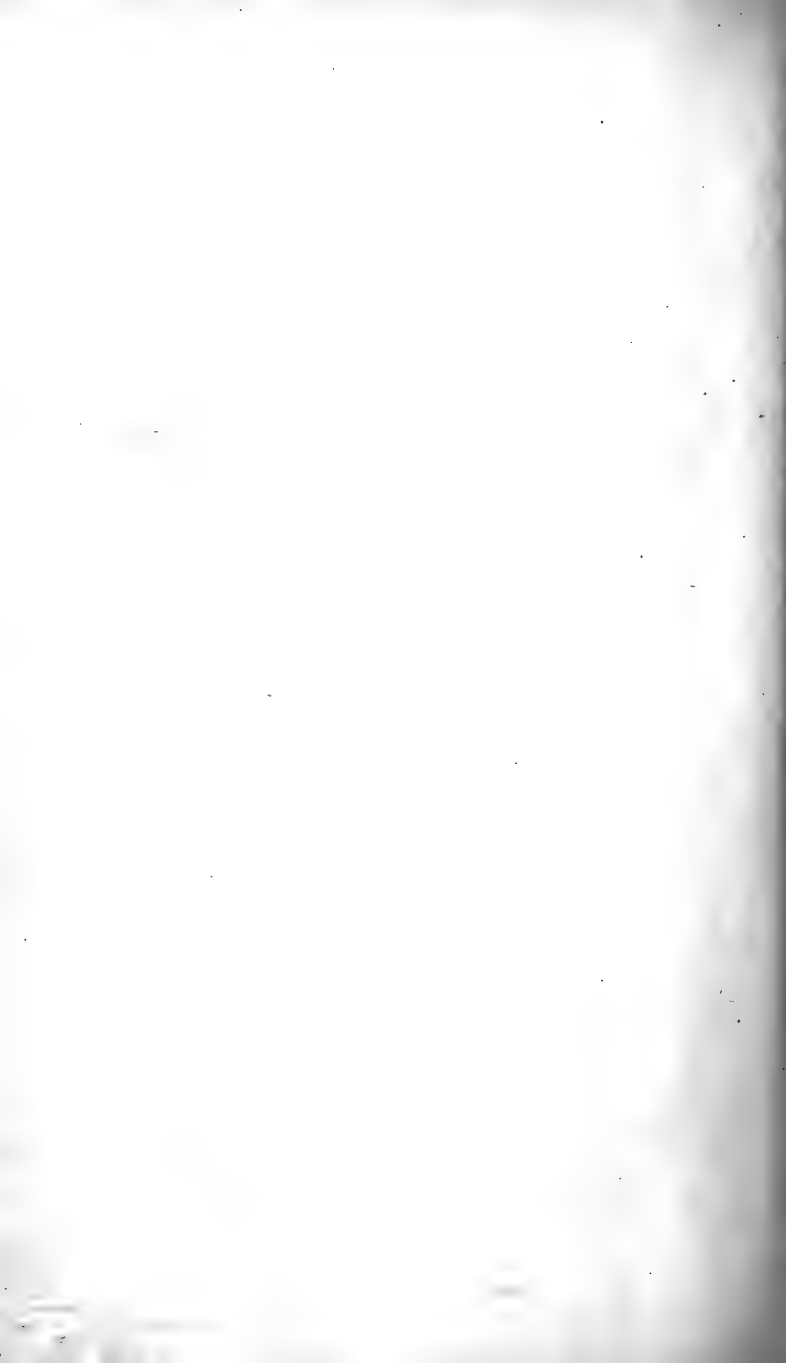
peared, but an excellent idea of the gallery and window arrangement is yet presented. Roughly speaking, the basement walls of both towers average 11 to 12 feet in thickness, the internal diameter 30 to 33 feet, so that they must have been about the same size as Grugaig, although the stones used in their construction are not nearly so large as those in the last-mentioned. This difference is noticeable all over the districts where brochs once abounded, and may be accounted for simply enough by inferring that the founders used the materials readiest to hand; and the conjecture might perhaps be added, that in localities where greater danger was to be apprehended, the towers would be built in more massive form, so as successfully to resist attack. Concerning this broch, Pennant makes a remark very difficult to comprehend and still more to believe, to the effect that at the east end there was an aperture, "once of such extent that the goats which sheltered in it were often lost." One would conclude from this that something resembling the "pit of Tophet," on a diminished scale, existed in this now peaceful and smiling vale: if it ever did, it certainly cannot be discovered now, happily for the resident population.¹ There is one row of internal windows running from the bottom to the top, and a smaller duplicate at the east side, beginning about 18 to 20 feet from the ground, and this would give light to the upper galleries only. Like its neighbour, the hand of the Goth has pressed heavily here also. But not to prolong description of those two well-known examples, we will push on to the third, which, as already indicated, has attracted such comparatively trifling notice from antiquaries.

About a mile to the east stands the farmhouse of Baile Braghad, where the road ends; and striking up the rough slope at a distance of another half mile, Caisteal Chonil is descried crowning the top of a precipitous knoll formed largely of solid rock. From its position this broch in olden times must have been absolutely impregnable, as on the south side it rests on the brink of a steep declivity washed at the foot by a brawling mountain-torrent. Access from that quarter would be attended with considerable danger, while the other sides, more

¹ Tradition says that a passage existed leading from the tower to the river, this aperture being the entrance to the same.



No. 3. CAISTEAL TRODDAN. GLEN BEG, INVERNESS-SHIRE.



or less sloping, could easily be defended if necessary. As at Grugaig, huge masses of fallen rock cover the hillside to the south, and all around the scenery is of a wild and most attractive character; in fact, it is safe to say that no other broch in Scotland occupies a more striking or picturesque site. Certainly a more commanding situation, either from a strategic or scenic point of view, could scarcely be conceived—the deep ravine at the side separating it from the steep hill to the south, and the abrupt descent of the hillock to the north and west; while the romantic and lonely glen that dies away among the high mountains to the east adds to its interest in a ratio to which the other two towers cannot attain. Judging from the moss-covered masonry and general overgrown appearance of the surroundings, many years must have elapsed since the structure was destroyed, and in all probability a large section of it may have tumbled into the burn below, as for many a long day little inducement for spoliation could be found, since neither dykes nor houses are common in its vicinity. The eastern side still shows a height of 18 to 20 feet, but the southern portion facing the stream is gone, and only fragments are left of those which faced the other two points of the compass. Sufficient remains, however, to trace the foundations, which partake more of an oval than a purely circular form, the founders being forced to follow the configuration of the ground to a certain extent, as the tower occupies the whole space available on the summit. Only one chamber is visible, about 2 feet wide by 20 feet long, the binding-stones forming the roof being still intact. The doorway would appear to have been on the east side, just at the entrance to this cavity, so we may with something like probability conclude that the latter represents the guard-chamber. No traces of interior openings appear save on the north side, where, amidst a mass of fallen *débris*, is partially concealed a large flagstone, which may have formed part of the roof of the entrance to a chamber, or the lowest tier of window apertures. It is not at all unlikely that when at its full height, communication might have been made by signal with the Troddan broch, which in turn was in sight of Tellve, and the latter again with Chalamine; but in its present state of decay it is impossible to observe the first named, owing to an

intervening spur of the mountain. A few feet more masonry would, however, make all the difference, and enable one to attain a point of vantage sufficient to overlook the obstructing ridge. It must not be inferred from this that it was a necessary part of the economy of these erections to be always in sight of each other, as such a theory will not stand the test of examination; but, at the same time, it is probable that where so many occurred in one short space, and all seemingly for defensive purposes, the additional safeguard of rapid interchange of communication would not be neglected by the builders.

In penning the foregoing remarks, I have gone upon the assumption that most of you have either seen or read accounts of those earliest known stone buildings in Scotland; but should this not be the case, permit me in conclusion, and very briefly, to give a cursory sketch of what we might suppose a perfect broch to be. Composed entirely of unhewn stone, with no lime or cement, in outward appearance it is circular, and slopes gradually upwards like the base of a lighthouse, or a kiln in a glass-work, this peculiar form being called by old writers a "truncated cone." There is no outward opening save a narrow doorway about three feet wide and five or six feet high, and this passage leads through the wall into the inner area. Passing a few feet into this entrance, we reach a point where are upright slabs jutting out, and here the door was placed, supposed to have been also of stone, and flanked by a cavity left in the thickness of the wall, known as the guard-chamber. Now consider the wisdom of this arrangement. Had the door been placed on the outside periphery, it could have been readily stormed by a number of men clustering round; but being four or five feet inside the narrow passage, only one man, or at most two, could attack it at a time, so that a determined handful behind could keep an army at bay. For several feet above the ground the wall is solid, except at intervals in the circle where there are cavities left that appear to have been rooms, on a small and very rough scale. The arch, as already remarked, being evidently unknown at that period, the stones overlap each other, and gradually narrow the space at the top, so as to admit of huge flat slabs being laid across, to serve the triple purpose of binding the walls together, and of forming

a roof for the chamber and a flooring for the gallery above. Entrance to these chambers is obtained by open spaces facing the interior of the tower, and above these are other square-looking openings running one above the other, almost to the top of the building, to take the place of modern windows, for the admission of light and air. Above the ground-chambers the walls are carried up separately, the interior one being perpendicular and the outer sloping inwards, so that when taken up forty feet or so they join together. At regular intervals these walls are spanned and bound together by the same style of flat slabs, each tier naturally getting smaller and smaller until the higher ones are almost too small to admit anything larger than a dog or cat. Having no internal obstructions, these passages run right round the whole circumference of the fabric. The lower ones would be capable of containing a good many people, as well as a quantity of goods; but to what purpose the higher ones were applied it is difficult to say. Probably they were not used at all, but were only a necessary part of the original design. Communication was had between the various tiers by means of a rough-and-ready sort of stair, formed also of flat stones.

Taken as a whole, if, as is believed, the object of these buildings was to ensure a place of temporary refuge in times of trouble, we must acknowledge that the device was admirable. From the outside they were absolutely impregnable to a people who had no artillery; and even granting that the assailants were able to shower stones and other missiles over the wall, they would fall harmlessly into the interior, and all the while this camisade was in progress the inhabitants would be enjoying their *otium cum dignitate* inside the galleries, no doubt laughing in their sleeves at the futility of the attack.

As regards the race who built these curious edifices, the most modern theory—the result of laborious investigation by eminent archæologists—is that they were Celtic, and not Scandinavian as was formerly believed; and that they are absolutely confined to Scottish territory is now proved beyond a doubt. For further and more reliable information as to their history, construction, &c., I cannot do better than refer those desirous of increasing their knowledge of these interesting

structures to the work already mentioned as written by Dr Joseph Anderson—the best and most exhaustive yet published.

At this meeting Mr J. C. Oliphant, M.A., gave a most interesting account of Bermuda, and exhibited specimens of shells, corals, sea-weeds, &c., gathered during a residence on the island.

IV.—O N D R Y - R O T.

BY MR A. B. STEELE.

(Read Feb. 27, 1889.)

DRY-ROT is the popular name applied to all fungi injurious to wrought timber. The best-known dry-rot fungus in this country is *Merulius lachrymans*, which produces such serious effects in the woodwork of domestic architecture. The genus belongs to the group of spore-bearing fungi, and is distinguished from the other genera of the group by its soft hymenium forming porous, sinuous, toothed depressions. It contains only twelve British species, from which *Merulius lachrymans* can easily be determined by the ferruginous colour of its spores, and by the drops of moisture with which it is covered when ripe. The generic name is apparently a corruption of *metulius*, from *meta*, a cone or pyramid,—so called originally from several of the species producing pendent processes like inverted cones. The specific name “lachrymans,” or tearful, has arisen from the drops of water which cover its fructification. This fungus attacks the timber of coniferous trees, but is not confined to such, and will prey upon any kind of timber that comes in its way. The conditions necessary for its growth are darkness, warmth, and stagnant air. Prof. Hartig has discovered that ammonia (which may arise from the soil, defective drains, or even bad mortar) is an essential element. A spore lodging in damp timber under such conditions soon begins to germinate. The prolongations or

hyphæ which it sends forth penetrate the wood. They soon exhaust the cells of the medullary rays of their contents, the nitrogen, potassium, and phosphorus of which are essential for the growth of the fungus. They permeate the wood in all directions, breaking up the substances, and appropriating those required for the development of the plant. On the surface of the timber little round patches like jewellers' wool first make their appearance. These increase in size, and, meeting, form a dense mass of interlaced material like felt, which covers the beam like a carpet. This is the mycelium or vegetative part of the fungus, and corresponds to the spawn of the mushroom. The part analogous to the pileus or cap is of a stiff corky nature, and lies next the beam. When the plant begins to fructify, the mycelium takes a more definite outline; it becomes wrinkled and pitted on the surface, and of a spongy character, having the walls of the depressions indented and zigzag. These depressions form the hymenium, and correspond to the gills of the mushroom. It now assumes a yellowish-brown colour, distils drops of clear water, and sheds a ferruginous powdery mass (the spores or seeds). A single fructification will produce hundreds of millions of spores, each of which is calculated to be about a 3000th part of an inch in diameter.

Dry-rot prefers unpolished deal as a substratum on which to develop itself. From wood the spawn spreads to walls of stone and brick. It will go through the mortar, and develop itself both inside and outside the wall. It has been observed growing on plate-glass, maintaining itself there by means of nourishment drawn from the wood. It is frequently found in wine-cellars, from the woodwork of which it creeps along the sawdust. It penetrates between the cork and the neck of the bottle, imparting a "corky" flavour to the wine. Dry-rot commits such rapid and deadly havoc in buildings, that it is not inappropriately termed the Jewish leprosy in houses. If the conditions are favourable when it attacks the woodwork of buildings, it continues to grow till the supporting wood is completely exhausted, causing the floors and the roofs sometimes to fall in. Cases of dry-rot in Edinburgh are more common than people have any conception of. Shortly after the opening of the Royal Infirmary, dry-rot attacked the woodwork of the wards, and the floors had to be replaced at great

expense. Many of the banks and large workshops in town have suffered from its ravages, and even the sacred precincts of the church are not exempt from its attacks. Before it was expelled from the Board schools, it had made more "progress" under the masters than the pupils had done. Many owners of handsome villas know to their cost the destructive properties of this fungus. When the outgrowth makes its appearance, it is a sure sign that there is havoc going on within. The wood becomes discoloured and cracks, and has all the appearance of being burnt. It gives a dead sound when tapped, and becomes so soft and light that it can be crumbled to tinder between the fingers. Having lost all its strength, it may give rise at any moment to serious accidents. It is said that families have been suddenly alarmed by feeling the floor giving way beneath them. In dry air the fungus soon withers and dies, for the failure of moisture is more injurious to it than the want of nourishment. The plant requires an enormous quantity of water, which bulks fully one-half in the weight of the fungus.

It is stated on the authority of a German builder that the germs of dry-rot may exist in the living tree, and instances are given by him where dry and sound wood has been attacked. It is also said that there are whole forests of pine in Russia from which no building wood is now taken, as it has always been attacked by dry-rot. But little faith can be put in these statements, for the germs are so insidious that they baffle every precaution taken to keep the wood from being infected. Sound timber cut by a saw which had been used upon infected wood has been attacked, and beams have been injured by being placed near infected wood. As a rule, however, thoroughly seasoned wood is not liable to the attacks of the germ.

It has long been known that there is a proper time and manner of felling trees. Vitruvius, a Roman architect, who lived about 70 B.C., knew that good sound timber could only be had by cutting the tree to the pith, so as to allow the sap to escape, which, by drying in the wood, would injure its quality. He directed that felling should take place from early autumn till the end of winter. In Scotland, during the reign of James I., there was a close time for felling trees—

viz., from the beginning of April to the end of June. "Fell not the tree," says Evelyn, "till the sap is at rest, as it commonly is about November and December, after the frost has well nipped them; the very saplings thus cut will continue without decay as long as the heart of the tree." The use of sapwood and of insufficiently seasoned timber are the chief causes of dry-rot. Young trees have too much proportion of sapwood to heartwood, and should not be felled till they arrive at maturity. The winter is the best time for cutting, and various experiments have been recently tried to discover whether germs of dry-rot would develop in wood felled during that season. Sections of fir and pine trees felled in January were taken in March of the same year, and germs of dry-rot sown in them. They were kept in covered vessels in a dark room, at an average temperature of 60° Fahrenheit. The spawn of the fungus showed itself in July. Sections of similar woods felled during the previous winter were found unsuitable for such experiments. A careful analysis of the wood showed that there was from four to nine per cent more potassium and phosphoric acid in the wood of the latter season than in that of the previous. Wood where experiments completely failed was found to have been previously immersed in water. To get thoroughly seasoned wood, the tree should be cut up, slowly and thoroughly dried, and then completely immersed in water. It was an ancient practice in England to place timber intended for dwelling-houses in running water to season it. Experiments have also lately been tried to determine whether wood felled in the summer could be rendered safe against dry-rot by the removal of the bark, and protracted drying and steeping in water, but with what result is not yet known.

It is easier to prevent the disease than to cure it. The timber should be perfectly sound and dry, and the basements of the building thoroughly well ventilated and free from damp, for the fungus cannot exist without stagnant air and wood saturated with moisture. When the mycelium has only penetrated a short distance, Professor Hillhouse recommends painting with corrosive sublimate dissolved in methyl alcohol; but nothing is more difficult to discover than how far the woodwork is infected, and it is safest to remove entirely an

infected beam and burn it. Professor Fasky discovered that a certain quantity of a solution of salicylic acid in alcohol was sufficiently efficacious to protect a flooring of 800 square feet from the spread of dry-rot, and to remove it from the places where it had appeared. Rough salicylic acid can be used, and the action of this antiseptic agent can be heightened by a slight admixture of carbolic acid. The cures that have been suggested, and the patents taken out for destroying this fungus, are numerous. Burnet's method, or the application of chloride of zinc; Kyan's method, or "kyanising," as it is called—the use of corrosive sublimate, which can only be applied effectively to dry timber; Margary's method, or "margarising"—the application of sulphate or other salts of copper; and Bethel's method, or "creosoting," are some of the best remedies. Bethel's method is considered by practical men to be the most effective. In this process the timber is first made dry by extracting the water and replacing it under heavy pressure by oil of tar, which does not get driven out of timber by moisture like all the salts of metal. Professor Hartig recommends all joints and timber-ends built into walls to be previously creosoted, so as to protect them during the time when the walls are drying. Petroleum has been tried, and said to be both a cure and preventive, but it is very dangerous; and a concentrated solution of common salt is also said to be effective when applied to the beams in a boiling state. Airing with dry air is also recommended; but hot-lime wash, which is most commonly applied in cases of dry-rot, is found to be useless. In a paper read before the Architectural Association of London last winter, it was pointed out that the woodwork should not only be dry but kept dry, which is impossible if the air of the chamber in which it is built is damp, as it condenses and absorbs moisture, and various means are open to builders to prevent moisture, but chiefly by securing thorough ventilation, so that there is no corner where the air can stagnate. Mrs Hussey, writing on this subject, says, that once on a visit to an old mansion-house in England, she expressed her admiration to the housekeeper of the splendid condition of the oaken floors and panelling. "Yes," said the housekeeper, "but you can't carry a lighted candle through these rooms." The horror of draughts nowadays is the life of dry-rot. It is also necessary that all vegetable soil be

removed from the site, that the drains be sound, and the wood not painted unless thoroughly dry, as it imprisons the moisture. For a similar reason, linoleum on floors is also objectionable. A few years ago the flooring of the telling-room in one of the branch banks in town was completely destroyed by dry-rot, which, in the builder's opinion, was caused by the laying down of linoleum. Practical men are now taking every precaution to prevent the spread of this disease. A builder of twenty-five years' experience deprecates the risk run of communicating dry-rot to sound timber through the practice of using dry sawdust as "filling" in framed partitions, and between flooring and sound-boarding for the purpose of deadening sound. The sawdust contains particles of all kinds of timber, some of which may carry a germ of the fungus, which only requires the specified conditions to begin its havoc on the surrounding timber. No instance of dry-rot, according to the editor of 'The Builder,' arising from such a cause, has ever been recorded; but sawdust so used should be stove-dried, and, if heated to the highest temperature it will bear without burning, would prevent any spores of dry-rot or other disease from germinating. But without stove-drying the danger is a real one, and slag-wool should be used instead of sawdust.

From the life-history of this endophyte we have seen the refined and insidious nature of the germ, as well as the destructive properties of the spawn. Dry-rot is one of the most distressing of vegetable diseases, and the more highly cultivated the plants useful to man are, the more liable are they to the attacks of parasites. All kinds of parasitic and destructive fungi are rapidly multiplying, for their means of existence have been more largely increased. A thorough acquaintance, therefore, by practical men, with the details in the life-history of these vegetable parasites would probably be a more effective means for their suppression than all the cures and patents hitherto invented.

[The above paper was illustrated by diagrams, as well as by pieces of timber attacked by dry-rot.]

At this meeting a paper was read by Mr J. W. Tait on "Embedding and Cutting Animal Tissues," illustrated by microscopic preparations.

V.—*THE GENUS COLLETIA*.

BY MR HUGH FRASER.

(Read Feb. 27, 1889.)

THIS genus—named in honour of M. Collet, a celebrated French botanist—forms a part of the Natural Order of the Rhamnaceæ, which consists of about 40 genera and 260 species of small trees and shrubs, distributed over the greater part of the globe, and varying very much in habit of growth and general appearance. Many of them contribute to the convenience and necessities of man by their woods, barks, and fruits. The order is represented in this country by two species—the one *Rhamnus frangula*, which supplies the charcoal so much used in the manufacture of the finest gunpowder; the other *R. catharticus*, which is used in medicine. Chili and Peru are the homes of the *Colletias*, though the *Discarias* of Australia and New Zealand, according to some authorities, should be merged in the genus, as they have certainly close affinities with these, both botanically and in general characteristics. In this country *Colletias* can only be regarded as half-hardy, and consist of small trees and dwarf shrubs, varying in height from about two feet to twelve feet. In some districts, however, they withstand the rigours of our winter, and grow fairly well in sheltered situations, and especially when enjoying the shelter of a wall with a warm aspect. In our own Botanic Garden several of the forms grow wonderfully well; and on a recent visit to the beautiful and highly interesting garden of Charles Jenner, Esq., Easter Duddingstone, I found two specimens, the one being *C. spinosa* and the other *C. cruciata*, in robust health, from eight to ten feet high. In Dublin, however, and notably at Trinity College Botanic Gardens, I noticed several plants which seemed to be quite at home.

Among the peculiarities of this very interesting group of plants may be noted the small development of leaves. They do produce leaves on their young growth, but soon shed them, so that for practical leaf-functions their real leaves are useless. Another curious feature of the *Colletias* is their spines, with which all are armed with a profusion rarely seen in other

shrubs, and forming formidable obstacles to the traveller in those regions where they abound, as well as to the animals which find their food on branches and other herbage. These spines were doubtless developed for protection; but it does not seem so clear why the *Discarias* of Australia and New Zealand are so armed, when there are no native browsing mammals in these countries. But the most extraordinary feature of these plants is the tendency they possess to change their characters. The late Dr Lindley records a case, on the authority of Mr Barnes of Bicton, in 1849, of a seedling from *C. spinosa* taking the form of *C. cruciata*, which latter is now generally known as *C. Bictonensis*. In the Botanic Garden of our own city there is a plant of *C. cruciata* with a dimorphic branch agreeing with *C. spinosa*; but there is no evidence of *C. spinosa* ever producing *C. cruciata*. Thus though a number of so-called species have been named, the probability is that they are for the most part wide phases or forms of one or two real species. Of the *Discarias*, one species, *D. serratifolia*, is found associated with the *Colletias* in Chili and Peru, and the other two are confined to Australia and New Zealand. The following is a list of the known forms of *Colletia*, with their synonyms:—

- C. armata*, *syn.* *C. spinosa*.
- C. Bictonensis*, *syn.* *C. cruciata*.
- C. ferox*, *syn.* *C. spinosa*.
- C. horrida*, *syn.* *C. spinosa*.
- C. polyacantha*, *syn.* *C. spinosa*.
- C. ulicina*, *syn.* *C. Benthamiana*.
- C. Valdiviana*, *syn.* *C. spinosa*.

VI.—*THE ICHNEUMON OR MUNGOOS.*

By MR ROBERT STEWART, S.S.C.

(Read March 27, 1889.)

ON the banks of the river Findhorn, a few miles above the pretty town of Forres, a number of herons had taken up their abode, until some years ago a colony of jackdaws set up a

rival establishment close by, with the result that the herons, disgusted at having such a noisy and mischievous set of neighbours, broke up their establishment and winged their royal flight—following the rule in like fashionable society—to a more aristocratic centre. This portion of the river where the herons bred and mustered was called the “heronry,” and many persons came from far distances to see these beautiful birds in their native *habitat*; for the heron, though ungainly in appearance when the surroundings are uncongenial, is an elegant bird when seen standing knee-deep near the edge of some lone, rocky pool, and its presence used to add an additional charm to what is acknowledged to be the finest river scenery in Scotland. The herons built their nests in some old and decayed trees which grew out of the face of what appeared, to any one unacquainted with the high value set upon his existence by the average schoolboy, to be a wholly inaccessible cliff. That this was not the case, however, is evident from the fact that several heron’s eggs were freely bartered in the district, and I myself have now in my possession one of the large blue eggs of the bird, taken from a nest at the heronry. Shortly before the departure of the herons, a company of ladies and gentlemen hired a machine in Forres, for what may be called the chief end of visitors to the district, namely, a drive up the banks of the Findhorn. As the party drove past the heronry, the birds took wing, and flew, or rather sailed, in all directions round their nests, to the great delight of the visitors, not one of whom, however, knew what the birds were, and the driver was in consequence eagerly appealed to. With a patronising wave of his whip, he thus addressed the leading lady: “Them’s the gooses, mum!”

A few months ago, I had a call from a friend who resides in London, and in the course of conversation he mentioned incidentally that he had lately come into possession of a most entertaining pet, namely, a mungoos. I have to confess that visions of my old friends the herons, mixed up with the well-remembered rubicund face of the said driver, flitted across my imagination, and it was only by carefully sticking to generalities that I managed to preserve the respect of my friend. Luckily, however, for my slight reputation as a lover and friend of animals, the mungoos took shape and substance, and

I soon found that the pet referred to was the ichneumon. Since that time I have collected some information regarding this animal, and as I found the subject an extremely interesting one, I have ventured to bring it before the Society.

Of the ichneumon (*Herpestes*) there are, it would appear, twenty-two species in all; but the Egyptian and Indian ichneumons are the forms best known. The ichneumon is of the family Viverridæ, and resembles in appearance the civet or ferret. It is nocturnal in its habits, and is the unrelenting foe of birds, reptiles, rats, and mice. It is a very pretty animal, and being cleanly and easily tamed, it is in great demand in the countries which it inhabits, where it is used for the purpose of keeping the houses free from vermin. One great drawback it has, however, namely, that it is impossible to get it to give its undivided attention to vermin, and it invariably plays havoc in the poultry-yard whenever opportunity offers. The ichneumon was one of the animals proposed to be sent to New Zealand for the purpose of lessening, or, as some of its admirers prophesied, stamping out altogether, the rabbit pest, with which that colony has suffered so much lately. It was considered that being so readily domesticated, the same danger might not apply to its introduction as in the case of other recognised enemies of the rabbit, of the remedy ultimately proving worse than the disease. I do not think that any permanent good is ever accomplished by the interference to any great extent in the distribution of animals, whether by the extermination of one species or the forced increase of others. Witness the result of the raids which are made periodically against certain classes of so-called vermin. So surely as the balance which is seen everywhere in the animal world is upset by, say for instance, the extirpation of any one species, so surely do the executioners suffer by the abnormal increase of another species which it was the province of the exterminated animals to hold in check. When one, therefore, hears gamekeepers who, after indiscriminately trapping and killing all manner of furred and feathered vermin, complain of weak and unhealthy birds; or gardeners who, after shooting without mercy our feathered friends, bewail the damage done by grubs and insects to their fruit-trees; or farmers who, after destroying the entire rooks in their neighbourhood,

bemoan the ravages of slugs, wire-worms, &c.—one is inclined to reply to one and all, “Who began it, my friend?”

But to return to our mungoos. The Egyptian ichneumon is, as its name implies, an inhabitant of Egypt and the north of Africa, and is known there as Pharaoh’s rat. This species, when full grown, is about the size of a domestic cat. The fur is a mixture of chestnut brown and yellow, while the feet and muzzle are black. Among the ancient Egyptians these animals were considered sacred, and were after death buried in “holy repositories.” The mungoos feeds on rats and mice, birds and reptiles, and its fondness for eggs leads it to search for those of the crocodile, and scratch up the sand under which they deposit their eggs. It is in this way they do good, in checking the too great multiplication of these disagreeable animals; but there is no truth whatever in the belief, entertained at one time, that the mungoos destroyed the crocodile by springing into its open mouth when that animal was having a *siesta*, or lying gorged after a heavy meal, and, to put it mildly, “upsetting its internal arrangements.”

The Indian ichneumon or mungoos is much smaller than its Egyptian brother, and is of a beautiful, freckled, grey colour. It is often brought to this country for the purpose of destroying rats, and thrives well in confinement. Mr Bennet tells of one kept in the Tower, which killed no fewer than a dozen full-grown rats, which had been turned out before it in a room sixteen feet square, in less than a minute and a half. It is stated that in Jamaica alone the introduction of the mungoos has resulted in a saving of from £100,000 to £150,000 annually, owing to the decrease of rats, which destroy the sugar-cane. It is, however, especially appreciated in India as a serpent-killer, and it never hesitates to attack even full-grown venomous snakes. The fact that the mungoos survived these encounters led to the belief that it was impervious to the bite of the snake, and that the poison had no injurious effect upon it, and this was explained by the fact that the mungoos, when bitten, searched for and ate an herb or root known in India as *munguswail*, which was said to prove an infallible antidote to snake poison. This belief, however, has not stood the test of experiment, for it has been found that when fairly bitten by a venomous snake, the mungoos has no

charmed existence, but succumbs to the effects of the poison ; though, at the same time, it may be that it is *less* susceptible to a snake-bite than most other animals. The truth really is, however, that the mungoos is so quick and active in its movements that it is impossible for the snake to touch it ; and so confident is the little animal in its own powers, that it appears to delight in tormenting the poor reptile—dodging out of the way of its fangs at the very time when it looked as though escape was impossible. In these encounters with the snake, the mungoos quietly waits his opportunity, and when the reptile has tired himself by lashing out at his opponent, the little animal, pouncing suddenly on the serpent, seizes it by the head, and shakes it as a terrier does a rat until it is killed.

So much for the mungoos abroad ; now for a short account of him in captivity. The mungoos in question was of the Indian species, and was brought to this country by an engineer on board one of the P. and O. steamers. His owner seldom came into port without having in his possession a regular menagerie of animals of one kind or another, and he was often hurt at the doubtful manner in which his gifts were received on the occasions of the breaking up of his collections by the arrival of the ship at its destination. On one occasion he called upon a friend and left with him a couple of monkeys, a cockatoo, two parakeets, and several curious-looking animals in a cage, with an intimation that he would call back and see to their disposal in the course of the afternoon. To his friend's intense horror, however, day after day passed without the owner of the animals turning up ; and, as one may well suppose, the responsibility of keeping a couple of monkeys, loose, in a room full of furniture, made life a burden, so that in self-defence a cab was procured, and the whole collection transferred bodily to the Zoological Gardens. The mungoos on the voyage home had the run of the ship, but always shared his master's berth when the hour for retiring to rest arrived. When the presentation took place, my friend confesses that he was rather afraid of the mungoos, but the animal's master buttoned it up in his coat front, and carried it in this way to the railway station. It may, however, be better now to let my friend tell his story in his own way. He says : " When I got home with the

animal, I was in a fix what to do with him, as my wife could not bear his look, and imagined all manner of horrible possibilities in connection with him. I thought, however, little harm could be done by him in one night, but I determined for safety to tie him up outside the bedroom door, so that we might hear if anything went wrong. I accordingly put a piece of string round his neck, and so secured him. In the morning, when I got outside the bedroom to go down-stairs, I found the mungoos quite safe; but I had not been many minutes away when I heard loud cries of distress, and on hastening up-stairs, I found that the animal had slipped the string and invaded the bedroom, and, what made matters worse, I could not find him for some time, as he had gone into the wash-basket and covered himself over with clothes. This exploit of his meant banishment from the house, and as I had peremptory orders to take him away then and there, and not knowing what else to do, I took him to the office, where he soon made himself at home. After examining every nook and corner, he found a hole under the floor where he used to sleep, coming out occasionally to warm himself at the stove. I had a small box made for him, which I filled with fine hay, and put it in a dark corner. The entrance was by a small hole in the side, just large enough to allow the mungoos to squeeze himself through. He found it out almost immediately, pulled every straw out of it through the hole with his fore-feet, which he could use like hands, and then took possession, never afterwards sleeping anywhere else. He used to hunt for mice outside and then inside a large coal-box. His movements were as quick as lightning, and when he caught a mouse, which he often did, it was just one crunch and over it went—bolted in a second. The men used to bring mice alive in small wooden traps, and on whistling or calling him, he would come out of his box, and they would let them loose in front of him, when he never failed to make short work of them. Though he was ordinarily tame as a cat, and went over all the place in very much the same manner as these animals do in a house, he was occasionally subject to savage fits. One of the men brought a large rat in a cage and let it out in a room in front of the mungoos, but he did not seem to take much notice of it at first. As soon, however, as he missed it,

he hunted round the room, and the rat, coming in the opposite direction, ran into him, when he gave it one bite across the head and settled it. The rat was then taken from him and thrown out of the window, when he went all over the place hunting for more, and presently his tail began to swell and his hair to stick out, and he gave two or three screams that had the effect of making one and all beat a hasty retreat; so it was thought better in future not to arouse the savage part of his nature. He used to be fed principally on cat's meat, as he preferred it to any sort of cooked food, and it was his custom to wait for me every morning at the top of the stairs for his breakfast. In fact, he used to come out once or twice a-day and stand looking at me with his head twisted on one side, when I would go to my pockets and see what I had got for him. He could, however, pretty well tell by smell what was there, as he was always sure to be around if I brought any bread and jam for tea. Jam he was very fond of, and esteemed it such a delicacy that it was never safe even in my pocket, as, if opportunity offered, he invariably helped himself. He knew well that he had done wrong on such occasions, and never put in an appearance till he thought the offence was forgotten. At dinner-time and tea-time he was always on the look-out. As soon as he heard the arrival of the tea-man and the cups begin to rattle, he came out of his box; and instead of coming in a direct line to where I was sitting, he would make a complete circuit of the room, and end by jumping into my lap, turn himself on his back, and commence snapping and biting like a puppy. I would lift him by the ear, the fore-feet, and the tail, when he would catch hold of my fingers in his mouth in play. It sometimes happened, however, that when I pinched him too hard he returned the compliment with interest, and gave me a good bite, when he immediately made for his box. It was in this connection that I particularly admired the sagacity of the animal, for, besides keeping out of the way for a day or two afterwards, he would, when he ultimately came out, stand at a distance watching me with his head turned on one side to see on what terms we were, and if I put on an angry expression, without moving hand or foot, he was into his box again like a shot. He was very affectionate, and would come and hold up his head to have his

neck rubbed and other attentions paid him. I had him for nearly three years, and was very sorry indeed to part with him; but as I could not leave him in the office during the recess, and daren't take him home, he was given to one of the boys, box and all. He was taken by him to a tea-warehouse, but he felt the cold there so much that he used to get into the oven whenever he had the chance, no matter how hot it was at the time. As might be expected, he did not long survive in his new situation, the cold ultimately proving too much for him. I was very grieved to hear of his death, as in my large circle of pets he was, I think, one of the most interesting."

Here endeth my friend's letter, and I have only to add that the history of this mungoos exemplifies in a striking manner the irony of fate. Instead of living in the odour of sanctity, and being laid in sacred repository like his kindred, he shuffled off this mortal coil in a London tea-warehouse, and his last resting-place is unknown to history. Let us, however, hope that his trials are ended, and that he has now passed to some happy hunting-ground where mice and rats and every manner of reptiles abound, and where the temperature is hot enough to satisfy even the constitution of a mungoos.

[In illustration of the above paper, a stuffed specimen of the ichneumon or mungoos was kindly lent by Mr Small, bird-stuffer, George Street.]

VII.—*A FEW NOTES ON BIRD LIFE, ETC.*

BY MR A. B. HERBERT.

(*Read March 27, 1889.*)

MANY of you are aware that it is my custom to pay an annual summer visit to a country house in the centre of England where bird life of all kinds is strictly protected, and which on this account, among others, has to me peculiar attractions, and it has been thought that a few notes from observations there might not be altogether uninteresting. I never make

any claim to deep scientific knowledge, and you will therefore be kind enough to consider these remarks as merely a little bird-gossip.

On arriving at my native "cycle town," as it is now called, on the 1st of August last, as an experiment I told a cabman that I wished to go to the residence of the man most esteemed and respected in that neighbourhood, and asked where he proposed to put me down. He smiled, thought for a moment, and then named correctly my destination—for I may mention that my old friend and host, besides being a great lover and protector of birds, is not unmindful of the wants and desires of his fellow-creatures, but is actuated by a wide philanthropy, and is consequently well known to all. Among many acts of benevolence, he has provided a drill-hall for the volunteers; and a few years ago he bought a disused jail and converted it into a free library, to which he is now adding a large reference library.¹ I happened to mention this curious mutation in the uses of property to that large-hearted man amongst us, Dr Walter C. Smith, who made an observation highly characteristic of him, and which I know will meet with a warm response from you all. He said, "Oh that we could convert all our jails into free libraries!" When residing with my greatly valued old friend, who is much my senior, I always sleep with an open window, in order that I may listen to the birds in the early morning—for, in the words of Richard Jefferies, "it is sweet, on awaking in the early morn, to listen to the small bird singing on the tree." One of the first sounds is usually the very pleasing twittering warble, followed by that long-drawn-out cadence of the swallow—notes always associated with bright summer days. These are followed by the cooing of three species of wild pigeons, all of which breed in or near the garden. There is the universally known note of the cushat, then the short jerking coo of the stock-dove, and at intervals the low murmuring or purring coo of the turtle-dove. The latter always reminds me in some degree of what is called "the Dutchman's organ"—that

¹ A similar case has just occurred in the town of Selkirk, where Mr T. Craig Brown, the historian of Selkirkshire, has bought the old town jail, fitted it up as a library and reading-room, and presented it to the inhabitants on the condition that it should be upheld under the Free Libraries' Act.

is, the croaking of frogs—except that if you stand beside a pond where a concert of these creatures is taking place, you find they do not all croak in the same key, and therefore there is a certain want of harmony, while the low murmur of the turtle is always pleasing. I was not aware till recently that this bird often builds very near the ground. I saw a nest last year in a thick hedge not higher than five feet; and I see that the Rev. Richard Lubbock, author of ‘*The Fauna of Norfolk*,’ calls attention to this habit, saying, “It is content to place its nest much nearer the ground and in a much smaller tree than the ring-dove affects.” The turtle is readily distinguished in its flight from all the other Columbidae by the white tips to all the tail-feathers: when the bird spreads out its tail on settling, this white line is very conspicuous. The most common bird about the house in the summer is the fly-catcher: there are always several nests of them in the garden. Magpies strut about in the fields near the house as though the place belonged to them; and so it does, as far as all usufruct goes, for they are not interfered with. Willow-warblers, chiffchaffs, garden-warblers, four species of tit, and most other common birds, abound; and a very favourite bird with my friend is the blackcap, whose song is inferior only to that of the nightingale. I saw a blackcap in the garden last year making a hearty meal on the ripe red berries of the honeysuckle. I am sorry to say the nightingale is seldom heard there now, though some years ago, when I lived on the adjoining property, one reared three young birds in my garden, and I well remember that the nest was made almost exclusively of bits of matting used by gardeners for tying up trees. I gave the nest, after the young birds had flown, to our surgeon, Mr Troughton—the gentleman mentioned by Mr S. Grieve in his book, ‘*The Great Auk or Garefowl*’—who wished to have it for his collection. The little tree-creeper had her nest behind an ivy bough growing up one of my friend’s avenue trees. I stood close to her as she passed in several times with food for her young: this seemed to consist mainly of small black flies. The long-tailed tit had her beautiful domed nest in a hedge within twenty yards of the front door. But the birds to which I propose to direct your attention by a few remarks this evening are the gold-crested regulus, the

cuckoo, the hawfinch, the kingfisher, the crested grebe, and the green woodpecker.

The gold-crest,—“that mere shadow of a bird,” as Gilbert White calls it,—which braves our severest winter, is a frequent visitor to my friend’s forty-feet-high Wellingtonia and the large deodar near the house, and I have no doubt builds there. There was once in my garden a nest of these birds in an arbor-vitæ, when a violent gale blew the nest to pieces. The parent birds were in great distress, and the poor little helpless young, only about half-fledged, were clinging with their small claws to the shreds of their habitation. When I witnessed the disaster, I ran into the house for a very small basket, and in this collected as neatly as possible the fragments of the nest, and placed the little creatures in the centre. I fixed the basket in the tree, and had the satisfaction of seeing the parent birds come close to me with food for the brood, which were successfully reared without further mishap. The gold-crest is one of our earliest spring song-birds, and has, as Yarrell says, a soft and pleasing song. Last month, while resting in the Botanic Garden of our own city, one came very near me, and sat singing on a fir bough for some time. I know no bird so fearless of mankind, and yet it is the smallest bird indigenous to these islands. Gold-crests are supposed to be more numerous in England in winter than in the summer, very large migrations of them coming to our shores in the autumn. The nest is generally suspended very cleverly from a fir bough. Colonel Montagu records having kept a nest of eight young ones in his room for some time, and noticed that the female came with food to them on an average thirty-six times in the hour, and this continued for sixteen hours. The male would not venture into the room, yet the female would feed her young while the nest was held in the hand. I once found a young gold-crest fluttering along the ground, but unable to raise itself out of the reach of cats, so for safety I took it into the dining-room and placed it near the open window. The old bird came fearlessly into the room and fed it all afternoon, and in the evening I placed it at some elevation on a fir bough outside. The accounts of the migrations of these diminutive birds are very interesting. The late Mr Robert Gray states that large flights of them

make their appearance suddenly in April, and actually swarm in some parts of Haddingtonshire. He had seen them arrive at Dunbar about daybreak, and on reaching the shore cling to the rocks and walls in search of insects. They were exceedingly tame after their long flight, and on one occasion he caught one with his hat. He further states that in autumn similar flights are observable coming from the surrounding country coastwards; and in 1847 a large flock of these little creatures took possession of a cabbage-plot, and looked more like a swarm of bees than a crowd of birds. On every plant there were half-a-dozen or more perched, some busied looking for insects, others bathing in the rain-water collected on the broad leaves. He walked through the plot, and with a butterfly-net caught ten or twelve specimens: some of these lived in confinement for a fortnight, and were supplied regularly with insects. They became tame almost immediately, and were allowed the full use of an attic facing the sea which they had intended crossing. They frequently perched on his hand, and were most interesting pets; but a single night's frost killed them all. In the report of the Migration Committee of the British Association there is an account of the enormous numbers of these birds appearing at various times at Heligoland. They are described as being seen there by hundreds upon hundreds, sitting about on every available spot on the lantern of the lighthouse, and preening their feathers in the glare of the lamp. It must be a matter of wonder how these and other birds, to whom, when in captivity, frost is so inevitably fatal, manage to exist in our severe winters when at liberty, and where they get shelter during night. I have observed that bullfinches in captivity often perish from cold, while the goldfinch appears not to be in the least affected by a frost which covers his drinking-water with ice. We should have thought the bullfinch the hardier bird of the two. In a long life of seventy years, I have only once met that rare and beautiful bird, so nearly allied to the gold-crest, the fire-crested regulus (*Regulus ignicapillus*), and this was at Allesley, in Warwickshire. The crest is a brilliant red, and I thought the bird rather larger than its congener.

I shall now make a few remarks on the cuckoo. At a short distance from the damaged gold-crest's nest before mentioned,

I found a young cuckoo in a hedge-sparrow's nest in a thick holly hedge. When I first discovered it, the bird just filled the cavity of the nest, but as it grew the nest would not hold it, and became a small platform on which the bird sat. I think there never could be a more exacting and troublesome offspring: it was whining all day for food, and kept the poor little accentors very hard at work to supply its cravings, and I was not sorry to see it one day fly across the lawn, and to know that their labours were nearly over. My friend is in the habit of inserting in the local papers what he terms his monthly weather letter, giving a report of temperatures, rainfall, &c., and in this he introduces any peculiarities in bird life which come under his notice. In this letter of last December is a curious incident regarding the cuckoo, told him by a mutual friend of ours upon whose veracity we can rely, which, with your permission, I shall read. It shows that the instinct of the cuckoo in selecting a nest for her egg is not always unerring. He says: "I may venture to repeat a curious case of the involuntary detention of a cuckoo which was related to me by the late David Smith. In the month of October David was surprised to see a couple of redstarts, which should have taken their departure long ago. He stayed to watch them. They were taking food to a hole in an old willow, which they entered as though they had a nest and were feeding their young. Approaching this hole, he was still more surprised by an extraordinary hissing sound, which he could not make out. Determined to solve the mystery, he fetched some tools and cut open the stump. He found an imprisoned cuckoo, which had grown too large to allow of the possibility of escape by the hole which formed the entrance to the nest. The bird had become crushed and deformed, having no more room to grow, and completely filled its narrow home. The poor little redstarts had stayed to feed the thankless prisoner, which never got the use of its limbs, and did not long survive its release." We naturally wonder how the egg which produced this young cuckoo was laid in this limited space in the willow, as it was utterly impossible for the old cuckoo to have got in there; but it is now generally admitted by close observers of the habits of birds that the cuckoo frequently, if not always, lays her egg on the

ground, and carrying it in her mouth, deposits it in a nest; and there is a case recorded where a cuckoo was shot while so conveying her egg. The only cuckoo's egg I ever found was in a hedge-sparrow's nest in a very dense bush. I do not say in this instance that it would have been absolutely impossible for the parent bird to have got into the nest, but it would certainly have been with very great difficulty. Young cuckoos are very unlike the mature birds in colour: they are brown, of a shade somewhat like that of the woodcock, and do not obtain the bluish-grey colour till their first moult. My favourite place for reading and observation at Stoke, during the absence of my friend on magisterial or other business, is a summer-house facing a long gravel-walk in the garden—a quiet, retired spot among the trees, having on either side a very large *Pinus pinaster*. In front of the summer-house I always scatter in the walk hemp and other seeds to attract the birds, so that I am seldom there without company. One day in August, while reading there, a squirrel came down one of the pines close to me and trotted off straight to the fruit-garden, where he would doubtless find plenty of suitable food. Preparatory to another visit from him, I put a number of nuts in a low fork of the pine, and sitting there the next day, I heard the well-known call of the nuthatch, and soon saw the bird creep down the tree and stick a nut in the rough bark, and cleverly open it in the manner mentioned by me in a former communication to our Club.¹ This bird came daily for nuts during my visit, and I showed my friend the nutshells studded about in the bark crevices. The nuthatches are great favourites with both of us, being always so peculiar in their habits, and so active and cheerful; and they are unlikely to leave that locality while there are so many fine filberts in the Baronet's garden close at hand. I have never found the nest of the nuthatch, but it is said that they often breed in holes made by woodpeckers, and if the entrance is large they partially fill it up with clay.

I shall now speak of the hawfinch. On my first walk last year with my friend through the vegetable garden, I noticed that some pea-pods were split open in a manner peculiar to the operations of the hawfinch, and I soon saw that a pair of

¹ See 'Transactions,' vol. i. p. 184 (Sess. 1883-84).

these birds paid daily visits there. Most birds which eat peas are content to peck a hole in the pod and extract the pea, but the hawfinch proceeds in a far more wholesale and effective manner. With his powerful bill he tears the pod from end to end, and clears out all the contents, the pod having the appearance of being cut open with a blunt pair of scissors. Now many persons, on seeing these pods, would at once say, "Oh, these birds are very destructive, and must be destroyed." Not so with my kind host: his principle is, "Live, and let live;" and while we could have daily any quantity of fine marrow-peas for dinner, we could see no reason why the beautiful hawfinches should not participate in the luxury. The hawfinch, like the turtle-dove, is readily distinguished from all other finches, while flying, by the conspicuous white tips to the tail-feathers. Its mode of flight much resembles that of the chaffinch. They are very shy birds, and on the least alarm usually fly to high trees. They remain in England throughout the year, but are of very rare occurrence in Scotland. They used to breed in my garden in Warwickshire, and fed much in the winter on laurel berries, the stones of which they readily broke with their powerful bills.

I must now say a few words on kingfishers, the most brilliant of all our British birds. They are not uncommon in Warwickshire. There is a small stream running through the garden at Stoke, in which I have successfully introduced the Cape pondweed (*Aponogeton distachyon*). The rich almond scent of the flowers of this plant many of you may know as so delicious in the pond at the Royal Botanic Garden. This stream abounds with minnows, and consequently is much frequented by kingfishers. One year there was a nest of them in a gravel-pit on the property, at some distance from water. These birds are well protected on the Combe Abbey estate, only three miles distant, and build regularly near the decoy there, and I was informed that they often have two broods in the year, and as many as six young at a time. I scarcely know any bird of more rapid flight than the kingfisher; and when we consider their dartlike flight, we cannot wonder at the sad fatal accident which befell one of them at Stoke last August, a few days after I left. My friend gives the details in his monthly letter to the papers, thus: "Last Sunday a

pair of kingfishers, probably one pursuing the other, dashed themselves against my dining-room window at Stoke. One was picked up quite dead, and the other so completely stunned as to be nearly incapable of moving or showing signs of life. I laid him on the grass, and in about a quarter of an hour he recovered sufficiently to fly away. They were both young birds, but in very good plumage. A kingfisher once similarly dashed itself against my dining-room window in Priory Row"—*i.e.*, in the very centre of the town. "In each case there is another window in the room, so that the birds would see the daylight, and might suppose there was a passage through." I well remember the incident in the town to which my friend alludes, and that the bird recovered, and he carried it out of the town and restored it to liberty. It adds somewhat to the pleasure of our frequent rambles together along the river Sowe in that neighbourhood, to know that we are certain to see one or more of these splendid birds dart by us, or hover over the stream in the bright sunshine. Kingfishers, I need scarcely say, are rare in Scotland. I have seen only two in twenty-three years—one between Roslin and Polton, and another on the Keltie, near Callander. Mr Speedy informs me that two years ago a pair frequented the Pow burn, but were cruelly shot, much to his regret and annoyance.

In the winter of 1887-88 a few pheasants appeared frequently in the garden at Stoke, and the gardener reported that they had pecked up many crocus roots; but we agreed that a fine cock-pheasant strutting on the lawn was a beautiful object to look upon, even if the crocuses were consequently less numerous: so the birds were not scared, and some Indian corn was scattered about, as being more attractive to them than the bulbs, and a hen-pheasant evinced her confidence in the protection afforded by hatching her young, last summer, in the bank of the garden hedge, and I learn that the birds were there again during last winter.

We went occasionally for a few hours' fishing in the lake in Combe Park. It is a large sheet of water, extending for about half a mile from the Abbey walls, having the deer-park on one side and plantations on the other; and the bird life there under strict protection is always interesting. There is a heronry on an island, and I was glad to learn that the birds

have of late so much increased in numbers that the trees on the island are insufficient for them, and nests are now built in trees on the mainland. You may often see as many as thirty or forty of these handsome birds together there. Combe Pool is the only large expanse of water situated just in the middle of England. Warwickshire is often designated the heart, and Corley Hill in it the backbone, of England; and though this hill is only some 550 feet above sea-level, it is a singular fact that two small streams, not a mile apart, have their origin there, one of which, taking a north-easterly course, finds its way into the Humber; while the other, running in a south-westerly direction, flows into Shakespeare's Avon, and on to the Bristol Channel. The whole district forms part of the ancient and extensive forest of Arden, and many large old pollard oaks are yet standing—

“ Whose boughs are mossed with age,
And high tops bald with dry antiquity,”—

which are believed to have formed part of this forest. The name is still retained in the two villages of Hampton-in-Arden and Henley-in-Arden—places some twenty miles apart. No doubt Shakespeare was well acquainted with the latter. The “woodmen of Arden” still exist in the form of a well-known county toxophilite society, who hold their annual ward-mote in Packington Park, near Meriden. In the summer of 1887 the High Sheriff of the county conceived the happy idea of having the play of “As You Like It” performed on the actual site of the forest, at his residence near Stratford. A first-rate company was engaged, and most of the county families were invited. The audience attended in gay summer dresses; the stage was a spacious lawn; the performers emerged as required from glades among the shrubs and trees; and the *tout ensemble* was, I believe, most enchanting, and extremely picturesque.

Combe Pool being so central, forms a temporary resting-place to many sea-birds crossing England, gulls occasionally visiting it. I have often regretted I did not obtain from the late head-keeper, who lived there all his life, some account of the rare birds at various times shot or seen by him; but I well remember his account of an osprey, which, as a stuffed

specimen, ornamented his room. He was crossing the Pool with his gun when this strange bird flew over him. He fired and broke its wing, and it fell into the water. On getting it into the boat, he threw a handkerchief over its head to prevent being pecked; and holding it in one arm, he commenced paddling the boat to shore with the other. But he soon found the bird had other offensive weapons besides its beak, for he had not proceeded far before he felt the talons of one foot penetrate his thigh, and on moving a little, in went the claws of the other foot into his other thigh, and the blood soon began to ooze through his trousers. In this peculiar fix he paddled to the shore and obtained assistance. He tried to keep the osprey alive, but was unsuccessful, and it was after this adventure with the osprey that the keepers were forbidden by the noble owner of the estate to kill any strange birds appearing on the property. This prohibition has continued up to the present time, and I know that subsequently, for several years in succession, a pair of peregrine falcons regularly spent the winter there, feeding on the wild ducks and coots, &c., frequenting the pool. On our fishing excursions to Combe we always took a field-glass; and one day last August we saw five birds on the water which we were certain were none of the ordinary wild-fowl. We soon made out that they were a family of crested grebes (*Podiceps cristatus*), two old and three young ones, the latter more than half-grown. While we were noticing them through our glass, one of the parents, after several long dives, came up near us carrying a small fish. He looked about for his family, and after several long dives, still retaining the fish in his bill, he emerged close to them, and placing the fish in a young one's bill, who bolted it whole, went off again for more sport. We did not see these birds fly or swim far on the surface—indeed they seldom either fly or walk, and there can be no doubt that diving is their natural mode of progression. In flying, they would have the exertion of supporting their body on short and not very powerful wings, and could use wings alone; on the surface, the legs only could be used; but in diving, both legs and wings are brought into action. The nest where the young grebes were hatched was curious. It was made of reeds and rushes, and floated on the surface, but

was kept from sailing away by being intertwined with the thin twigs of an oak bough which hung into the water, the upper overhanging branches of the tree forming a screen from sun and rain. It was an ingenious structure, and well put together. I have never before seen crested grebes in the county, though I once shot a little grebe or dabchick (*Podiceps minor*) in a tributary to the Avon, and have on several occasions seen them in that river between Leamington and Warwick.

One Sunday afternoon we walked over for a ramble in the Abbey Gardens, where flowers, fruit, and vegetables are grown in the greatest perfection, the grapes almost rivalling those at Clovenfords. On our way across the deer-park we came upon a flock of more than fifty Canada geese; and as I always enjoy the sight of their rising in the air, we walked towards them. They let us get very near, and then rose in a body, uttering their strange, musical, clarion-like notes, so different from the call of any other of the anser tribe, and taking a long circuit round, settled on the pool. I noticed a plant in the gardens which much interested me: it was by far the finest specimen I have ever seen of the Japanese brier (*Rosa rugosa*). It must be ten or twelve feet high, and covering a larger space in diameter, and had a great profusion of its large-petalled, handsome, single, crimson flowers. These are followed by large, orange-coloured, globular fruit; and its glossy, rich green foliage, I think, surpasses that of any other rose. I have often thought what beautiful hedges these roses would make, and from their very thorny nature they might perhaps be a good fence against sheep. Two years ago a member of our Club sowed a row of the seeds for a hedge across his garden, and I see the plants are now about eighteen inches high, and making excellent growth. These seeds are now articles of commerce, and are advertised for sale.

We noticed one day a strange coincidence between animals of very different natures. It was a very hot day, and we were standing in the avenue admiring two fine heifers lying in the shade, when I remarked how terribly they were tormented with flies, which were in large clusters at the corners of their eyes, and evidently causing the creatures much annoyance. After a few minutes we saw two young cocks walk up from the

farm, and one went to each animal and commenced at once to peck off the clusters, and from their deliberate manner of proceeding we believed it was not the first operation of the kind. The cows remained perfectly still, and it struck us as a strange instance of mutual benefit. The birds got a good meal of insect food, and the cows were relieved of an intolerable pest.

My friend wished to see some pictures and sculpture at the Italian Exhibition, being himself an artist of no mean ability; so we went together for two or three days' sight-seeing in London, visiting the Zoological Gardens, Kensington Museum, &c. I then went on a visit to my nephew in Somersetshire—a county quite a *terra incognita* to me. I was there told to look out at my bedroom window in the morning, when I should probably see some interesting birds; and accordingly, while dressing, a fine green woodpecker came on to the tennis-court, followed by a nearly full-grown young one. The old bird at once began to thrust her long beak into the turf and wriggle it about: this brought up numbers of ants, which she very adroitly picked up and gave to her offspring, traversing the whole length of the edge of the court, and this she did regularly every morning during my visit. I chanced to find a flower-pot full of soil in which was a strong colony of ants, many in their winged stage. In the evening I turned the whole contents out in the form of a pyramid on the court, ready for the woodpeckers' breakfast, but when I looked out in the morning I saw a starling very busy upsetting my pyramid. He was not, however, allowed to remain there many minutes; the woodpecker came soon and drove him off, and had a hearty meal. The gardener complained of the unsightliness of the perforations from the birds' beaks on the lawn, but as these would disappear after a shower of rain and rolling, we would not have the birds disturbed. There can be no doubt that ants enter largely into the ordinary diet of woodpeckers; but you may see them often settle against the stem of a tree, and after giving it several sharp raps, remain perfectly motionless, waiting for the appearance on the bark of any insects they have disturbed. Green woodpeckers—"yaffles," as they are called—are not uncommon in Warwickshire, Worcestershire, or Somersetshire. In a lady's garden near Temple Cloud I met with a

shrub quite new to me: it formed a large bush about ten feet high, with a stem about eight inches in diameter, and covered all over with pendent nuts enclosed in a thin envelope, very like the Cape gooseberry. The owner did not know the specific name, so I brought a bough to Mr Lindsay, Curator of the Royal Botanic Garden, who at once pronounced it the *Staphylea pinnata*, or five-leaved bladder-nut, indigenous to the South of Europe. I learn that the nuts, being hard and smooth, are strung for beads, and used by the poor in Roman Catholic countries in their devotions. Parkinson says, "It groweth in many places in this land, as at Ashford in Kent and at Milton near Cambridge." I hoped to have driven over to Cheddar Cliffs, and procured some plants of the pink (*Dianthus cæsius*) peculiar to that locality. A botanist whom I met told me it had one advantage over our *D. deltoides* in being very sweet-scented. But the day fixed for our excursion there proved a perfect deluge, so my nephew consoled me by stating that both cliffs and pinks would keep till my next visit! I found Somerset a most charming county, and I would strongly advise any one going to the South-west of England, by all means to take the new Severn tunnel route. You turn off to the right at Crewe, and pass through a fine country thence all the way to Bristol, the counties being Cheshire, Shropshire, Monmouth, Hereford, and Gloucester—getting into the valleys of the Severn, the Teme, the Wye, the Lug, and the Usk, going by a long tunnel under the Severn as you approach Bristol.

My recent visit to Bristol brought to my remembrance my former journey to that ancient city, as nearly as I can remember just half a century ago, and with a few remarks on that visit I will conclude these rambling notes. It was a visit remembered from two incidents—one, as to my travelling companion; and the other, as fixing an important date in the history of steam navigation. It was during my legal clerkship at Worcester that I was sent on professional business to Bristol in the night-mail. I had only one travelling companion, rather a stout man, who, wrapping himself in his cloak, went fast asleep. I alighted to see the horses changed at Tewkesbury, when I noticed a man with some letter-bags look into the coach, and then go to the guard and remark, "I

see you've got the Devil with you to-night." "Oh, yes," the guard replied, "we're taking him down to Bristol." These remarks naturally excited my curiosity, as I had not observed anything super- or rather infra-human in my companion. However, the mystery was solved a few months afterwards, when the guard of the Aberystwith mail got into difficulties through dishonesty, and I was sent to have an interview with Mr John Bull, the Government inspector of mails, on the subject, and in Mr Bull I at once recognised my quondam fellow-traveller. I can only say I found this "prince of darkness" civil, even courteous, and, as he is proverbially said to be, "a gentleman," though the erring guard whom he dismissed from the service might not coincide with my opinion. The other incident was, that I found a crowd on the quay at Bristol looking at and discussing a steamer just arrived, which proved to be the Great Western—the first steamer which ever crossed the Atlantic, and then just returned from her first voyage. Some were sanguine enough to prophesy that a regular monthly steam communication might be established between the two countries, while others held the utopian idea that it might even be weekly; but look what is the case now, and who can say what may happen in another half-century? The power employed will probably not be the direct action of steam: it may be compressed air, or a series of gas explosions, or electricity, or some other as yet unknown or undeveloped power. I do not suppose the passage will be submarine—it may still be on the surface, or perhaps a pleasant aerial voyage, terminating in a Baldwin landing!

The last indoor meeting for the Session, held in the Hall, 20 George Street, on the evening of Wednesday, the 24th April, was almost wholly taken up with a Lecture delivered to the members of the Society and their friends by Dr Alex. Edington, Lecturer on Bacteriology, on "Bacteria—what they are, what they do, and what they may suffer." This lecture, which was illustrated by diagrams and by numerous "cultivations," was much appreciated by all present, and a hearty vote of thanks was accorded to Dr Edington for his kindness and courtesy in delivering it, and for the trouble taken to illustrate it in such an interesting manner.

VIII.—*In Memoriam: JOHN ALLAN.*

BY MR JOHN LINDSAY.

(Read Jan. 23, 1889.)

It was with a painful sense of surprise that, a few days after our first meeting for this Session, the members of the Society read in the daily papers the announcement of the sudden death of our fellow-member and Councillor, Mr John Allan. He was with us on Wednesday, the 28th of November last, when the President delivered his opening address: on the Saturday following he went to Easter Middleton, near Gore-bridge, where his wife was an invalid at the house of her parents:¹ while there he was suddenly prostrated by sickness, on the evening of his arrival, and died the next day, after a few hours' illness, of acute inflammation of the brain. On Wednesday, December 5—one short week after our meeting—Dr Macfarlane and I accompanied the relatives to Carluke, where loving hands laid him to rest side by side with his kith and kin in the quiet village churchyard.

John Allan was born on July 12, 1845, at Carluke, Lanarkshire.² His father, John Allan, was a farmer, and owned the farms of Tanhill and Windyha', near Carluke. Shortly after the birth of a younger child—a girl, who died in early life—his father died, and the widow was left alone in the world with her boy. He was sent to the parish school at Carluke, then taught by a Mr Barrie; and on that gentleman being appointed head-master of the Grammar-school at Dalkeith, John Allan proceeded thither, boarding in the school-master's house. While here his boyish love for Nature was much quickened by new scenes and surroundings, and the Saturdays were generally spent in roaming about the banks of the Esk, or in excursions to some of the picturesque places in the neighbourhood. Returning home when school days were over, a profession had to be decided upon. Seeing he came of a race of farmers, and that his father's farms (to

¹ Mrs Allan died, after a long illness, on August 2, 1889.

² For the facts in this short memoir regarding the early life of Mr John Allan, I am much indebted to Mr Thomas Walker, Middlehouse, Carluke—a relative of Mr Allan, and his companion in many a botanical ramble.

which the adjoining farm of Middlehouse was added in after years) were his by inheritance, one would have naturally expected that the young lad would now have adopted the life of a farmer. But, for some reason, the legal profession was chosen instead, and accordingly he became a law-apprentice in the office of Mr Davidson, solicitor at Lanark, when, after remaining there a few years, he left to push his fortune in Edinburgh. He secured a place in the office of Messrs Macallan & Chancellor, which firm was subsequently merged in that of Messrs J. & F. Anderson. Mr Allan now began attendance on the law-classes of the University, in order the better to fit himself for the duties of his profession, and continued a member of these classes for three years. When Messrs Drummond and Reid withdrew from the firm of Messrs Hill, Reid, & Drummond, to found a new firm, Mr Allan joined them; and here he continued for the remainder of his life, highly respected by his employers, and filling positions of trust in the firm.

The summer and autumn holidays of each year were spent by Mr Allan, before his marriage, in excursions to distant places at home or abroad. Various parts of Scotland, England, and Ireland were thus visited, while longer journeys were also made to France, Germany, Holland, Belgium, and Norway. Many pleasant recollections of these places were stored up in his memory, and it was his great wish to revisit some of them. Paris was seen after the havoc wrought by the Commune, and when order had just been restored; and he would have liked to see it again, when the evidences of the perils it had passed through were all effaced. To spend a second holiday in Norway was specially desired by him, so much had the wild and romantic natural features of that country impressed him by their charms. But the death of his first wife, and the care of three young children, chiefly prevented the carrying out of these designs.

John Allan's love of the country, including especially his passion for flowers, dated, as I have said, from his school days. Indeed to such a sensitive nature it could hardly have been otherwise, reared in this upland district, in the retired little cottage, with its large and beautiful garden where numerous ferns and alpine plants were carefully tended,

and where he possessed the finest collection of roses for miles around. Until he left home to settle in Edinburgh, he was a frequent exhibitor at the Carluke annual flower-shows, often taking prizes. It was always a great delight to him to visit famed gardens or conservatories, at home or abroad. His own little greenhouse at Portobello was a perennial source of pleasure to him; while the garden there contained several of our rarer native flowers and ferns, gathered in botanical excursions. He had a wide and accurate knowledge of the British flora, and felt that keen sense of enjoyment in searching for plants which only a true botanist can experience. On two occasions lately he joined a few of the members of the Botanical Society (of which he was also a member) in their summer camp,—first at Applecross, Wester Ross, in 1886, and next at Glenure, Argyllshire, in 1887. A paper on the former of these, entitled “Jottings on a Ramble in Wester Ross,” was read by him to this Society in Session 1886-87;¹ while the Report to the Botanical Society on the results of the same visit was the product of his pen.² Both of these summer holiday-excursions were keenly enjoyed by him,—especially the former, to Applecross, where mountain, loch, and seashore were alike laid under contribution, and not only flowering-plants, but desmids, diatoms, the larger algæ, and zoophytes, were all collected and brought home, to form afterwards, as prepared microscopic objects, a source of constant delight. Living at Portobello, the seashore, with its characteristic botany and zoology, soon attracted him; and to the Report of the Botanical Society’s summer camp at Wester Ross, above mentioned, a “Note on the Algæ” is appended, most of the fifty species then collected having been gathered by himself. It was largely owing to his enthusiasm in this branch of natural history that several members of this Society were induced to give some attention to it. In Session 1885-86 two marine excursions were made, one to Granton and the other to Joppa, when Mr Allan drew up a short account of the latter, which is now printed in the first volume of our ‘Transactions.’³ Other marine excursions were afterwards made under Mr Allan’s leadership; and it is to be

¹ ‘Transactions,’ vol. ii. p. 23.

² ‘Trans. Bot. Soc.,’ vol. xvii. p. 117.

³ “Marine Excursions: Joppa”—‘Transactions,’ vol. i. p. 315.

hoped that, with our long stretch of coast-line close at hand, marine botany and zoology will not henceforth be neglected by the Society.

Of all that Mr John Allan was in private life I can hardly venture to speak. A kind husband and a loving father, he was also, to those who were privileged to know him intimately, a true and warm-hearted friend, high-souled in principle, with a feeling of aversion akin to contempt for all that was mean or self-seeking. As a companion in outdoor rambles, his acute and trained observation of natural objects was very marked; and those of us who shared these country walks with him, or wandered in his company by the sea-shore, or hunted in the rock-pools—now and then sitting down beside him afterwards over the microscope when home had been reached, to examine more carefully the treasures gathered—will not soon forget these pleasant hours. Alas! that they are all now but memories of the past.

I cannot close this short biographical sketch without observing that Mr Allan's connection with the Society furnishes a good illustration of the *raison d'être* of such societies as this. Everything pertaining to the observation and study of Nature is included in the rules of our constitution; and all who in any way have a love for Nature, and are actuated by a desire to become better acquainted with any of its manifold aspects, are welcomed as members. Thus many of our number are engaged daily in avocations which lie wholly outside of these studies; but by taking them up simply as a pastime, and as a relief from the daily routine of business, the health and vigour of both mind and body alike are sustained, and a pleasure in life is acquired which knows no satiety and never becomes uninteresting, but which often helps to brighten what might otherwise prove dull periods in existence. While the members of this Society owe a debt of gratitude to John Allan for the enthusiasm for the study of Nature, in some of its departments, which he helped to increase amongst us during the years that he was a member of it, there can be no doubt that he, on the other hand, was largely indebted to the Society for help and guidance in his scientific pursuits, and he would have been the first himself to acknowledge this indebtedness. Indeed it is this pleasant bond of helpful fellowship which

gives half the charm to the work of the Society, and it is earnestly to be desired that such a spirit, which "blesseth him that gives and him that takes," may long be dominant in it.

MEETINGS OF MICROSCOPIC SECTION.

DURING the past Session the members of the Microscopic Section met on the first and third Friday of each month, "for the examination of slides and micro. apparatus, and the discussion of different methods of work." It is much to be regretted that these meetings were not taken more advantage of by the members interested in Microscopy; and it is hoped that the resolution come to at the Annual Business Meeting, to consign the charge of the Microscopic work to the Secretary and Council of the Society, will prove advantageous. At the monthly meetings of the Society, microscopic preparations were exhibited throughout the Session by the following members: The Secretary, and Messrs Coats, Forgan, A. Fraser, Lindsay, Penman, Tait, and Wright. Mr Tait also contributed a paper of a practical nature on "Embedding and Cutting Animal Tissues."

ANNUAL BUSINESS MEETING.

THE Annual Business Meeting of the Society was held in the Hall, 20 George Street, on the evening of 23d October 1889, —Dr William Watson, President, in the Chair. The Secretary submitted the usual Report, from which it appeared that in all 15 meetings had been held during the past Session, 6 of these being indoor and 9 field meetings. The following are the dates and localities of these meetings—viz.:

INDOOR MEETINGS: 1888—November 28, December 26; 1889—January 23, February 27, March 27, April 24.
FIELD MEETINGS: 1889—May 4, Pepper Wood, Kirkliston; May 18, Palace Gardens, Dalkeith; May 29, Arthur Seat; June 1, Peebles; June 15, Elie; June 26, Duddingston Loch; June 29, Gordon Moss; July 13, Ben Ledi; September 7, Polton and Roslin.

The Treasurer's Statement showed that, including a balance from last account and special contributions made towards the Publication Fund, the income had been £80, 4s. 1½d., and the expenditure £70, 9s. 8d., leaving a balance of £9, 14s. 5½d. in favour of the Society. During the past Session 46 names have been withdrawn from the roll and 13 new names added, making a net decrease of 33, and giving a total of ordinary members at the close of Session 1888-89 of 190.

The election of Office-bearers was next proceeded with, when, after vacancies had been filled up, the complete list stood as under:—

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Dr WILLIAM WATSON.

Vice-Presidents.

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Council.

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Secretary and Treasurer.

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JOHN LINDSAY.

Auditors.

HUGH H. PILLANS; JOHN PAIRMAN, S.S.C.

The bye-law passed during the Session to admit life members to the Society on payment of £3, 3s. was confirmed, and made a law of the Society. It was agreed to merge the Microscopic Section in the general work of the Society, to be managed by the ordinary office-bearers—viz., the Secretary and Council. It was also remitted to the Council to revise the Laws of the Society, and to issue a copy annually to each member with the 'Transactions.' *Recd*

6 JAN 90



LIST OF PAST PRESIDENTS.

Dr ROBT. BROWN, 1869. Mr R. SCOT SKIRVING, 1869-1874. Mr WM. GORRIE } 1874-1877. (deceased), Rev. R. F. COLVIN } 1877-1879. (deceased),	Mr JOHN WALCOT, 1879-1882. Mr A. B. HERBERT, 1882-1885. Mr SYMINGTON GRIEVE, 1885-1888. Dr WILLIAM WATSON, 1888-1889.
--	--

OFFICE-BEARERS, 1889-90.

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Dr WILLIAM WATSON.

Vice-Presidents.

GEORGE BIRD. | WILLIAM FORGAN. | ARCHD. CRAIG, Jun.

Council.

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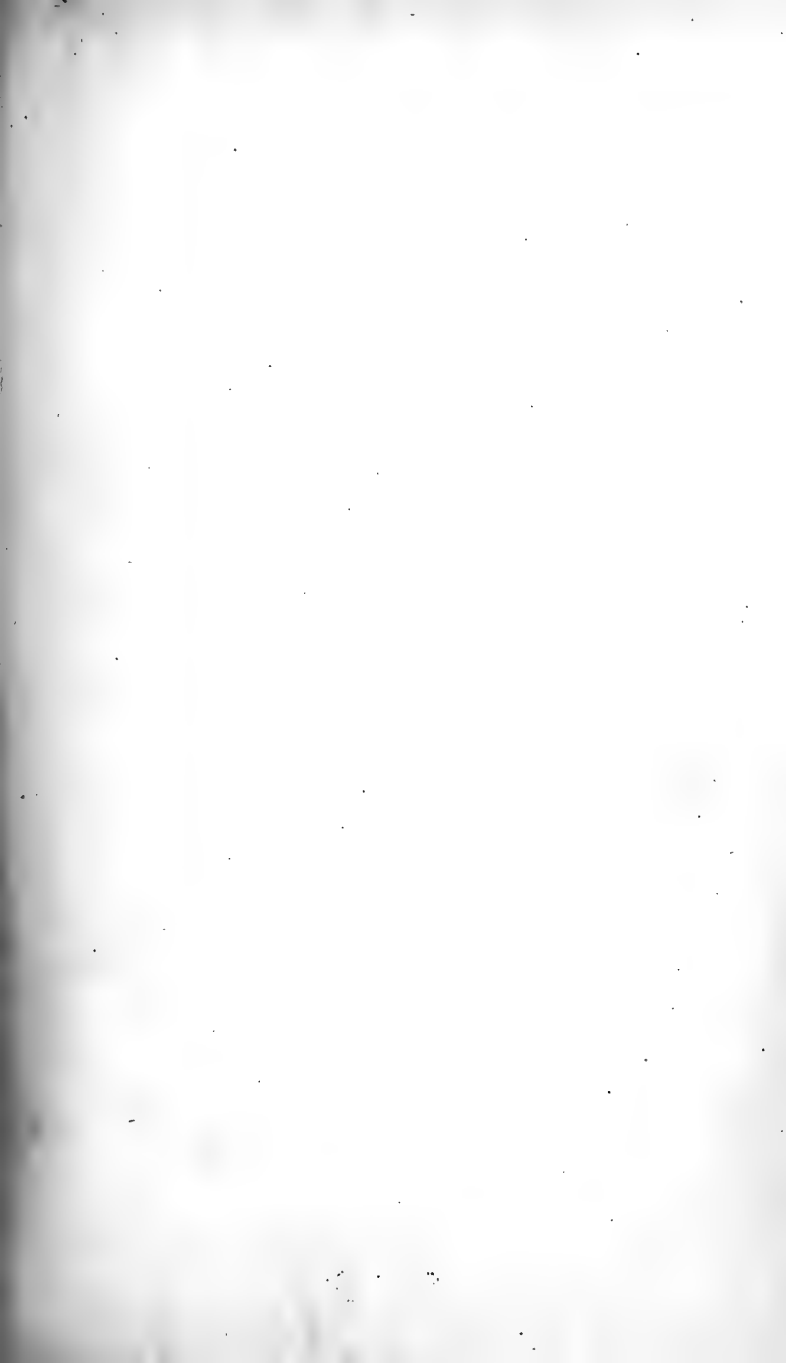
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 HOSSACK, B. H., Craigie Field, Kirkwall.
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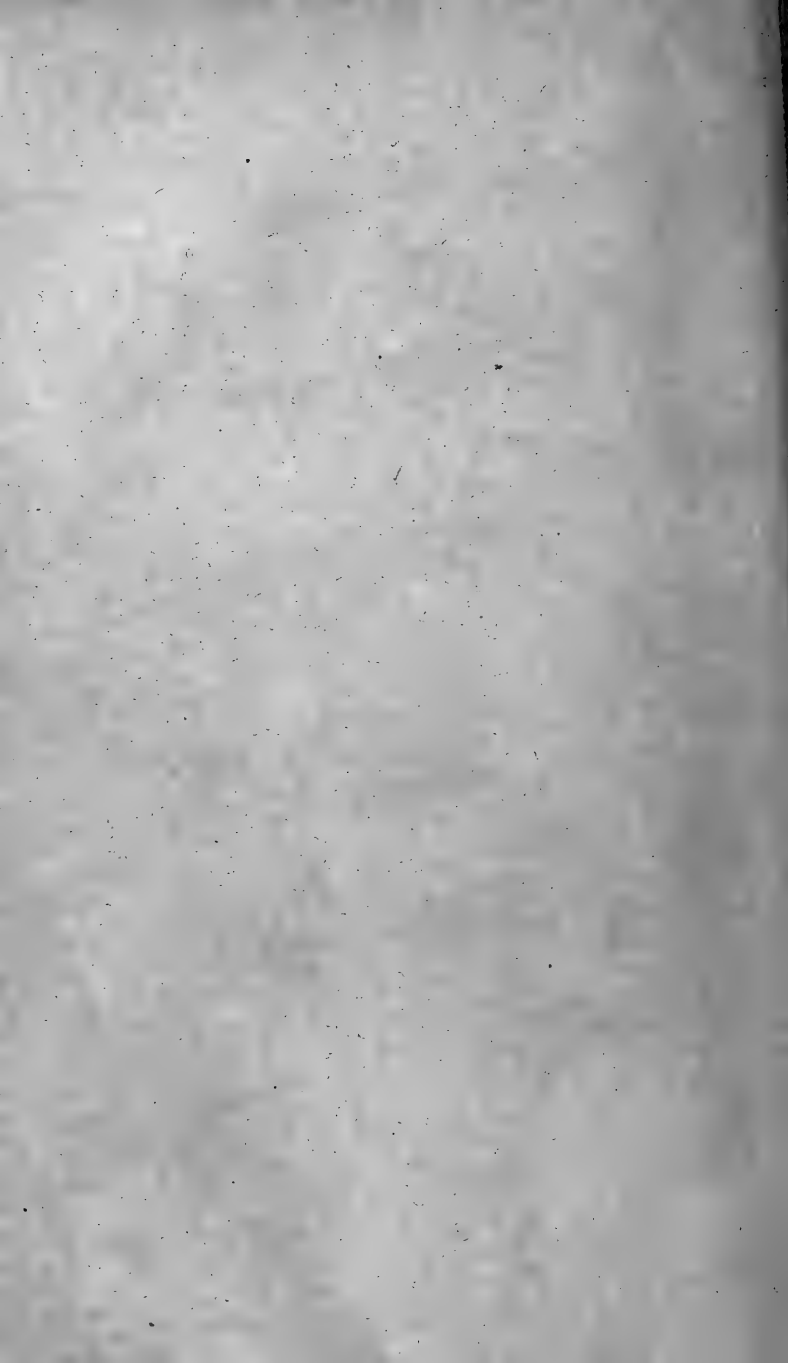
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TRANSACTIONS

OF

The Edinburgh Field Naturalists' and
Microscopical Society

SESSION 1889-90

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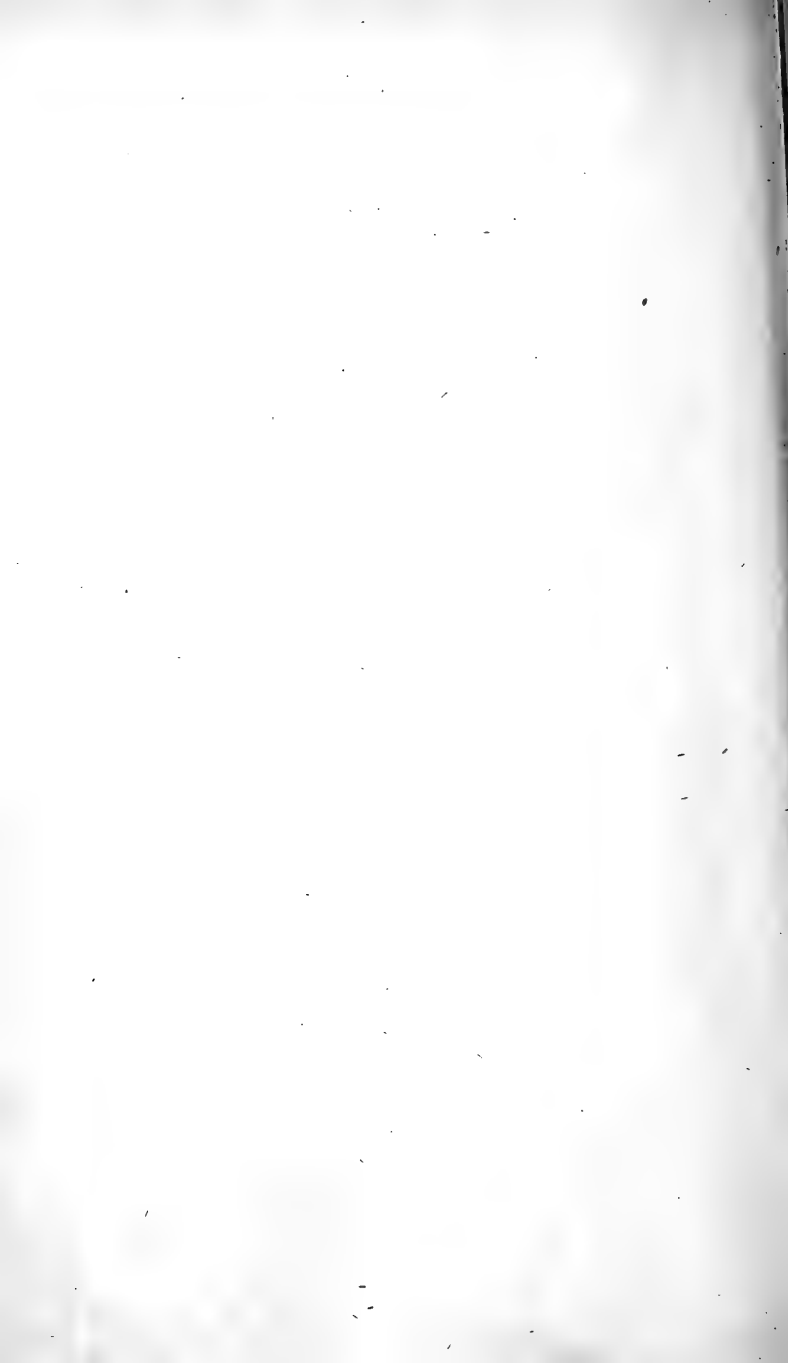
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I.—AN ACCOUNT OF GURHWAL, A DISTRICT
IN THE HIMALAYAS.

BY DR WILLIAM WATSON, PRESIDENT.

(Read Nov. 27, 1889.)

I HAVE chosen, as the subject of my introductory address, an account of Gurhwal, a country in the heart of the Himalayas. It is a district not often visited by Europeans, though the town of Naini Tal, the summer capital of the Lieutenant-Governor of the North-West Provinces, lies not far from it on the east, and the town of Mussourie, a favourite sanitarium, not far from it on the west.

Gurhwal, meaning "the land of forts" or "the land of streams"—both derivations are possible—is about a hundred miles long by some fifty miles broad. It practically consists of the drainage-area of the great river Alaknanda, one of the two great streams which unite to form the Ganges river. The drainage-area of the other stream, the Bagirathi, belongs to the native principality of Tehri, sometimes called Independent Gurhwal. British Gurhwal, of which alone I treat, is in the central part of the Himalayas, where the mountains are not so high as they are farther east; but it has many peaks in it over 22,000 feet. The best known are—Trisul, 23,382 feet; Nundadebi, 25,661 feet; Budrienath, 22,901 feet; and Kidarnath, 22,853 feet. Before the conquest of India by the East India Company, Gurhwal was a Hindoo principality, tributary to the Emperor of India at Delhi. During the period of confusion, when the Delhi empire was falling to pieces, and a new empire, whose capital was at Calcutta, was rising in its place, Gurhwal was conquered by the Goorkhas, a semi-savage tribe of Mongolian origin.

The King of Gurhwal was killed in 1803, and his family fled, to live in exile in the plains. In 1815 the army of the East India Company, consisting of three regiments of native

infantry, with some irregular troops, drove out the Goorkhas, to the great delight of the inhabitants. The East India Company kept to itself the greater part of Gurhwal, including the old capital, but restored the western part of the country to the representative of the old royal family. The evil days of the Goorkha government are still well remembered in Gurhwal. The common phrase for oppression is "Goorkha rule"; and when a man thinks himself injured, he generally says, "Have the days of the Goorkhas returned, that I should be so treated?" The natives are of mixed origin, partly Hindoo, partly Thibetan—the Hindoo element predominating in the south and centre, the Thibetan in the extreme north. There may also be an infusion of Mongol blood, but there is not, I think, much.

The language is almost everywhere Indian, Thibetan being only spoken in a few villages on the northern frontier. The dialect of Hindi spoken is called Nepauli, or more usually Hill language, and is a well-marked dialect of the great Aryan language, which is spoken across Northern India from sea to sea. Curiously enough, the words used in the hills are for the most part those of Western India, while the pronunciation is distinctly that of Bengali, as spoken near Calcutta. This is a strong argument in favour of regarding Hindi, Punjabi, Bengali, and the hill language, as being in reality only four dialects, not four languages. The only one, of the five daughters of Sanscrit, which has diverged so much from the others as to be entitled to be considered a distinct language, is Maharatti, the language of the south, though most people consider Bengali also to be a distinct language.

There are no towns in Gurhwal. The two largest places are the villages of Sreenugger, with 562 inhabited houses, and Joshimut, with 119 inhabited houses.

Sreenugger, the old capital, built on the banks of the great river, is a ruined city, chiefly remarkable for the four-storied stone palace of the old Rajas, built in 1358, the stone walls of which are curiously carved with Hindoo mythological subjects. Sreenugger has still, however, a traditional reputation as a seat of learning, and Dya Nand Shastri, one of the greatest of modern Hindoo thinkers, spent some years here studying Sanscrit. Poetry also is cultivated. When I was in the

village, a local poet of considerable reputation and great merit was singing the praises of a lady named Dhana Barula, and vowing that if she would not love him he would leave his native hills and settle in Bareilly,—exactly like a Highland poet threatening to leave Lochaber and go to settle in Glasgow.

Joshimut is the winter residence of the high priest of Budrienath temple. The temple is in the region of the eternal snows, and has to be shut up in winter, so the high priest has to go down to a palace, which stands about thirty miles down the stream from the temple. The village is an exceedingly beautiful one, built half-way between the river and a great forest of hazel-trees (*Corylus colurna*), called by the natives Kapasi. In the forest are quantities of the beautiful Kapasi bird (*Nucifraga hemispila*). Like most hillmen, the people of Joshimut have a good conceit of themselves and their village, and are constantly quoting a rhyme, "There is no water on earth like that of the Dandhara spring; there are no girls on earth like the girls of Joshimut."

In Gurhwal, five great rivers and many smaller streams join the main river, Alaknanda; and at each of the great junctions, called "preag," there is a sacred bathing-place much resorted to by Hindoos, both natives of Gurhwal and pilgrims from the plains. The five bathing-places are named going down—Vishnupreag, Nandpreag, Kurnpreag, Ruderpreag, and Deopreag. The whole land is a network of big rivers, the drainage coming into it from the east and west, as well as its fair share from the north. In order to cross these many rivers, the British have built a number of iron bridges, but in most places, rivers have to be crossed by native bridges. The most common of these is the *jhula*, which is made as follows: two strong ropes are stretched across the river, and a roadway is suspended from them. The traveller has to walk on this roadway a long distance, with the roaring torrent far below him. If he misses his foot and falls into the river, he is certain to be drowned. The strongest swimmer would perish in a torrent of ice-cold water, rushing along at a furious pace. As a rule, if a man falls in he is never seen again. The current sucks him in and he does not even once rise to the surface, however good a swimmer he may be.

Even in a calm day it requires some nerve to cross such a bridge. In a windy day, when the two ropes swing backwards and forwards with the breeze, it is something terrible to have to cross. The traveller, to ensure his safety, may try to lay hold of the main ropes with his hands; but this is only possible, or, at all events, only easy, in part of the journey. The two ropes, close to either bank, are too high above his head for his arms to reach them, and in the middle they are too low down—too close to his feet. In the better form of *jhula* there are four cables instead of two, the upper ropes being used as guiding-ropes, the lower to support the roadway. The ropes are frequently made of a grass named *Andropogon involutus*, but other materials are sometimes used. A second way of crossing rivers is in a basket called a *chinka*. One single cable is stretched across the river, and a basket is suspended from it. The traveller gets into the basket, and a man on the opposite bank hauls him across by pulling a string or thin rope attached to the basket. The basket, of course, runs along the cable. A third way of crossing rivers is by a bridge called a *sanga*. On each bank a series of planks are put,—one above the other,—each projecting a little beyond the one below it, till the two series nearly meet in the middle of the river, and then a single plank is thrown across to unite them. The ends of the projecting planks are fixed in stone piers, built on each side of the river. Usually the *sanga* is two or three planks wide, and sometimes it has a railing on each side. Cattle and sheep can cross it much more easily than they can cross a rope-bridge. The fourth kind of bridge is a tree, or a single plank, laid across a stream. Nothing surprised me so much as to see the fearless way with which the people of Gurhwal—men, women, and children—crossed these bridges. Of course many accidents occur, but nobody seems to think anything about the danger.

The inhabitants are not divided into many castes, like the people of the plains. In Gurhwal, there are only three castes—(1.) The Brahmins, who alone can be priests in the temples, and who also have got possession of all the Government posts. They are the local judges, magistrates, doctors, schoolmasters, and postmasters. (2.) The agriculturists, who call themselves *Bishts*, and who are called by Europeans *Rajpoots*.

They form the bulk of the community, and include almost all those who own land and farm it. (3.) The *Domes*, which includes the tailors, shoemakers, blacksmiths, workers in the iron and other mines, and, in short, everybody except the priests and the agriculturists. It is quite absurd the contempt with which Brahmins and Rajpoots look down upon Domes. They actually hate and despise them. In every village there are two wells, one for the Brahmins and Rajpoots, the other for the Domes; and in olden times it was a capital crime for a Dome to take water from the well which belonged to the higher classes. Even yet, the Domes must build their houses at a distance from the cluster of Brahmin and Rajpoot houses. Under our Government some few Domes have become rich, and have built themselves good houses. Seeing such a house always makes a Brahmin or Rajpoot very angry. I was often told that our Government spoilt the Domes, and that it was a disgrace to the British Government that such wretches should be able to accumulate money, and actually live in better houses than Rajpoots. Physically, the Domes are inferior to the Rajpoots, and they are possibly of non-Aryan origin—at all events, they have less Aryan blood in their veins than the Rajpoots have. Among themselves, the Rajpoot inhabitants of Gurhwal—in other words, the bulk of the population—are an amiable, kindly, and singularly honest race of people. Theft is almost unknown, crimes of violence are rare, and there is very little immorality. Year after year, generation after generation, they plough their fields, sow and reap their rice and *mandua*, and herd their cows, buffaloes, goats, and sheep—keeping them near the village all winter, and driving them in the summer to pasture in the high hills, just as is done in the Alps and in Norway. The annual migration in spring, from the village near the river to the *kharak* on the mountain-top, and back again to the village in autumn, is the great incident in Gurhwal life. It breaks the monotony, and gives a romantic colour to their rural life. Nobody is fonder of flowers than a Gurhwali. He is seldom seen without a flower stuck in his hair above his ear; and when herding his cattle, he is often singing to himself some village song, or playing on a pipe made of the *ringal* bamboo (*Arundinaria falcata*). There are

three kinds of songs: (1) *Bharav*—songs in praise of local gods and demigods; (2) *Josa*—comic songs on local events; (3) *Bairi*—love-songs, generally put into the form of a duet, to be sung alternately by a man and a woman, like the Scotch song “Huntingtower.” It is a proverb that no female heart can resist a young man who sings *bairis* well.

Dancing is a great institution. Once every year, at least, the local idol is brought into the open air, and everybody dances round him. He is made to dance himself by being put on to a sort of bed, held at the four corners by four men, who then jerk the bed up and down, as high as possible, to the sound of drums and pipes—taking care, of course, that the god does not tumble off. Intellectually, the Rajpoot does not stand high. He dances and sings and composes poetry, but does not read much, and dislikes new ideas. Like some of the members of the Art Congress who lately visited Edinburgh, he loves beauty, but does not care for science, with its array of factory chimneys, telegraph wires, and Darwinian theories. With regard to Board of Manufacture schools and female education, I am afraid the Gurhwal peasant-proprietor would agree with Mr J. E. Hodson and Mr J. C. Horsley in condemning them. If he had the same command of the English language, he would agree with the latter in saying that women should not aspire to the higher walks of art. He might, perhaps, go further even than Mr Horsley, and exclude them from the decorative arts also, and maintain that painting idols of a blue or red colour can be better done by men than it can be by women. I had an illustration of this at Niti, the most northern village of Gurhwal, which is one of the highest inhabited places in the world. I was there on a festival day, and saw all the men (boys, adults, and greybeards) dancing round the local idol, but I noticed no women were present. I asked the reason, and was told that the local idol of Niti liked to see men dancing in his honour, but as regards women, he liked to see them working in the fields. Men should dance and women should work—such was the Horsleyan view of life taken by the Niti deity. With regard to another burning question of the day, prohibition of the sale of alcoholic liquors, the state of things in Gurhwal is extremely satisfactory. In this great province, 5000 miles square, there are only

three shops where alcoholic liquors are sold—one at the capital, another at Kotdwara, and a third at Gaurighaut.

One great institution of the past is now rarely seen—rope-dancing in honour of the god Mahadao. This used to be practised once a-year in every large village, and with great *éclat* at the capital. One part of the performance consisted in stretching a very long rope from a mountain-peak to a strong stake driven into the ground in the valley beneath. After sacrificing a kid on the hill-top to the god, the performer was tied firmly to a sort of wooden saddle, and bags of sand were attached to his feet to secure his keeping his balance. The saddle was then put on the great rope, and it slid along it, carrying the man with it a distance of 1000 to 3000 feet. The saddle was well greased, but the pace was so tremendous, and the friction along the ropes so great, that it was apt to catch fire. This ceremony was supposed to please the god, and ensure favourable harvests. If the performer arrived safely at the bottom, he was remunerated by getting a rupee for every 150 feet he had passed over in his perilous journey. He was also entitled to a specified amount of grain from every landholder in the township, on whose behoof he had thus propitiated the god.

In all parts of India there is a superstitious belief in the evil eye—a belief common to ancient Greece and Rome, and to modern Italy, where it was believed, for instance, that if the late Pope Pius IX. looked at a child, he brought it bad luck. In addition to this belief, common to Gurhwal with the rest of India, there is a peculiar superstition, imported perhaps from China, which attributes to some inanimate object the same power for evil. This is called *bedh*. For instance, if a new house is built in a village and any sickness subsequently breaks out in the village, this is attributed to the new house, which has affected the old houses with the mysterious curse of *bedh*. Of course, the more common forms of superstition are rife in Gurhwal: ghosts abound, and often take the shape of animals. The chief varieties are: *Masán*, the ghosts of infants, which are peculiarly fond of taking the shape of bears; *Tola*, the ghosts of old bachelors, appearing as will-o'-the-wisps in marshes, and much dreaded; *Acheri*, the ghosts of girls who die unmarried—(these are chiefly to

be feared if you happen to be wearing any red article of dress, the ghosts of unmarried young ladies having a peculiar antipathy to that colour); *Bhut*, the ghosts of those who have died a violent death, the most dreaded of all. You may have noticed that after the discovery of the body of the unfortunate English gentleman Mr Rose, who was murdered lately in Arran, his boots were carefully buried below high-water mark. I mention this to illustrate the fact that mountaineers seem, in all countries, to be more superstitious than those who inhabit plains.

I have not yet touched on the aspect in which Gurhwal is best known to the people of India generally. This is as a sacred country, as a land of pilgrimage. Every year, on the 12th of April, the greatest of all the sacred fairs of India is held at the point where the Ganges leaves the hills and enters the plains. This place is called Hurdwar, or the gate of the gods. On an average, more than a million people assemble there every year to bathe in the Ganges on the holy day. Some years there have been three millions, or even four millions, of bathers. This bathing festival is called the "Vernal Equinox Festival," and was arranged by the Hindoo astronomers to be held when the sun entered the *constellation* Aries. Unfortunately, these astronomers did not allow for the precession of the equinoxes. The vernal equinox—the 20th March—is now a long way from the 12th April, the day when the sun enters the *constellation* Aries; but the Hindoos have adhered to the date of stars and sun, and disregarded the date when the day and night are equal. One advantage there is, however—the date of the institution can easily be calculated. It must have been instituted when the vernal equinox coincided with the entrance of the sun into Aries—that is, about the year 500 A.D.

After their bath on the 12th April most of the pilgrims from the plains trudge back home, or, in modern times, take third-class railway tickets; but some of the bolder spirits—some 10,000 or 20,000 men and women—venture to enter the mountains, and struggle through fearful mountain-passes, to visit two temples which have been built inside the eternal snows,—one named Budrienath, to the god Vishnu; the other named Kidarnath, to the god Mahadao. It is easy for a well-

fed, well-clothed European to visit these places; but it is a terrible thing for the half-starved pilgrims from the plains, dressed in cotton clothes. The mortality is something awful. All along the road the Government has built hospitals for the use of these pilgrims, and it was as superintendent of these hospitals that my visits to Gurhwal were chiefly made. Walking along from one hospital to another, I often found pilgrims lying dying on the road, and had to carry them on to the hospital to which I was myself going.

The easiest, though not the most comfortable, way for a pilgrim from the plains to visit the two temples, is to have himself or herself carried in a basket. At Hurdwar, on the 12th April, any number of stalwart mountaineers are to be seen, offering to carry a pilgrim, with a preference to a feeble old man or woman, from the plains to Kidarnath and Budrienath and back, for the ridiculously low charge of 16 rupees, equal to 32s., paid in advance. If the man or woman who is carried in the basket die *en route* from cold, as is too often the case, the carrier of the basket is able to make a new contract with some pilgrim who has gone part of the way on foot, and who is not able or willing to walk any farther. Generally the mountaineer does some twenty miles a-day with his basket and the passenger in it. There is, of course, not much fear of *his* dying on the road. He is well clad in blanket clothing, not in cotton, like the woman he carries; and he is accustomed to the hill food, and it agrees with him, which is not the case with the pilgrims from the plains.

The temples open in the end of April, when their respective high priests go up to them. During winter, the high priest of Budrienath, with all his assistant priests, resides at Joshimut; the high priest of Kidarnath, with his assistant priests, at the village of Okiemuth. Their winter palaces are large buildings. The temples in the eternal snows are small. The high priests are very wealthy and influential persons, and I used always to consider them as the Indian representatives of our Archbishops of Canterbury and York. The Archbishop of Canterbury, or High Priest of Budrienath, is always a Nimburi Brahmin, from Kirat Malwar, in Southern India. The Archbishop of York, or High Priest of Kidarnath, is always a Jungam Brahmin from Maisur, also in Southern

India. Each of them has always with him a deputy, who succeeds him when he dies. When this occurs, a new deputy is at once sent up from the convents in Southern India, which have held from time immemorial the patronage of the appointments. Once sent up, the priest never returns to the sunny south, but lives and dies in the mountains. He has, however, a brilliant position, especially the high priest of Budrienath. The greatest native princes of India kneel before him, and almost worship him as a divinity.

In the plains of India, among the adherents of the Vaishnav sect, a fanatic devotee often takes a vow to visit four great temples at the four corners of India—1st, the temple of Juggernath in the east; 2d, the temple of Dwarka in the west; 3d, the temple of Cape Comorin in the south; and 4th, the temple of Budrienath in the Himalayas. Owing to this, the Vaishnav pilgrims in Gurhwal are more numerous than the Sivite ones. It is easy to know them, as the two sects mark their foreheads with chalk of different colours, and in a different way. The followers of Vishnu mark their foreheads with three perpendicular lines, the centre one being red and the lateral ones white. The followers of Mahadao use white chalk only, and mark their foreheads with horizontal lines, not perpendicular. Imagine this being introduced into Scotland—Episcopalians putting horizontal lines in white chalk on their foreheads, and Presbyterians perpendicular lines. English travellers sometimes absurdly call these marks caste-marks. They have nothing whatever to do with caste, since a Brahmin and a low-caste man who belong to the same religious sect, wear exactly the same mark on their forehead. I repeatedly called on the high priests, and found them very pleasant and intelligent men; but I used to wonder whether they would not have been happier if they had remained poor monks in their convent in the warm south, instead of becoming high priests in the cold bleak mountains, living practically their whole life in the region of perpetual snow.

Close to the temple of Kidarnath is a famous precipice, from which, in former times, pilgrims used to throw themselves down, believing that by so doing they would go straight to heaven. This has been forbidden by the British Government, and one of the duties of the high priest of Kidarnath,

imposed on him by the British Government, is to prevent any pilgrims going near the precipice for fear of their trying to commit suicide. This precipice is famous in Hindoo legend, as the place from which the five Pandu heroes ascended to heaven. But the mere fact of the pilgrims coming up from the plains is a species of suicide, so many of them die before they quit the mountains. One day when I was at Vishnupreg, an incident occurred. An old pilgrim and his old wife, a childless couple, had been to visit Kidarnath and Budrienath. On their way back, the woman became ill; was taken to the hospital, and died there. Her husband, as is the custom, committed her body to the sacred river. He then gave a great feast to all the Brahmins of the place—as much wheat, flour, and rice, and clarified butter, and sweetmeats, as the little money he had left would pay for. Rising from the feast, where he had presided as host, but had eaten nothing, he went down to the river bank, and, with something like a smile on his old wrinkled face, walked deliberately into the roaring torrent. In an instant, the mighty waves had beaten him down, and he was never seen more. His life had not been a wasted one. He had had a wife whom he had loved. In his youth, while ploughing his fields, he had often had dreams of some day visiting the Himalayan mountains. Now, in his old age, he had seen the eternal snows, and the two holy temples of Kidarnath and Budrienath, and he was not going back to live alone in his Bundelcund village.

I shall now proceed to speak more particularly of the fauna and flora of Gurhwal, and shall take up first in order the

ANIMALS.

In Gurhwal only two species of monkeys are found, but both are abundant. They are *Presbytes entellus* and *Macacus rhesus*. The same two are found all over the northern plains of India, except that the black-faced monkey, *Presbytes entellus*, has, in the plains, the hands also black. In the hills it has only a black face, and the hands are body-coloured—a difference not sufficient to make it a separate species. It is

curious that these two monkeys should be found all over the country where dialects derived from Sanscrit are spoken—no other monkeys occurring there—and that they should be found nowhere else. It looks as if identical causes sometimes determined things apparently so distinct as the fauna of a country and the language spoken by its inhabitants.

Of Insectivora, the most common is the musk-rat, *Sorex*, several species of which are common, and most useful in destroying noxious insects. They have, however, an abominable smell, which is very offensive to Europeans. Of the Carnivora, the black bear (*Ursus tibetanus*) is exceedingly common. It seldom attacks man unprovoked, except in the case of a female with cubs; but when the natives try to drive a bear out of their fields, it often shows fight, and inflicts fearful injuries with its claws, sometimes tearing off all the skin of a man's face. I have often had patients in hospital, frightfully disfigured by attacks from bears, and numbers of people are killed annually. The white snow-bear (*Ursus isabellinus*) is found, but only in the highest mountains. Allied to the bear, but much smaller, is the long-tailed bear-squirrel, which Cuvier calls the most beautiful of quadrupeds. Of the weasel tribe two are found—*Martes flavigula*, a most inveterate destroyer of poultry, as I more than once experienced, and a beautiful *Mustela*. Of otters, *Lutra monticola* is common. I have sat watching it hunting for fish, floating down one of the great rivers, swept along by the current, and then returning up-stream by land. Of the true Felines, the tiger is met with, but can hardly be called common. Every now and then, however, an old tiger or tigress, no longer able for the hard work of catching deer and cattle in the plains, makes its way up to the hills in summer, and takes to the easier occupation of killing the village women, who are employed cutting grass on the hillsides. It does not so often attack men. The reason probably is, that it is the custom for the village women to go every day to the hills, and there cut grass, and bring home a load of it for their cattle, while the men are employed ploughing, or working in the fields, near the village. Thus the women wandering about the hillsides, often far from each other, fall an easy prey to a tiger. The number of tigers is not, however, very great, and practically they are confined to South

Gurhwal, the part nearest the plains. Bishop Heber says that tigers make their way up to the snowy range, and other writers have copied his statement. This is possible, but I never heard of such a thing, and do not believe it occurs oftener than once perhaps in a century. With regard to leopards, the case is very different. They are common everywhere, and are great destroyers of dogs. In the plains of India, every village swarms with dogs. In Gurhwal, village dogs are rare, being generally soon eaten by leopards. European travellers in Gurhwal often bring up dogs with them from the plains, but they are very apt to lose them. Some day, generally some evening about dusk, when the dog is running along, it may be only a few feet from his master, the noise of a spring is heard, and a leopard is seen, but only for one second; the next, it disappears behind the bushes with the dog in its mouth. Next to dogs, the favourite food of leopards is monkeys. Another interesting animal, much dreaded by the natives, but fortunately not very common, is the wild dog (*Cuon rutilans*), differing from the true dog somewhat in its dentition. This creature hunts in packs, like the wolves of Siberia, but it does so normally, while they only do it occasionally. Owing to the systematic way in which a pack work together, the wild dog is dreaded by all other animals. Once it has chosen its prey, escape is all but impossible. Fortunately it is rare. I have more than once heard from natives about packs they had seen, but I have never myself seen a wild dog. Jackals are common, but are not dangerous, as they do not combine in packs. Wolves, which are so common in the plains of India, are, curiously enough, unknown, or at least exceedingly rare, in the hills. Of Rodents, squirrels are common, especially the flying squirrel (*Pteromys inornatus*). The marmot is common in lofty mountains. I killed one at 16,000 feet. Mice, rats, and field-mice are very common, and the curious tailless *Lagomys Roylei* is found, but is not common. The porcupine (*Hystrix longicauda*) is common. This animal is the pest of gardens. It burrows under the enclosing walls, and, once in, makes short work of all the vegetables growing inside. The beast itself is good to eat. Porcupine flesh is very nice indeed, but beasts of prey avoid an animal so protected by sharp spines. A

tiger sometimes ventures to eat one. Once on the borders of Kumaon and Gurhwal a sick tiger was seen wandering about helpless, and emaciated to the last degree. It was easily killed by a friend of mine, who had killed many tigers far more formidable than it was. After it was killed, the cause of its illness was discovered. It had swallowed a porcupine, and the spines of the porcupine had made their way through the tiger's stomach into its flesh, causing the poor tiger horrible torture. Of Ruminants, many are found. Indeed the chief reason why European travellers visit Gurhwal is in order to shoot these animals. In the lower or southern hills the most common are the barking deer (*Cervulus aureus*), which has a call exactly like the barking of a dog, and the pig-donkey (*Nemorhædus goral*), whose native name of Ghuror occurs in a common Gurhwal proverb, "Ghuror khani chant piyar"—"The goral loves the broken ground," equivalent to "There is no place like home." Less common and much bigger beasts are the *Nemorhædus bubalina*, or cow-goat, and the *Rusa Aristotelis* or jarao, called Sambur in the plains, where it also occurs. This animal is supposed by some to be Aristotle's horse-stag.

In the higher or northern hills the common ruminants are the wild goat, which is, however, occasionally found pretty low down; the wild sheep, confined to the snowy ranges; and the musk-deer, which yields the valuable scent musk, which is so costly that even in Northern Gurhwal it is from ten to twenty times its weight in silver. Of the Edentata, only one is found, and that even is doubtful, but it is certainly found in parts of the Himalayas, and the natives believe in its existence in Gurhwal. This is the manis, or ant-eater. If all tales of it are true, it is a most unpleasant animal to meet after nightfall, as it has a habit of addressing travellers with a voice apparently human. If the traveller speaks back, he infallibly dies. In the neighbouring province of Kumaon, a friend of mine fell from a precipice one evening and broke his ankle. The place where he fell was close to the road, and the natives heard him calling for help, but they would not go to his assistance, or even answer him a word, fearing that he might be a *nish-chur*, or night-walker—the name they give to the ant-eater. A similar superstition is referred

to in Shakespeare. Sir John Falstaff says, in "The Merry Wives of Windsor": "They are fairies; he that speaks to them shall die."

Of Gurhwal birds, the first place undoubtedly belongs to the pheasants. Five of these are common—*Lophophorus Impeyanus*, *Ceriornis melanocephala*, *Pucrasia macrolopha*, *Gallophasis albocristatus*, and *Phasianus Wallichii*. No birds except the humming-birds can equal the beauty of the two first-named. To see them in their native hills is alone almost worth a journey to Gurhwal. It is, however, only the males that are beautiful. The females are sombre coloured, and far less attractive. Near the snows I saw numbers of two beautiful birds, the black and white snow-pigeon, and the Cornish chough, or a bird nearly allied to it. Of the other birds I saw in Gurhwal, the most interesting were the white-spotted serpent eagle, with its fine black-and-white crest, the Himalayan osprey, and the purple-tailed honey-sucker. I shall leave the other birds of Gurhwal for a future paper—should I ever write one—on the birds of Kumaon and Gurhwal; but I cannot conclude this section about birds without mentioning that most beautiful singer, the yellow-billed whistling thrush (*Myiophonus Temmenckii*). In the early dawn, long before sunrise, the glorious notes of this bird used to pour in through the canvas walls of my tent, waking me with music—just as I had been lulled to sleep some hours before by the soft double note of the owl (*Ephialtes pennatus*). No human music could be softer and more soothing than the sweet low murmur of the owl; no music more arousing and enlivening than the rich, full, strong notes of the thrush.

Of lizards, two are exceedingly common—*Calotes versicolor* and *Stellio tuberculata*, both belonging to the thick-tongued section. Both are insectivorous; but they also eat grass and garden plants. One day, coming along a road, one of these little creatures attacked me, apparently for the purpose of protecting her eggs, which she was watching over, having very stupidly made her nest on the side of the public road. They themselves are preyed on by snakes. Of snakes, by far the most common is the pretty, non-venomous, little *Simotes Russellii*, but three venomous ones are abundant—two of them, the cobra and the Russell's viper, being met with from

the plains up to as high as 6000 feet. The third, *Halys himalayanus*, is only seen at great heights—I have never seen it below 10,000 feet. Above that height it is common. One day a friend and I killed two in the course of five minutes. Two other poisonous snakes are found, but are rare—*Bungarus cæruleus* and *Trimeresures gramineus*. I was only able to get one specimen of each. The boa-constrictor, or python, is not uncommon, and is said to grow to 20, or even to 30, feet. The only specimen I ever possessed was 14 feet long, and was shot in Gurhwal by a friend, Mr Batten, who presented the skin to me. A python is a very thick heavy snake, not a slim one, like most of the poisonous snakes. When this one was first shot, it took four men to carry it to Mr Batten's house. A python has no poisonous fangs, but if a large one could get a coil round a man's body, it would kill him instantly. On one occasion, when riding with my wife in Northern Gurhwal, at a height of about 9000 feet, an enormous python rolled across the road, and so terrified my wife's pony that it nearly jumped over a precipice.

Of Amphibians, frogs are very common, especially *Rana tigrina*, and they are the favourite prey of the common snakes. In the higher hills I often saw a beautiful tree-frog, which I believe is named *Rhacophorus maximus*, but I had no good book on the Amphibia. There is not, as far as I know, any good book on the Amphibia like my friend Mr Theobald's 'Descriptive Catalogue of the Reptiles of British India'—a most valuable work, and of portable size, which I always carried about with me everywhere.

Of fishes I can say little. The common ones in Gurhwal are a silurus, called "gonch" by the natives, and three species of *Cyprinus*—"ashala," "paprua," and "patua." I tried to identify them by means of Dr Day's book on Indian fishes, but could make nothing of them. Of butterflies I made a considerable collection, but giving a list of their names would have no interest. One moth, *Bombyx atlas*, is often noticed by travellers in Gurhwal, on account of its great size. Every traveller also notices two other insects,—the *Cicada pulchella*, which sings all day long in the trees, as the cicadas did in ancient Greece; and the homopterous insect called *Psylla*,

which secretes a white cottony substance in flakes, with which it covers itself all over. The people of Gurhwal call it the "debri insect," because it is generally found on the debri shrub (*Elæodendron Roxburghii*).

As for the biting flies, the traveller has not to search for them—they come to search for him. Last century, at Upsala, Linnæus drew up what he called "A Watch of Flora," or floral dial telling the hours of the day by the opening and closing of the corollas of the common wild-flowers. In imitation of him, I composed a somewhat similar entomological dial for Gurhwal, to enable the traveller to tell the hour of the day by the insect which was biting him. As drawn up by me in 1866, it stands as follows:—

Before sunrise.	Midges.
Sunrise to 8 A.M.	Black flies, called by the natives <i>mura</i> . Bite remains painful for about a week.
8 A.M. to noon.	Horse flies—native name, <i>moniya</i> . Bites bleed, and are painful, but only at first.
Noon to 3 P.M.	Another species which creeps under traveller's clothes and bites him— <i>dans</i> fly. Pain temporary.
3 P.M. to 4 P.M.	Small black-and-white fly with green head. Bites smart unpleasantly.
4 P.M. to 6 P.M.	<i>Mura</i> flies reappear.
6 P.M. to 7 P.M.	Midges reappear.
7 P.M. to 9 P.M.	Fleas and daddy-long-legs.

Though this sketch could be much improved, it is, I believe, correct, as far as it goes—at all events, for the month of May. Some other nasty biting flies appear in June and July. Then there are the land leeches of damp soil, but these bite you all day long, and keep to no particular hour of the day. In the hot weather they are only found in damp places, but during the autumn rainy weather they are almost everywhere. In some Gurhwal villages the inhabitants spread wood-ashes all round the village, to keep out the land leeches. European travellers often dip their stockings in salt-and-water before putting them on. This, to a certain extent, keeps off leeches. For protection against the *mura* fly, they sometimes wear veils. The natives, to keep off this fly, nearly always carry a leafy twig in their hands, and use it as a sort of fan. With regard to land leeches, the natives of Gurhwal simply look down every now and then at their bare legs, and pick off any leeches

that may be clinging to their ankles, or their feet above their sandals. I need scarcely add that, in winter, there are no biting flies, and no leeches. This would, therefore, seem to be the best season to visit Gurhwal; but unfortunately it is very cold at that season, especially in the narrow sunless valleys. Then there is the absence of the beautiful butterflies and flowers, though there are some fine flowers even in winter, such as the lovely tree convolvulus with white flowers (*Porana paniculata*), the Acanth (*Hexacentris coccinea*) with deep red flowers; and the cherry is in full bloom during winter.

The mention of these Gurhwal winter flowers leads me next to speak of

PLANTS.

Gurhwal was the first place in the Himalayas of which the botany was investigated. This was done so long ago as 1796. The father of Himalayan botany, Major-General Hardwick, spent the months of April and May of that year plant-collecting in Gurhwal. This was before the Goorkha conquest. After that event, Gurhwal was practically closed to the visits of European travellers. Many of his plants seem to have been named for him by the great Calcutta botanist, Wallich; and Roxburgh, of Madras, named after him one of the finest trees of Central India, calling it *Hardwickia binata*. His collection is, of course, enumerated in Linnæan order, but it was the only local flora I had when I visited Gurhwal, and I will follow it in this paper. I must add the autumn flowers, as he only gives the spring ones, and gives them in many cases with names different from those now employed. In all such cases I will adopt the modern names, not those given by General Hardwick. The first plant he mentions was also the first that caught my eye, growing on the green banks of the smaller rivers—*Curcuma angustifolia*, with yellow flowers and beautiful rosy-red bracts. Then follow in his list three species of jasmine, and the little, pink, perennial *Androsace rotundifolia*, so named by Wallich, but confounded in Europe with Wallich's white-flowering annual *Androsace incisa*. Next follow two common Gurhwal shrubs—the white, purple-spotted *Leycesteria*

formosa, and the yellow *Linum trigynum*, both highly ornamental shrubs. *Chiretta* is not mentioned by the General, as it is an autumn plant. *Chiretta*, or "the bitter plant," is a name given to various species of the two genera, *Ophelia* and *Agathodes*, which agree in yielding a tonic infusion, much used in Indian medicine. They are allied to the gentians of the Alps, but differ in having glandular pores at the base of the petals. These pores are naked in *Ophelia*, but covered with a fimbriate scale in *Agathodes*. As a tonic, few plants surpass them. When required as a medicine, they are simply pulled up by the root and dried in the sun. The infusion is prepared in an equally simple manner. Fragments of the stem, with the dried leaves and flowers on it, are put into a vessel, and hot water is poured over them. The infusion is then allowed to cool, and is drunk exactly like tea. Mothers in India sometimes give delicate children a morning cup of *chiretta* to breakfast, instead of a cup of tea. Of the berberries, the General only mentions one species, but in reality two species are common — *Berberis asiatica*, with short racemes, and *Berberis aristata*, with long compound racemes. They have different Hindustani names, so it is strange that the General confounded them. Their properties are, however, similar. Their berries are eaten, and the dried extract of their roots is perhaps the best, and certainly the oldest, of all known remedies for ophthalmia. Buried under the lava of Herculaneum, jars have been found containing Berberry extract, and labelled by some old Greek or Campanian druggist, "Best Himalayan light-giver," or *Lycium*. The species of *Berberis* found in the western Himalayas has been properly named *Berberis Lycium*. It very much resembles the Gurhwal *Berberis asiatica*.

In the class *Decandria*, two *Bauhinias* are mentioned. One of these, *Bauhinia Vahlia*, is a very common and very interesting plant. It is a gigantic climber, growing in the valleys chiefly, covering large trees, and often smothering them. It is particularly injurious to *Shorea robusta*, the most valuable of Indian timber-trees, and it is therefore mercilessly destroyed by the officers of the Forest Department, in the forests, at the foot of the hills, where *Shorea robusta* grows. In the lower hills it still holds its own. The natives

of Gurhwal have a fancy that the poison of malaria ascends as high up a hill as the Bauhinia grows, and that you are quite safe anywhere above the Bauhinia level. The natives of Gurhwal also say that the green-eyed cattle-fly only appears when the Bauhinia flowers, which it does in April. This fly is rather peculiar in its habits, as the male feeds on flowers, while the female bites cattle, driving them nearly to distraction. In sunny weather the cattle are only safe from its attacks by lying down in water. It also bites horses and human beings. Of Rhododendrons, the General only mentions the most common one, the scarlet *R. arboreum*; but three others are found in the northern part of the country, which he did not visit—the white *R. campanulatum*, the dingy-red *R. barbatum*, and the sulphur-yellow *R. anthopogon*. He also mentioned *Oxalis acetosella*, identical with the British plant. This, I myself never succeeded in finding in Gurhwal. The next interesting plant mentioned is the tree, *Ægle marmelos*, from the specific name of which is derived the word marmalade. It belongs to the orange family. From the tenacious pulp of the fruit of this tree a medicine is prepared, which in India is much used in diarrhoea and dysentery, and which, for these diseases, is superior to any medicine I know. The three most useful plants in Anglo-Indian medicine are all natives of Gurhwal—Chiretta, Berberry, and *Ægle marmelos*.

In Icosandria, the General mentions the pomegranate—a most anomalous genus, which has been referred to many natural orders. The fruit is eaten, though, as met with wild in Gurhwal, it is not particularly good to eat. The bark of the root is an excellent vermifuge, and the rind of the fruit is used in dyeing, and in tanning leather. Though a native of Asia, it was known in very early times to the Greeks and Romans. The Romans called it “Punica,” because they first saw it growing at Carthage—naturalised, however, not wild. So much did the Romans think of this plant, that the adjective *punicus*, meaning coloured like the pomegranate, became the common word for the colour red. Next in the list follows the common Indian hill-cherry (*Prunus paddam*)—not identical with our cherry. The Indian cherry flowers in October or November; the leaves appear soon after, and the fruit ripens in the succeeding April. Its active life is during the eight

dry months, and it rests during the four months of the autumn rains. Several other species of *Prunus* occur in Gurhwal, but mostly in the upper country, where the autumn rains are less severely felt. The most important of these is the apricot, which ripens its fruit up to a height of 10,000 feet, and which is an important article of food in the high hills of Northern Gurhwal. The common wild pear, *Pyrus variolosa*, is found all over Gurhwal, but the fruit is so harsh that it is little eaten, except by children and bears. The common rose of Gurhwal is the very strongly scented white rose, *Rosa moschata*, which grows along the banks of every stream, forming dense thickets which are good covert for leopards. Higher up the country, I have found three other species of roses—*Rosa sericea*, with four white petals; *Rosa Webbiana*, a pink flower, climber; and a red rose, *Rosa macrophylla*—an unfortunate name, as the leaves are not very large. It should have been called “*macrosepala*” or “*polyphylla*.” Of brambles, two are mentioned by Hardwick—*Rubus ellipticus*, with yellow fruit, much eaten by the natives and by European travellers; and *Rubus lasiocarpus*, with black fruit, which he calls *Rubus idæus*. Many others are found, but these two are by far the most common. Of strawberries, the only one he mentions is one with yellow flowers, and tasteless insipid fruit; but above 8000 feet I found abundance of a white-flowering species, the fruit of which is nearly as good as that of the wild Scotch strawberry.

Of leguminous plants, the most conspicuous in Lower Gurhwal is the lovely climber, *Pueraria tuberosa*, with blue-and-white flowers. Of *Compositæ*, the General only mentions four—*Leontodon taraxacum*, identical with the British dandelion; *Lactuca obtusa*, *Tragopogon gracile*, and a very conspicuous shrub with white flowers, *Leucomeris spectabilis*, belonging to the *Mutisaceæ* section. These are the common spring composites. If he had visited Gurhwal in autumn, he would have found the country covered with many species of *Anaphelis*, allied to our *Gnaphaliums*, but differing in being diœcious, thus resembling the edelweiss of the Alps. The edelweiss has been found in Gurhwal above 12,000 feet, but I never got it. I found, however, at 13,000 feet, another very rare plant, *Phagnalon niveum*, of which I sent specimens to

Kew. It had only been once discovered before, probably at the very place where I found it, on the banks of the Alaknanda river, near its source. It is a species quite distinct from the well-known *Phagnalon denticulatum*, a common plant in Afghanistan. I found, at similar elevations, quantities of various species of *Saussurea* plants, which have a musky smell. They are presented, as offerings to the gods, by pilgrims when they visit the temples of Budrienath and Kidarnath: the gods are supposed to like the smell of musk. The two most common species are *S. obvallata*, with a large coloured bract, and *S. gossypina*, covered with wool. Of the birch family, the only one common in Lower Gurhwal is the *Alnus nepalensis*; but in Upper Gurhwal, true birches are very common, and from their bark Thibet paper is made, on which are written Thibetan books. Maples are common in Central Gurhwal, and from maple-wood dishes are made, and used instead of crockery. When travelling in Gurhwal, I often ate my dinner off maple-wood dishes. Elm-trees are also common, and still more so the allied tree, *Celtis tetrandra*, which is often planted round villages. Another village favourite is the *Olea fragrans*,—a tree probably not indigenous, and possibly an importation all the way from Japan. Hooker and Bentham call it an *Olea*, though it has an imbricate corolla and ex-albuminous seeds, which made me take it for a jasmine. The scent of the flowers is delicious, and it is often planted in the centre of a village, and stone seats arranged all round it under its shade. It is what in old Scotland was called a “covin tree.” Such stone circles of seats are mentioned in Homer—

“οἱ δὲ γέροντες
εἶατ' ἐπὶ ξέστοισι λίθοις ἱερῶ ἐνὶ κύκλῳ”¹—

but Homer does not mention the tree in the centre. In Gurhwal, the greybeards of the village assemble in the summer evenings, and smoke their pipes, and discuss the price of rice and *mandua*, or the mischief recently done by the ravages of bears, or perhaps the hardship of the custom, handed down from ancient times, which forces every peasant-proprietor, when he kills a goat, to send, as a present, a fore-quarter to the *thokdar*, or lord of the manor. This, in most places, is still

¹ The Iliad, Book XVIII., ll. 503, 504.

always done, even by the *padhan* or leading peasant-proprietor of the village, although nowadays the *thokdars*, or hereditary representatives of the old lords of the manor, are generally mere peasants, like their neighbours. They have, however, as may be imagined, an ample supply of fore-quarters of kid, and do not require to kill their own goats for food.

Of oaks, four species are common in Gurhwal, belonging to two of Aersted's sub-genera—*Euquercus* and *Cyclobalanus*. Judging them by their leaves, they belong to the sections with entire, and with dentate leaves; none of them to the sinuate-leaved section, to which British oaks belong. Of willows, the most common species is *Salix tetrasperma*, but many others are found.

One of the most common and most useful of Gurhwal plants is the Indian hemp (*Cannabis indica*). It is called "Bhang" in Gurhwal. It grows sometimes to a height of ten or twelve feet, and flourishes best at elevations of from 6000 to 7000 feet. A resinous juice exudes from, and concretes on, the leaves, stem, and flowers. This juice is collected, and is the most popular intoxicant drug of Northern India, more used than any of its four rivals—(1) spirit made from rice; (2) spirit made from palm-trees; (3) spirit made from bassia flowers; (4) opium. This is the famous drug "Hatchis," used by the sect called the "Assassins," who flourished on the shores of the Caspian Sea in the time of the Crusades. There is also a long account of this drug in Dumas' well-known novel, 'Monte Christo.' Very probably it, not opium, is the "Nepenthe" of Homer. In Gurhwal this plant is used in another and less objectionable manner. From its strong fibres clothes are made, and it is generally easy to distinguish a native of Gurhwal from a native of the adjoining province of Kumaon by his dress. The Kumaoni always wears a woollen plaid, or blanket; the Ghurwali generally a hemp one, called a *bhangela*, from the word bhang, being the name of the plant. This hemp blanket or plaid is worn as an upper garment by both men and women, but it is fastened differently. The men fasten it with a pin or brooch on the breast, the women fasten it with a girdle round the waist.

Allied to the hemp, and even more abundant, is the nettle,

a plant much eaten in Gurhwal. The young shoots are boiled, and are most palatable. I have often eaten them myself, so speak from experience. According to a Gurhwal proverb, a poor man's dinner is

“Mandua ka roti,
Shishauna ka sag”—

which means bread made from millet (*Eleusine coracana*), with nothing for kitchen but nettles. The poet who composed this verse had apparently forgotten the existence of ferns, which are even more eaten by the poor than nettles are. The young fronds of two species, called by the people “Lingra” and “Kutra,” are most eaten. Both are very common. “Lingra” probably is *Nephrodium polymorphum*; “Kutra” probably *Nephrodium odoratum*. These, at least, are my identifications of them, but I may have been mistaken. My difficulty was that the natives showed me “Lingra” and “Kutra” in the young state, without spores on the back of the leaves, whereas it was only after the spores appeared that it was possible to name the plants from Hooker's ‘Synopsis Filicum,’ or any other scientific book.

Of the edible fruits growing wild, by far the best are *Myrica sapida* and *Eleagnus ghiwain*. Both are delicious. I should think there are few nicer wild fruits in the world. They are far superior to the raspberries mentioned above. Of the pine family, by far the most common in Lower Gurhwal is *Pinus longifolia*, with three leaves in each sheath. *Pinus excelsa*, with five leaves in a sheath, I found only at one place, Kunol, at a height of 10,000 feet above the sea, but there, it was abundant. Along with it I found *Abies Smithiana*, which is also rare. *Picea Pindrow*, *Picea Webbiana*, and *Taxus baccata* are all common. They are the three most common trees of Upper Gurhwal, as *Pinus longifolia*, *Quercus incana*, and *Rhododendron arboreum* are of Lower Gurhwal. *Cupressus torulosa* is fairly common. *Cedrus deodara* is planted round every temple, and is abundant, wild in the north-western part of the country. The river Alaknanda, near its source, runs through a magnificent deodar forest. The junipers grow all over the northern part of Gurhwal, and grow nearer to the line of perpetual snow than any other

woody plant. In Thibet, juniper is used to burn as incense in the temples; and it is planted round every temple in Thibet, in the same way as *Cedrus deodara* is planted round every temple in Gurhwal.

I shall now speak, very shortly, of a few of the common diseases I met with in Gurhwal, more especially of the plague.

DISEASES.

The common diseases of Gurhwal differ much from those of Britain. Phthisis and cancer are comparatively rare. On the other hand, goitre, calculus, ague, rheumatism, leprosy, cholera, and plague are common. Goitre one of course expects in a mountainous country. Juvenal long ago wrote: "Quis tumidum guttur miratur in Alpibus." The only one of the other diseases I will notice is plague—a disease which, in the middle ages, appeared in Europe,—at Florence in 1348, and at London in 1563-64, and which was common in Egypt last century. In recent times, it is met with, so far as I know, only in the Himalayas, in the mountainous province of Yunan in China, and in Mesopotamia. In Gurhwal, scarcely a year passes without an outbreak; but in some years these are much more severe than in others. The first sign of its appearance is, that all the rats and mice in a house are found lying dead. If the inhabitants do not immediately quit the house, many of them are struck down, a day or two after, with burning fever, and great prostration of strength; but without diarrhoea, pain, or rash on the skin. The majority of those attacked die before the third day of their illness. Those who do not die begin, after the third day, to feel pains in the groin, the armpit, or under the ear. A large boil or carbuncle forms at the painful place, and soon bursts, after which the patient generally recovers pretty quickly. The native name of the disease is *gola rog*, which means "ball disease"—the boil being compared to a ball or *gola*. According to the universal belief, a person who has recovered from this disease is absolutely safe from a second attack. This is most important, for the disease is very infectious, and people dread to nurse, or even remain near, a sick relative. The only people who can safely

attend to the sick are the fortunate persons who have already had the disease, and have recovered.

The worst epidemic I saw was in 1877. It was a terrible disease to have to treat, as no medicines I gave seemed to do any good. In other diseases—even in cholera—I myself believed in the remedies I administered, and the friends of the patients, and the patients themselves, were most anxious to get medicine from me; but in this disease they protested that all medicine was absolutely useless. Twice I had quoted to me a sad couplet of verse, which I felt was only too true:—

“Aukhade Ganga toyam,
Baidyo Narain Hari”—

“All medicine is useless; no one can save us but God.” When I went to see a village where plague was said to have broken out, I used to start from my tent, pitched on the bank of the river, and take a guide from some healthy village. This man guided me to a hill-top, a mile or two from the infected village, but within sight of it, and pointing out to me the cluster of houses, took his departure. Nothing would have tempted him to go with me to the entrance of the village. On one occasion, my guide pointed out to me a hamlet, named Kherki, where he said all the inhabitants were dead. As I, and the native doctor who was with me, approached nearer the village, we found the village cattle wandering about in the grain fields; and a poor dog—the only living inhabitant of the village—barked furiously at us, from the top of one of the houses. On reaching the group of houses, and going in, we found all the people lying dead, some on their beds, some on the floors of the rooms. Probably a month had elapsed, and during all that time no one from any neighbouring village had ventured to go within a mile of the plague-stricken place. The native doctor and I drove the cattle and the dog away from the place; and then, as the best means of disposing of the dead, I set fire to the village, and burned the whole of it down—cottages, cattle-sheds, and barns full of grain.

On another occasion, about three weeks after, nearly a quarter of a mile from a plague-stricken and deserted house, the native doctor and I found the dead body of a woman.

The neighbours had told us that this woman had buried all the other inhabitants of her house—her husband, her mother, and her sister. Last of all, she herself had sickened and died. We buried her on the spot where she was lying. As before, no villager from any other place would go with us nearer than about a mile from the house.

I was told that at a village called Balt there were sixty-four inhabitants when the disease broke out,—that of these, sixty died, three recovered, and one was supposed to have remained unaffected. I believe this account to be substantially true, but I did not visit Balt till a long time after the epidemic was over. In another smaller village I found that of the whole population, only one man and one woman had survived. The man had lost his wife and children, the woman her husband and children. In the other houses in the village, all had died—men, women, and children. One more story to conclude with. When I was returning home, after the epidemic was practically over, and was marching down the bank of the great river, a native pointed out a cave to me, and told me that two little girls, about ten and eight years of age, had taken refuge there. Their parents had died of the plague. No village would allow these children to enter it, for fear of their bringing infection; but the neighbouring villagers daily carried food to a place near the cave, where these children could find it. I walked to a large village near, where I purchased blankets, carried them up to the cave, and gave them to the girls. I then went to a rich native gentleman who lived near, and asked him to see that the children continued to get food regularly. I afterwards heard that the children survived their life in the cave, and were taken back to village life again. All the neighbours told me they were girls of good family, and rich. I mention this to show that it was not a case of poverty. It was terror of infection, and that alone, which kept these children out of the shelter of a house, and forced them to take refuge in a cave.

II.—*THE HOOPOE IN WESTMORELAND.*

BY BAILIE WALCOT.

(Read Dec. 26, 1889.)

ON September 16 of the present year I sent the following letter to the 'Scotsman':—

SIR,—Last Saturday morning, the 14th inst., while enjoying a ramble on the hills near the Shap Wells Hotel, Westmoreland, five or six of the hotel visitors were fortunate enough to see a fine specimen of the hoopoe. The size, back, crest, and markings on back and tail were distinctly seen by us all, and their correspondence with the hoopoe characteristics is beyond all doubt. When first seen it was picking up food along the banks of the roadway, and apparently so unsuspecting of danger that we were able to get within three or four yards of it. In a short time it rose, and leisurely flew twenty or thirty yards on the moorland. This it did several times, each time allowing us to follow it and get another view. Finally it took a stronger flight towards the beacon, as if disapproving our attentions, and bidding us a decisive farewell. As this migratory bird is only occasionally seen in this country, the above incident is, I think, worthy of being recorded, and will be read with interest by those who have a "passion" for bird-life.

This letter gave rise to considerable correspondence, all of which showed that the number of these attractive birds which visit the British Isles is exceedingly small, and that to see one of them alive is to become the object of congratulation and envy. One of these correspondents was the Rev. Mr Macpherson of Carlisle, a distinguished ornithologist, and author of a book entitled 'The Birds of Cumberland.' In his letter, dated October 12, he informed me that a farmer had just brought him for identification a hoopoe, taken accidentally in a rabbit-trap the previous Wednesday. He added that in his book just referred to, only about half-a-dozen Cumbrian hoopoes are included, and that he only knew of *one* shot in Westmoreland, which is preserved at Kendal. As I was extremely anxious to know whether this bird caught in the rabbit-trap might be the mate of the bird I saw on Shap Fells, I immediately wrote inquiring where it was caught. The reply received at once dispelled the idea, as it

was caught on the coast of Cumberland, some miles farther north, and about a month later in the season.

Macgillivray's description of the hoopoe is brief, and singularly clear: "Head and neck light red, crest feathers tipped with black, fore part of back light purplish red, middle part barred with black and reddish white; rump white, tail coverts black, barred with white; wings and tail black—the former with several bands, the latter with a single band of white." As the female bird differs from the male mainly in having a somewhat shorter bill and crest, and the plumage paler, I have no doubt that the bird we saw in Westmoreland was a female bird. The time during which at intervals we were able to examine it was about fifteen or twenty minutes. As it did not condescend to lift up its voice during this time, we were not able to form any opinion on the disputed question whether its common name originated in the appearance of its crest, or in its ordinary cry "up-up" or "pu-pu."

It is somewhat interesting to note that in the revised version of the Bible the word "lapwing," in Levit. xi. 19, has given place to the word "hoopoe,—a translation justified by the original, and now generally accepted as the proper one. Thus we learn that this "bird of beauty" existed early in the Mosaic period, and has been an attraction to the human eye through all the ages that have since then elapsed. It is a somewhat humiliating thing to know that the hoopoe is classed among "unclean birds" forbidden as food. Some say it has a disagreeable odour which arises from a substance secreted by the glands of its tail, while others affirm that it has the habit of selecting disagreeable materials for its nest, and so try to explain and justify the Scripture prohibition. But whichever may be the correct theory, we cannot avoid the natural inference that beauty may have its dangers and unpleasantnesses as well as its attractions.

III.—*A FEW NOTES ON A JOURNEY FROM BOMBAY TO JEYPORE, RAJPUTANA.*

BY MR SYMINGTON GRIEVE.

(Read Dec. 26, 1889.)

I HAVE been requested to give you a few extracts from the diary of my recent tour round the world. As I visited part of Western, Northern, and Central India, also Ceylon, Australia, Tasmania, New Zealand, Samoan and Sandwich Islands, California, Oregon, Washington State, Vancouver Island, and the mainland of British Columbia, the Selkirk and Rocky Mountains, thence the prairies and Winnipeg by the Canadian Pacific Railway, a considerable part of the Central and Eastern States, as well as Canada,—you will be able to appreciate the difficulty I feel in knowing what to present for your consideration this evening. I am aware that to most of you there would be little pleasure in hearing about the voyage to Bombay, with its trifling incidents, and, in our case, inconveniences; so I do not intend to refer to that part of my tour. Nor is there time to tell you of the many and wonderful sights we saw in Bombay, with its teeming multitudes of natives, who make its streets one of the most interesting and instructive sights in the world.

We reached the metropolis of Western India before the hot season was over, and were glad, after a few days' stay, to make a trip to Poona, visiting Khandala and the caves of Karli *en route*. The cool breezes and fine scenery of the Ghauts was delightful after the steaming heat of Bombay. It was almost with a feeling of regret that we had to retrace our steps to the great city before starting northwards towards Rajputana. I say we, as I was not alone; and it may be as well you should be introduced to the other members of my party. There were two European ladies, myself, and our native servant. The ladies were my wife, and a young Quakeress who had been introduced to us on the voyage, and had asked to join my wife and myself, as she otherwise would have had to travel alone, with an *ayah* and native man-ser-

vant—not a very pleasant prospect in India. This young lady, however, is a born traveller, and well acquainted with the methods of dealing with orientals, as she had visited Egypt, the Soudan, Palestine, and Asia Minor, although this was her first trip to India. We were exceedingly lucky in securing the services of our man-servant, as he proved a very superior person; and altogether our experiences with servants were much more favourable than those of most visitors we met.

It is my intention merely to read to you a few extracts from my diary, which was written under great difficulties, as we travelled so constantly that unless it was kept up to date from day to day, it would soon have been hopelessly in arrears. No doubt many things we saw were not described in detail as they should have been; but that, perhaps, is not to be regretted, as everything in India is so difficult to understand properly, that we should probably have fallen into even more mistakes than we in all likelihood have done.

The first extract is regarding the Towers of Silence at Bombay. Having received a permit through the kindness of friends, we drove to the Towers of Silence—the place where the Parsees dispose of their dead. Our drive took us past many private gardens, brilliant with poinsettias and red and yellow crotons; and every now and again the eye was diverted by the movements of the beautiful little striped squirrels that rushed across the road and up the trees, or sat on walls looking at us, quite fearless from being continually unmolested. At length, having gradually ascended Malabar Hill, we began to look down upon the groves of palm-trees and bananas on the lower ground, with hardly a breath of air to rustle their tufted foliage or relieve the oppressive heat. I almost felt inclined to get out and walk when I thought of the poor horses, as there were three of us inside the carriage and four natives outside—not a bad load. As all the natives were dressed in full costume, our equipage was most picturesque, and would certainly have caused a sensation if it had appeared in Edinburgh. There was the driver and his *syce* or footman, our native servant Lhalla, and the head butler of the friends who had kindly given us the permit.

When we had reached within about 100 feet from the top of Malabar Hill the carriage turned into a private road, and

in a minute more we found ourselves at a large iron gate, and were told that we would now have to leave the carriage, as we were about to enter the grounds connected with the Towers of Silence. Passing through the gateway, we found we were on the upper part of a long causewayed road leading from the valley below, with many flights of steps on the way up. Below us this approach to the top of the hill was a beautiful shady walk, as the foliage of the trees met overhead. We were told we must ascend, and, gasping as we were without any exertion, it did not improve our sensations having now to go in for a climb up several long flights of steps. As there was no way of evading the difficulty, we had just to face it, and in a short time found ourselves at another gate, where an official met us and examined our pass. As it was in order, he called one of the attendants, who took us round and told us the limits beyond which no persons except the *nasasalar*, or official corpse-bearers, are allowed to go. Our guide first took us to the three *sagris*, or houses of prayer, the principal of which contains the sacred fire, which is fed day and night with incense and fragrant sandal-wood, and never extinguished. The three *sagris* are close to each other, and in them we saw several priests engaged in prayer. We were next taken to a place in the grounds where there is erected a small model of one of the towers, so that visitors may understand the internal structure of these buildings, as no one is allowed to enter their precincts,—not even Parsees, but only the corpse-bearers already referred to. Having examined the model—a duplicate of which, I think, is in the Museum of Science and Art, or at least in South Kensington—we went forward until near the first of the towers. Great numbers of vultures were sitting round the circular wall, and as we approached a few made a slight movement; but seeing there was no funeral, they immediately relapsed into a kind of torpid state, and seemed fixed like a horrid vision before our eyes. The scene at the other four circular towers and the one square tower was much the same, only the square tower seemed least in favour, owing, no doubt, to its being seldom used. It stands apart from the rest, and is for the purpose of disposing of the bodies of persons who have suffered death for heinous crimes. One at least, and perhaps both, of the smaller circular towers belong

to private families, while the two large circular towers are for the general use of the Parsee community.

The arrangements connected with the construction of these buildings are with a view to the prevention of mother earth being contaminated by dead humanity: thus sound sanitary laws have been kept in view. The towers are built of the hardest black granite, plastered over with white *chunam*. There are no roofs upon the towers, which are thus quite open above. There is a pit in the centre of the building to receive the bones of the bodies, which have been in the first instance laid upon one or other of the circular tiers of the sloping gallery above the sides of the pit which are separately provided for men, women, and children. From the bottom of the central pit are drains which carry off any rain-water into wells filled with charcoal, through which it is filtered and purified. When a funeral approaches the enclosure in which these buildings are situated, there is immediately a stir created among the multitude of vultures sitting round the top of the walls. They seem to waken up from their lethargy in anticipation of the sickening feast in store for them. We shall suppose a funeral has arrived at the gateway of the sacred enclosure. It is there met by the priests who perform the sacred rites, and then the company, preceded by the *nasasalar* or corpse-bearers, proceed to within a prescribed distance of the door of the tower in which the body is to be placed. The mourners then stop while the corpse-bearers go on to the buildings, and, having unlocked the door, go inside, taking the body with them. After a few minutes of suspense they return without the body, and by this time the vultures are holding high revelry behind the wall of the tower. A Parsee believes that if the right eye of the body is plucked out first by the vultures, the soul goes to heaven; but if the left is taken out first, the soul goes to the place of woe. Consequently a good deal depends upon the amount paid to the corpse-bearers as to where the soul of the deceased is supposed to go. The corpse-bearers are highly paid, as they are supposed to contract impurity in the discharge of their duties, and are compelled to live apart from the rest of the community. It is said that these peculiar funeral rites are observed by no other people than the Parsees, and this makes the Towers of

Silence specially interesting. As far as I am aware, the only other place where Towers of Silence exist is near Poona; and as these are seldom used compared to those at Bombay, they have less interest to the ordinary visitor—especially as they are on a much smaller scale. The advantages of having a residence in the neighbourhood of these places of funerals and vultures, even although the locality may be beautiful, is not without its drawbacks. The birds of prey do not always end their feast within the Towers, and we heard stories of such things as severed fingers and toes being occasionally found in gardens or upon the verandahs in the morning. In answer to our inquiries, the attendant who took us round stated that it was thirty years since a young vulture had been seen at the Towers. He said it was not supposed that the vultures bred at any place in the neighbourhood, but went a long distance for that purpose. However, there was always such a large number in attendance, that any that might leave for nidification were not missed.

It was almost with a feeling of relief that we turned to leave this remarkable place, with its approaches, and enclosing wall and buildings, all so strongly built as to remind one more of a fortress than a house of the dead. As we descended the road leading back to where we had left our carriage, my eyes caught sight of a thin dark line that moved along the path. I saw it was an army of ants. They marched two deep, and appeared to have officers in command. They brought to my recollection the refrain of the familiar song, "March, march, march in good order." It was a wonderful sight. I walked on until I reached the head of the column, with advanced parties thrown out to reconnoitre. I then followed back along the line until I reached its rear, and martial order seemed to reign everywhere. We watched them for some time until their line of route led them into the long grass, where they disappeared.

Time will not permit of my saying anything more about Bombay and its vicinity, so I must ask you to try and travel in fancy with me for two nights in the train. We spent the intervening day at Ahmedabad and neighbourhood busy sight-seeing; but to rehearse to you the beauties of its Jain temple, or the marvellous tracery of palm-trees in the white marble

windows of the Sidi Syed mosque, or its wonderful tombs and other Mohammedan buildings, would only be a weariness to the flesh, so I won't trouble you. Try and think you are with us in the train, which goes jolting along at from fifteen to twenty-five miles an hour. It is daybreak, and we can see we are approaching a range of mountains. On each side of the railway is a great plain, arid and uninviting, with dense clumps of the high jungle-grass in which wild beasts find a hiding-place. Now and again we pass a few trees with great numbers of monkeys chattering in them, and quite fearless. Who dare touch them?—for we are now in Rajputana, where the lives of most animals are held sacred. We are entering a broad valley, with the Arvalli hills to the east, and the high, rugged, forest-clad spurs of Mount Abu to the northwest. At 7.40 A.M. we arrived at Abu Road station, where there is a refreshment-room to which we had telegraphed to have breakfast ready for us, and also ponies, as we had resolved to attempt an expedition to Mount Abu and the celebrated Jain temples at Delwada or Devalwádá. Dusty travellers we truly were when we reached Abu Road, and you can hardly understand the intense enjoyment of a bath under such circumstances. We were therefore overjoyed to find that there were bath-rooms at the station, and we soon were enjoying the luxury, and forgot the fatigues of two nights' travel in the train. We had a comfortable breakfast, made inquiries about the track we were to follow, and found we were likely to have a much more arduous journey than we had supposed. The distance through the jungle and over the mountain to the temples by the rough path is a little over twenty miles by the route we took; and as our time compelled us to do the double journey in one day, it was rather plucky of the ladies to attempt it.

Breakfast over, we found the ponies were waiting, and we mounted. Besides the two ladies, myself, and our native courier, who was also mounted on a pony, we had a wild-looking Gujarati *syce*, who was also to act as guide. He was not troubled with much clothing, which was fortunate, as, poor fellow, he had to run the whole distance of over forty miles. His remuneration, no doubt, he considered very handsome, as the tariff fixed by Government enabled him to earn

about 2s. for his day's work. We had the usual difficulties in starting with our steeds; and when we came upon a Government elephant just outside the station, we had no time almost to look at the huge beast, we were so much engaged trying to keep our saddles. However, we soon got fairly on the way, and had time to look around us. We were on a great plain which stretched away to the south and south-west as far as the eye could reach. There was much sand, with patches of long rank grass, and altogether the scene was typical of what was associated in our minds as like India. About a mile from Abu Road we crossed the Banas river by a long wooden bridge of rather rickety construction. We kept on over the plain toward the wooded spurs of the mountain, about three miles to the north. As we approached them more verdure appeared, then a few trees, and close to the foot of the ascent we entered the dense forest and jungle. The sun had now got high in the heavens, and we were grateful for the shade. We had hardly got beneath the trees when several wild peacocks strutted across the path in front of us, quite fearless, and almost seemed to resent our intrusion. A short distance farther on, a crashing sound arrested our attention, and as it came nearer I at first thought it must be a whirlwind. Our ponies got restless, but the natives only smiled, so I knew we need not excite ourselves. I rode towards the noise, and soon heard a chattering, and saw the boughs of the trees bending in an extraordinary way. It was a great troop of monkeys that had come to inspect us. How they crowded the branches that bent with their weight as if they would break! There were some so inquisitive that they sat on the trees within a few feet of our heads, and pulled the foliage aside to have a good look at us. Mother monkeys came to the front with their children clinging to them, to see the strange white faces and unusual costumes of the visitors. No doubt they asked questions and passed remarks as if we were wild beasts in a menagerie, but they offered us no nuts, and after much animated discussion in monkey language they ceased following, and we hurried on our way.

The path now became rougher and narrower as we ascended the spur of the mountain. The tropical vegetation became

denser, and we knew we were not far off the lurking-places of numerous wild animals that we did not wish to meet unarmed. The region abounds with big game, and is the yearly rendezvous of many sportsmen. There are tigers, panthers, leopards, lynx, bears, and several varieties of deer, and a few lions, the latter being now a scarce animal in India. We could only go along at a snail's pace, the track was so steep; and as the path was cut out of the precipitous side of the mountain, we were sometimes on the brink of an abyss, the dangers of which were only partially obscured by the dense jungle. It is very curious that ponies seem always to prefer going as close to the dangerous edge as possible. At first it causes alarm to an unaccustomed rider: however, the feeling of danger soon passes off, and one is able to enjoy themselves. I had a most curious experience, which I have no wish to repeat. The pony on which I was mounted behaved so strangely whenever I loosened the reins to look about, that I got down and examined it, and found it had entirely lost the sight of the left eye, which happened to be the one next the precipice. At first, whenever we got into dangerous places I tried to keep my steed as far back from the outer edge as possible, but the beast was so determined to walk close to the brink that I gave up the struggle in despair. Many a time we were in perilous positions, but my one-eyed pony took me safely through it all.

As the day advanced the heat became intense, and all nature seemed hushed. The birds appeared to be taking their siesta, and beyond the movements of numerous squirrels, and the dancing flight of butterflies, nothing stirred. We plodded on, as we knew we would have to fast until we got to Mount Abu, and the long journey we had made up our minds to perform in one day permitted of no delay. Every now and again we got glimpses of the valley below, the plain stretching away in the direction from which we had come, and the scenery was very grand, looking towards the rocky peaks of the mountain spurs. About 3000 feet above the plain we reached the summit of the first ridge. I shall never forget the view. It is quite beyond the power of pen to describe it. From our elevated position we looked along the tops of the spurs and down into the valleys on each side of

us, filled with rich tropical vegetation. In strange contrast to the vegetation were the sandy plains stretching to the distant horizon. Some miles after descending from this ridge, on its north side, we struck the main carriage-road for Mount Abu. It is a splendid road, and its construction along the side of tremendous precipices is a great work of engineering. It reminded me of the railway through Glen Ogle, only there can be no real comparison, as the valley leading to Mount Abu is much larger in every way, with dense forest, great bare rocks, burnt-brown vegetation, and little of the verdure of our Highland hills. Having reached this good road, we soon got over the few miles to the hill-station or sanitarium, and arrived at the Mount Abu Hotel, a clean but poor house, at 12.45 P.M. While we were resting, and tiffin being prepared, I sent our native servant with my card to the Commissioner, whose residence was near, requesting to be obliged with a permit for myself and party to visit the Jain temples at Delwada. He very kindly granted my request, and by the time our servant returned we were enjoying our tiffin. Our repast over, we remounted our ponies, as we had still to go $1\frac{1}{2}$ mile. The bridle-path went along a small valley near the centre of the cluster of peaks forming Mount Abu. On the rising ground at the end of this valley we saw the four Jain temples; and farther down the hill, and just outside their enclosing wall, a village of miserable huts, in strange contrast to the magnificence of the temples, which are among the most exquisite buildings in the world. It is said that it cost 56 lakhs of rupees, or £560,000, to level the site, and 18 crores of rupees, or £18,000,000, to build these temples. We were told they were constructed in the form of a cross, but owing to the high enclosing walls we could not make that out. Arrived at the entrance, we found a large crowd of pilgrims, men, women, and children, who seemed quiet-looking people. In answer to our inquiries, each group told us from where they came, and we found most of them had travelled on foot several hundred miles, and some far greater distances. I am afraid few of us would care to go to church so far, but these people have faith, and faith abundantly. Having presented our permit, we were admitted to the temples, which, by the way, are only open to visitors between noon and 6 P.M. We

had come to see something wonderful, but our expectations were far more than realised. Such beautiful buildings, composed of marvellous designs in carved white marble, we did not think it possible to construct. They are quite beyond any power of mine to describe, but a few photographs I now show may convey a faint impression to your minds of what some parts of the buildings are like. What is perhaps as extraordinary about these structures as anything, is that the nearest place at which the white marble of which they are built is to be obtained is at Jeypore, nearly 300 miles away. How the large blocks of this stone could be conveyed such a distance, through a wild and mountainous country without roads, is a marvel. The temples are dedicated to Parswanath, the chief of the deified men whom the Jains worship. Two of the sacred buildings are specially beautiful. The older of them is said to have been built by Vimala Sáh in 1032 A.D., and the more modern one by Tej Pál and Vasta Pál in 1177 A.D.

We had to remount our ponies with regret, and after visiting the Nakhi Lake, a sheet of muddy water surrounded by wooded hills, and prettily situated, got back to the hotel at 4.25 P.M. Our ponies were quite done up, so we got a change of steeds, and this time I had a fine charger—hardly the kind of animal for mountain paths. It had to be led for the first two miles by its groom until we got past a large tank, as it had, I was informed, a bad habit of rushing into the water, and leaving its riders there. We got past the tank all right, but then my charger knew it was going away from home, and it was only after a series of violent efforts that I overcame it, and got it fairly in hand. It afterwards was as quiet as possible, and gave me no difficulty. We pushed on as fast as we could so long as we had the carriage-road, as we began to realise that we would be only beginning the most dangerous part of the journey through the jungle when darkness would set in. I had been told that the risk we ran was considerable, as there happened at the time to be a great many wild hillmen wandering about, who were not to be trusted. In the next place, monkeys were apt to frighten our horses at night, owing to the noise they make; and last, but no doubt least likely to trouble us, were the big game, that probably would be more

afraid of us than we were of them. We were still riding along the main road when we heard the tinkling of bells in the distance, such as might be caused by an approaching pair of bell-hung circus horses. In a minute more a native rushed past, dressed in a peculiar costume, with a bag on his back, and a stick about four feet long in his hands, with lateral branches, on which the small bells were hung. He saluted us as he went by, and we asked who he was. He was the Government letter-carrier, and the stick with the bells his staff of office. We heard he had to run to Abu Road and back each day with the mails, which, if true, is a wonderful feat for any man to perform regularly in such a climate.

We had left the driving road and were a considerable distance up the rugged mountain path, and were passing through a portion of the forest that was more open than most other places. A troop of monkeys were on the boughs, evidently watching our movements, when suddenly there was a noise overhead, and a large flock of *mynahs* (a bird about the size of our blackbirds) flew past, and settled in a tree with dense foliage that grew apart in an open glade. The great chirping and chattering made by the birds immediately attracted the attention of the monkeys. It was amusing to see them looking at each other; then they seemed to resolve upon a plan to satisfy their inquisitiveness, for one of their number came down from a tree, ran quietly across the path in front of us, and stopped beneath the tree in which the *mynahs* were. Its presence was immediately discovered, the chattering ceased, there were a few spasmodic chirps, then all was silent. We had just reached the top of the ridge when the guide discovered he had taken the wrong path. He knew, however, how to regain the right one, and I knew from the mountain-peaks that we had not gone very far astray. Following a track in the direction we knew we must go, we came upon a large number of armed hillmen with their families, who were just preparing to encamp for the night. They had a number of camp-fires burning, and were busy erecting tents and arbours to sleep in. The men came to have a look at us, but the women and children kept in the background. They seemed of a morose nature, as, although I saluted them, they did not return the compliment. The shades of night were falling by the time we regained the right track. With

the waning light every tree appeared suddenly to become full of life, and the teeming multitudes of living things making themselves heard all around was amazing. It soon got so dark as we descended the mountain that we had to allow our horses to have their reins loose. They picked their way very well, although there was always the danger of some wild animal crossing our path, or lying near in the jungle. Horses become restive under such circumstances, and one false step on the narrow path meant a tumble over a precipice. The moon was up, but for some time we got no benefit from it, as we were in the shadow of the mountain spur. It was an ever-to-be-remembered sight—the weird illumination of the deep wooded valley, the opposite mountain-spur with its bare rocks, and in the distance the view of the plain as if we saw it through a film of smoke. As we descended we got out of the shadow, and the silvery light gave to everything an extraordinary beauty, in strange contrast to what we had seen in the daylight. It must have been a curious sight to view our cavalcade: first rode my wife, her pony led by our wild-looking Gujerati *syce*; then Miss S.; next myself, followed by our servant Lhalla. Every now and again the leaves would rustle, as some small animal startled by our presence rushed off into the forest, but none of the larger beasts of prey or monkeys troubled us.

When we reached the foot of the mountain, I told our servant to ride on to Abu Road station, and order some refreshment to be got ready for us. Miss S. and I galloped with him, to stretch our limbs after the long walk down hill, but had only got about 150 yards when the violent cries of terror of the Gujerati *syce* made us hurry back. We found he was in great fear of being killed by wild beasts, and his excited state had rather alarmed my wife. We remained close together until we were well out of the plain. About a mile from our destination I again went ahead a short distance, when, hearing a cry, I looked round and saw a riderless pony making towards me. I rode up to it, and after some difficulty seized its bridle, but in the struggle that ensued the bridle gave way, and the bit came out of its mouth. It galloped off, leaving the bridle in my hands. I knew it was the animal Miss S. rode, so I returned to the ladies as quickly as possible, and was glad to find that although the pony had stumbled

and she had been thrown, she was in no way injured beyond a cut hand and a contused face. I desired her to get on my horse and I would walk, but I could not persuade her to adopt this course. The next difficulty was with my wife, who also determined to get off her pony for fear of an accident to herself; and as it was no use trying to convince the two ladies, I had nothing for it but to let them have their way. The ladies walked, the Gujerati led my wife's pony, and I rode. Tired, pained, and hungry, we must have formed a comical picture, in marked contrast to that we afforded on-lookers at our departure. Fortunately, in the pale moonlight our features were dimly visible. The riderless pony galloped to the station, where its arrival caused alarm, as the natives thought one of us had been taken out of the saddle by a wild beast. A number of men came rushing along the road, as they knew from our servant that we could not be far off. The manager of the contractor for the ponies first came in sight, and we could see him with his outstretched right arm trying to count us, to see who was amissing. He seemed anxious to keep his distance from us; but as our own servant immediately arrived and informed us who he was, I desired him to ask the manager to come to me. He evidently was frightened, so I went forward while he was hesitating, and holding up the broken bridle I gave him clearly to understand that if Miss S. cared to bring an action for damages against his master, he might be ruined, and I told him that I would consider whether or not I should report the matter to the authorities. Whether this lecture has had any effect in causing the contractor to improve the harness of his ponies I know not, but suspect that with our departure in the train it would be a case of "out of sight, out of mind." We had only proceeded about a hundred yards after meeting the men, when we found ourselves in the midst of a troop of between thirty and forty Government elephants that were feeding upon great heaps of cut sugar-cane. They scarcely took any notice of us, but it was a remarkable sight to watch the huge animals by the light of the moon, in what might have been their native wilds. We reached the station without further adventure, and, after a comfortable dinner, caught the train for Ajmere at 10.39 P.M.

IV.—*RATS AND THE BALANCE OF NATURE.*

BY MR TOM SPEEDY.

(Read Jan. 22, 1890.)

THE subject of rats and their enemies was, as you are all aware, recently discussed at great length in the columns of the ' Scotsman ' and other newspapers. As one of those who took part in that discussion, I regarded the subject not merely in the aspect of its general interest, but as more far-reaching in importance than many would at first sight believe. It is a subject not merely affecting the industrial returns of the agriculturist, but if not checked must at no distant date affect our future food-supplies. Apart altogether from this important aspect of the subject, I felt interested in the discussion as a lover of natural history, and was therefore induced to read all the correspondence which appeared in the columns of the daily press, so far as these came under my notice. It will not, I am sure, be deemed discourteous or hypercritical to state that there was imported into that discussion very much that was irrelevant, and not a little that had no better foundation than that of pure speculation.

The rat pest, as is generally known, is pressing itself on the attention of agriculturists in most parts of the country. Within a circuit of some forty or fifty miles of Edinburgh it has been severely felt ; while south of the Tweed, especially in Lincolnshire, the mischievous visitation has been keenly experienced. Some estimate of the extent of the rat pest may be formed when it is stated that as many as from 2000 to 3000 rats have been killed in some places in little more than a fortnight. In a brief sporting excursion in Berwickshire for a couple of days last autumn, I observed, in passing, certain corn-stacks which had been built in the open fields that were literally riddled and honeycombed from top to bottom by rats. Why these stacks had not been thrashed, and the grain turned to account before falling a prey to the " rat plague," was to me unaccountable. That, however, was the farmer's concern, and not mine.

Why rats are increasing ; why they are betaking themselves

to fields and hedgerows, and burrowing like rabbits; and what are the best means of getting rid of them—are questions demanding immediate attention. Thirty years ago, at the age of thirteen, I began life as a gamekeeper in one of the finest agricultural districts in Berwickshire. My principal duty was that of kennel boy, but the trapping of rats and other vermin filled up my spare time. I frequently observed, on going into the boiler-house with a light, that a large number of rats always scuttled into the holes, or into the furnace and up the chimney. The first time I saw them go into the latter place, I thought I would make short work of some of them by putting in a wisp of straw and setting fire to it. This, however, was a failure, as the rats evidently had an exit from the chimney to more congenial quarters. Besides the furnace there were about a dozen holes in the boiler-house, and I thought that if by some process the holes could be simultaneously stopped up when the rats were out, a rare capture would be made. By an ingenious contrivance I was able so to arrange certain boards operating by communication with a cord outside, which, being properly set, could, by pulling the cord at the outside—pretty much as country boys are in the habit of catching birds during a snowstorm by the use of a riddle—fall down close to the wall, thereby cutting off the rats' possible retreat. The experiment on the first occasion was a perfect success. After pulling the cord, I obtained a lantern and gently opened the door a short distance, and discovered that there were several dozens of rats running about the floor in wild excitement. Having secured the door, I obtained the co-operation of one of the keepers, and taking with us a fox-terrier we went inside, and in an incredible short space of time upwards of fifty rats were killed. This incident quickly established my reputation as a rat-catcher, although I must confess my next experiment was by no means other than a failure. This incident reveals a peculiarity in the rat tribe, and one with which all rat-catchers are familiar. You may on the first experiment at rat-catching be very successful, but it will invariably be found that such are the instincts of the rat, that however well conceived the device, it is not a game that can be played twice in the same quarter with the same amount of success. On such occasions the rats immediately betake themselves to other

localities, and sometimes to a considerable distance. This will lead me to have something to say further on as to the necessity for simultaneous action, covering a considerable area, in order to meet this remarkable instinct in the rat tribe.

So long ago as the period just referred to I found that rats burrowed and bred out in hedgerows then as now, but never at a great distance from houses, to which they repaired on the approach of winter. The wholesale slaughter in the boiler-house had so terrified the remaining rats, that I found a few days after that they had migrated to a hedgerow, and burrowed in the banks at the root of the hedge. As this incident had opened up to me a new field of sport, I followed it up with ferrets and terriers, and by the use of a spade was able to diminish their number again very considerably. Subsequent experience taught me that one of the greatest difficulties in rat-killing was to combat successfully this migratory instinct. However, by the use of ferrets I was able to have them ejected from the numerous holes in which they had literally undermined some of the outhouses close by.

There were some old houses a short distance off which were also infested with rats, and I discovered that they travelled backwards and forwards. Observing their track, which came up through a garden, I resolved to try and trap one on the track. The "run" passed through between the stalk of a hollyhock and the wall, and there I planted the trap. Cutting out some of the soil and setting the trap as "kittle" as possible, I covered it with the finest earth I could get, threw a few dead hedge leaves on the disturbed ground, and sprinkled water with a branch over the place in order to take away the smell of my hands. On the following morning I found a heap of dead leaves at the spot, but on minute inspection I observed a pair of dark eyes peering out from among the leaves. With the aid of a stick I removed the leaves, and found a large rat secured by a hind leg. Finding it was impossible to get away, this wary animal collected all the leaves within his reach, and completely covered himself and the trap from view. Having heard that besmearing a rat with tar and turning him away again would banish rats from the locality, I resolved to utilise the one in the trap as a test experiment. I therefore attempted to put him in a bag, but

in doing so he got hold of the centre finger of my left hand and gave me a severe bite, hanging on for a second or two. Managing to shake him off, he scuttled away, and in the confusion escaped. My finger festered, and was very painful for a long time. I have been bitten by dogs, foxes, stoats, weasels, and ferrets, but these soon healed up. With the rat, however, it is otherwise, as their yellow cankered chisel-teeth inflict a severe wound, which is difficult to heal. The teeth of the weasel tribe are clean, and though the bite is severe at the time, it heals as quickly as if punctured by a surgical instrument. I am therefore of opinion that in a combat with a rat, though the weasel generally gets the mastery, yet, except in confinement, we know not what is the result of their wounds. In an experiment I made by putting a large stoat and rat together, the rat commenced the attack, but after a determined fight the stoat succeeded in killing him. The following day, however, I found the stoat had died from his wounds. Notwithstanding their ferocity, weasels are delicate creatures, and succumb to the slightest injury. This I discovered while having many hundreds of them in captivity, when collecting them to transport to New Zealand.

There are two kinds of rats which have successively been introduced into this country—the black rat (*Mus rattus*) and the brown rat (*Mus decumanus*). The vole, though popularly known as the water-rat, yet belongs to a different genus. It appears to me to be a sort of miniature beaver, and is fond of gnawing wood. This I discovered by planting a large number of young osiers on the banks of the Braid burn, where voles are very plentiful, and found to my annoyance that many of them were cut asunder by the animals in question. As far as I have observed by dissecting them, they are strictly vegetarians.

Both the black and the brown rat seem to have been natives of Central Asia, and did not appear in Europe till comparatively recent times—the black variety at the beginning of the sixteenth century, and the brown about the middle of the eighteenth century. Specimens of the black rat are still to be seen in our museums, while living ones are occasionally found in unloading ships from foreign ports. I have never seen one of them alive, and I think I am correct in saying

that they are practically extinct in this country, except in the places referred to. The brown rat was the principal factor in exterminating his less powerful cousins, numerous instances being recorded of his killing and devouring them. Having got rid of the black rats, the brown ones have multiplied to an alarming extent—so much so that, as already remarked, the columns of our newspapers have recently been deluged with articles, letters, and paragraphs, treating the rat pest as a modern plague. The notion that the brown rat came to Britain from Norway is of course a fiction, as it was known in our own country long before it was seen in Norway. Another notion, that it came with the House of Hanover, is equally ridiculous, though this was a long-standing taunt and reproach with the Jacobites.

The fecundity of rats is amazing. Commencing to breed at between three and four months, old rats produce from four to sixteen young ones at a litter. In fourteen days they open their eyes, and soon after become exceedingly active and playful. At six weeks' old they are compelled to fend for themselves, being supplanted by another brood. In open winters, and in places where their food-supplies are easily acquired, they are found to breed almost the entire year. I have heard it stated that, by a wise provision of Nature, there are a great many more males than females. The same remark I have heard applied to deer, foxes, and other animals, but neither comports with my experience, as I have found males and females in about equal proportion, and I think the rapid increase of rats amply corroborates my observations. This is a theory I cannot accept, as it is contrary to my experience.

Most animals have some one to speak or write in their behalf. Hawks, owls, stoats, weasels, and cats have recently had their virtues extolled in the columns of our leading journals, but in all circumstances no animal has so few to say anything in its defence as the rat. Man, their relentless enemy, utilises every expedient which human ingenuity can devise to keep them down; and even with the counteracting forces of nature, rats hold their own against their numerous enemies combined. It is therefore not to be wondered at that they are cunning; and the most superficial observer must have noticed the knowing and wide-awake appearance which

characterises the race of "*Mus*." It matters not what part of the world man may choose for his habitation, it is certain he will be followed by rats. The distance they travel is remarkable; and, as I lately pointed out in a letter to the 'Scotsman,' they annually made their appearance at Dalnaspidal in Perthshire when the shooting-lodge became tenanted. To those who know this wild mountainous region, and the distance of barren waste-land that intervenes between it and other habitations, it must seem manifest that they are endowed with a marvellous instinct. Rats, as a rule, make their appearance wherever man takes up his abode, and act the part of scavengers by picking up and devouring refuse that finds its way into drains, or is thrown out in the neighbourhood, and which when in a state of decomposition engenders disease. In this respect rats seem to have been destined to play an important part in the operation of economic laws. Indeed it has been asserted that "the visits of the plague to western Europe and to Britain have ceased from the very time when rats became plentiful."

Rats, like all animals that eat flesh, drink a large quantity of water, and sometimes travel a long distance in search of it. It is interesting to see them drinking,—lapping water with their tongues like dogs. Seeing this is their normal habit when on land, it has often struck me as remarkable how they manage to live in the iron holds of ships without water during long voyages. Notwithstanding the filthy character of their surroundings, rats are exceptionally clean animals, and are continually licking themselves with their tongues. Strange to say, while almost every bird and beast has a parasite, I never found one of any description on a rat.¹ I find, however, that rats are very subject to tumours of the skin. In a recent experiment I introduced a large rat in a cage trap into the presence of four cats, and he seemed a great deal more interested in licking his feet than in taking the slightest notice of his natural enemies—so much so that the owner of the cats declared he was a tame one.

While the amount of mischief done to the agriculturist, the game-preserved, and others, by the increase of rats, admits of

¹ I now learn that a parasite is also present on the rat, though sparingly. Mr Wm. Forgan has found one of these parasites, and has sent me a photomicrograph of it.

no dispute, the cause and cure, although freely discussed, appear in a great measure to be only a matter of surmise and conflicting speculation. I have read with interest the various theories that have been submitted from day to day, and without any wish to dogmatise, or to lay claim to any superior knowledge further than that which is implied by lengthened personal observation and a close and careful study of the subject, I feel satisfied that few of these theories will stand the test of close criticism, while some of them are transparently absurd. Let us look at a few of the most popular and reasonable explanations which are being given for the origin of the pest, and the best means of getting rid of it.

Warm weather and the scarcity of water about farm "toons," when the vermin betake themselves to the fields and woods, where they are allowed to breed without molestation, have been assigned as the cause of the nuisance. This may have been the case in some farm "toons," but about many others there is abundance of water, so that the reason here submitted is inadmissible except in some very exceptional cases. No doubt rats, like fashionable people in towns, like to rusticate in warm weather, and once having taken up their abode, will scarcely leave it so long as food-supplies are obtainable. The method of snaring and not trapping rabbits has also been submitted as a cause of the rapid increase of rats in the fields. A writer in the 'Scotsman' asserts that since the passing of the Ground Game Act, snaring rabbits has come more into vogue than trapping. Where snaring has been substituted for trapping, it is certain that many rats will be allowed to live that would have been caught in the rabbit-traps. A large East Lothian agriculturist, the late Mr Dudgeon of Upper Keith, told me shortly before his death that on his farm the previous winter two hundred rats had been caught in the hedgerows round his fields in the rabbit-traps. Had his rabbits been snared instead of trapped, it is easy to see how the following summer his fields would have been overrun with rats. A few weasels were also taken, which, of course, is inevitable in trapping, as they continually run in and out of holes. One objector blames the destruction of weasels by gamekeepers; while another, as we have seen, asserts it is because rabbits are not trapped that rats are allowed to increase. Nothing, I affirm, kills down stoats

and weasels — and, let me add, rats — so much as rabbit-trapping. Those who have watched the habits of weasels must have been struck with the alacrity with which they run into one hole and make their appearance at another a considerable distance off. As they are not suspicious like rats, they overrun traps without dread of danger, and as a consequence become decimated in those parts of the country where rabbit-trapping is practised. The result is that a certain class of naturalists denounce gamekeepers as ignorant, who know a great deal more of practical natural history than those who denounce them. One thing must seem clear, that the trapping of rabbits and the destruction of weasels are identical, and I ask in all seriousness, Has trapping to be abolished in the interests of weasels? I answer, No!

I know no subject upon which more nonsense is apt to be written than that of natural history. Let a man once get it into his head that he is a naturalist, and he seems to regard himself as licensed to revel in nonsensical speculation and superstitious folly. Let no one say that this is either uncharitable or exaggerated in view of a letter which appeared recently in the 'Scotsman,' wherein, with the greatest amount of sincerity, it is stated as an established fact that by the playing of bagpipes the rat plague can be "effectually overcome." Seeing that this letter is signed by "an old Highland minister," it may comport with Highland theology, but I submit that it is at variance with the facts of natural history.

As I have no desire unnecessarily to prolong this paper, I will now come to that theory which has been so much advanced by writers, some of them members of this Society. I refer to the alleged disturbance of those laws in the animal kingdom whereby the balance of nature is subverted by the destruction of vermin by gamekeepers and others. I need not recapitulate here what I recently wrote to the 'Scotsman,' but let a few words suffice.

Twenty years ago, on the Craigmillar property, game was strictly preserved, and vermin, including rats, trapped down with scrupulous care. Circumstances arose when it was deemed desirable to stop preserving. The result has been that vermin has increased, and so have rats. Being a thickly populated

district, cats are exceedingly numerous, and in snow their tracks are seen everywhere. Weasels are also numerous, and are frequently seen in close proximity to where rats are burrowing in dozens. One writer in the 'Scotsman' gave a graphic description of a fight between a weasel and a rat on the property referred to, and added that he had "often seen specimens of these animals in that locality." He stated that the rat was an "unusually large one" (which means about a pound and a quarter), and "the weasel of the ordinary size" (under a quarter of a pound). The battle was evidently a mutual one, the attack having been renewed after they were disturbed. The rat acted on the offensive, as was the case with the one I had shut beside a stoat in a large cage. In both cases the rat was killed; but in my experiment the stoat was severely bitten, and died from his wounds. How the weasel fared after the fight we have no means of knowing; but this I do know, that rats are as plentiful on the identical spot as ever they were before.

Only once in my life have I seen a combat between a rat and one of the weasel tribe in their normal condition; but as it was a small rat and a large stoat, the battle was of short duration. One writer stated he saw a weasel hunt a number of half-grown rats, and kill one in "two seconds or less." This I do not believe. Recently I was walking with two friends, when we heard a young rabbit squealing a short distance from the road. Borrowing a stick, I crept noiselessly forward, and observed a weasel hanging on to the neck of a small rabbit, which was struggling to escape. So much was the weasel engaged with its prey that it never observed me, and with a stroke of the stick I killed both it and its victim. Fully a minute must have elapsed from the time we first heard the squealing of the rabbit until I interfered; and the statement of half-grown rats—which are over half a pound in weight—being killed in "two seconds or less" may safely be consigned to the region of romance. I do not overlook the fact that while the instinct of the rat leads to its seizing its prey by any part which it may think vulnerable, it is otherwise with the weasel and the stoat. By a remarkable and terribly fatal instinct they strike only, and with unerring accuracy, at the leading artery at the back of the neck, which is death.

“J. H. Corballis,” who wrote at considerable length in the ‘Scotsman,’ stated “that the natural destroyers of rats are the hen-harrier, the long-eared owl, tawny owl, cats, weasels, stoats, kestrels, eagles, sparrow-hawks, lanner, saker, and goshawk.” This, I submit, is a mere trifling with the subject. As rats are nocturnal in their habits, it appears to me that, with the exception of owls, it is the extreme of folly to characterise the hawk tribe as the “natural destroyers of rats.” In promulgating his balance-of-nature theory, this writer states that “some keepers will, no doubt, remain incredulous.” He is quite right there, as I for one not only remain incredulous but resolutely oppose his theory. I oppose it—first, because it is inaccurate; and, second, because it is more far-reaching in its mischievous results than appears at first sight. This balance-of-nature theory, however plausible and popular, I regard as simply nonsense. Not only so, it is mischievous and most prejudicial to the substantial interests of landed proprietors who are foolish enough to believe it, and carry it out on their property. I know a large estate of over 15,000 acres on the west coast of Inverness-shire where the balance-of-nature theory is most scrupulously carried out. The result is that, in so far as ground or winged game is concerned (deer excepted), the shootings are comparatively valueless. This is not because the external and geographical conditions for an abundance of grouse, black-game, and partridges do not exist. For black-game the conditions are excellent, while for grouse and partridges they are fairly good. Now I venture to say that on these 15,000 acres it would baffle a couple of the best sportsmen to kill more than 100 or 150 brace of grouse during the entire season. Why? Simply because the balance of nature is preserved, and the hawks, ravens, and hoodie-crows are ten times more numerous than the winged game. Had I the control of that property for a few years, I feel assured that by killing down the winged vermin the shooting-rent would be increased at least 200 per cent. So much, then, for the economic policy of maintaining the balance of nature undisturbed. This advocate for maintaining the balance of nature asks incredulous gamekeepers and others to consult men who have shot game in Africa, China, Canada, &c., where the balance of nature is unmolested. But transferring his field

of illustration to foreign countries by no means improves his position. In foreign countries you may have a change of climate, and the hours which constitute day and night may produce a marked change in the climatic environments, but not so in the operation of nature's laws. Nature is ever true and unchanging when left to herself. But what of this foreign experience? I have never shot in either of the countries referred to, but the season before last I had a most enjoyable sporting tour all over Norway, where the balance of nature has not been seriously interfered with. The balance there shows a great deal more vermin than game,—hoodie-crows being in thousands, and magpies breeding on the tops of the houses, the peasantry being too superstitious to disturb them. The Norwegian Government are becoming alive to the destruction of game and farm stock by vermin, and are now giving rewards to those who kill certain birds and beasts of prey, including bears, wolves, eagles, hawks, &c.

While staying at Molde, a party of us were driving on the road a few miles to the east of the village, and when passing a peasant's house we observed a large hawk swoop down among some domestic poultry. The cock, having no chance of escape, stood his ground, but the hawk clutched a large number of feathers from his back, and doubtless would have killed him had an old woman not ran to the rescue with a heather besom. To have shot that hawk would have been disturbing the balance of nature, and to my mind it would have been a sensible act. During the same week news came in to the village that sixteen sheep had been killed, and a bear with two cubs had been seen within three miles' distance. A party of volunteers went off in pursuit to disturb the balance of nature, but in consequence of an accident I was unable to accompany them, much to my regret. Bruin, however, was too wide awake for them.

In a short sojourn among the Laps, I discovered that the greatest difficulties they have to encounter is in trying to disturb the balance of nature in the protection of their herds of reindeer from the depredation of wolves. Every device is resorted to in their primitive fashion to kill the wolves, and their destruction is as essential for the wellbeing of the

reindeer as is the killing of hawks and weasels in this country for the preservation of game.

In traversing the fjelds or mountain plateaux with pointers for ryper—the native grouse—I found them exceedingly scarce, and on hundreds of thousands of acres poor sport is to be had. And why? Simply because their eggs are destroyed by predatory birds, and hawks are ever hovering in the air ready to make a quarry. A sportsman with good dogs may kill from ten to twenty brace in a day, but if game preservation was better understood, a hundred brace might easily be acquired. Those who have sailed round the west coast of Norway must have been struck with the beautiful eider-ducks which are to be seen everywhere in the fjords. After a week's sailing last summer in a small boat round the islands of Hitteren, Scarso, Ertvaago, and others, during the breeding season, I was unable to find the eggs of the birds referred to, though a party of us went frequently on shore and made a diligent search. Of course the reason was not far to seek, but curiosity prompted me to ask some of the peasant-farmers on the coast, who replied that "the crows ate them all." It is easy to see how, if hoodie-crows and hawks were killed down to within reasonable limits, ryper, which contributes so largely to the food-supplies of the nation, and eider-ducks, from which that valuable commercial product, eider-down, is obtained, would be found in far greater abundance. This certainly does not comport with a statement made by our fellow-member, Mr Scot Skirving, to a Select Committee of the House of Commons in 1873, that "no bird would be a nuisance if man had not interfered with them."

Reverting to the rat pest, most of the writers in the 'Scotsman' assert that the increase of rats is due to gamekeepers exterminating birds of prey. This I deny, because, as I have shown, the only birds of prey that can destroy rats to any extent are those which are nocturnal in their habits, and which are confined to the owl species. Assuming that owls are destructive to rats,—which I shall subsequently question,—have they been exterminated by gamekeepers? My answer is, they have not. I was a gamekeeper for nearly twenty years, and never destroyed owls as vermin. I am acquainted with sportsmen all over England and Scotland,

and I do not know one who destroys owls. In recent years I have been at many cover-shootings, even in East Lothian, and have seen numbers of owls flying out of the thick woods before the beaters, but never knew any one lift a gun to them. Let those who write denouncing the destruction of owls in the papers state their authority, where they were destroyed, and by whom, before rushing into print and making statements which I believe to be rash, unwarrantable, and erroneous. Since the rat question came into such prominence, I have written to a large number of gamekeepers in different parts of the country, requesting them to send me their observations regarding what was the staple food of owls. As I have never known them to feed on rats myself—except dead ones in confinement—I was anxious to have the testimony of others whose veracity, I knew, could not be called in question. Some of them, like myself, have never seen any indication of rats having been carried to the nest of owls; but some, I must be frank enough to confess, have. Mr Thompson, head-keeper to Colonel Trotter of Charter Hall, in Berwickshire, a most intelligent observer, writes: “I have never known a hawk kill a rat. Kestrels may sometimes kill a young one, but, hunting during the day, their chance of killing rats is very small. I have seen the remains of young rats near an owl’s nest.”

Mr Martin, head-keeper to His Grace the Duke of Buccleuch at Bowhill, also writes: “I have never seen the remains of rats at owls’ nests in the woods, but it is right to mention that for several consecutive years an owl’s nest was in the pigeon-house beside the joiner’s shop, sawmill, &c., in connection with the Bowhill estate. When the young birds were hatched, great interest was taken as to what was carried to feed them. It was observed that the old birds commenced to carry food between three and four o’clock in the afternoon, and it was discovered that young pigeons, both wild and tame, young pheasants, and other young birds, such as thrushes and blackbirds, young rabbits, a great number of mice, and a few rats—none of the latter except very small ones—were included in the bill of fare. One day the owl was observed carrying something unusual into the pigeon-house, and a ladder being procured, a young wild duck, not quite dead, was found at the

nest. We never kill owls here, but as they destroyed all the young pigeons in the dovecot, they eventually had to be ejected."

What is the practical application of all this? *First*, as to the cause of the increase of rats, so generally complained of. There may be minor causes which have contributed to it, but I affirm that there are three outstanding causes which ought to be patent to every thoughtful observer. (1.) There is the modern improvement in our sanitary conditions in towns, and even farm-steadings. There is nothing which the rat finds more uncongenial to his comfort than sewer-pipes, with an occasional Buchan trap, and the introduction of cement, now being largely used for barn-floors, byres, and stable-yards. (2.) Another cause contributing to the increase of the rat pest is the remarkable dry summers and open winters experienced in this country during the last few years. Arising out of this, we have had heavy crops, and a superabundance of grain of all kinds left upon the stubble-fields, which no efforts of the husbandman could utilise without having recourse to the sickle. The effect of this exceptionally open winter, with abundance of food, has been to increase the number of rats. Like rabbits, as every schoolboy knows, its breeding-season is abridged or prolonged very much according to the external conditions in which it exists. (3.) There is, finally, the operation of the Ground Game Act, which, while pressing more heavily upon hares and rabbits, has operated in an adverse direction upon rats. Farmers may be disposed to question this, but it is nevertheless a truth which, in view of the interests involved, must be stated—viz., that since the passing of the Act in question, they have been much more zealous in killing hares and rabbits than they have been in the destruction of rats. Before the passing of the Ground Game Act, farmers and their servants were uniformly vigilant in killing rats as time and opportunity offered. Now I am libelling no one when I affirm that that vigilance has up till lately been very generally relaxed.

Second, as to the remedy. In view of the danger of water being poisoned, and of dogs being destroyed, by the administration of poison, I am reluctant to recommend its use, altogether apart from the question as to its illegality when openly exposed. I say nothing of the intolerable and unhealthy smell emitted

where poisoned rats find their way under floors, or into the partitions of inhabited dwellings. There is no need of having recourse to this doubtful expedient where there is an industrious effort in the application of measures which are well known to have hitherto proved successful. The use of traps, snares, ferrets, dogs, spades, and guns properly applied are perfectly competent to stamp out the rat plague if sufficiently persisted in. At the same time, it is well to state that no spasmodic effort, ever and again suspended and periodically renewed, will meet the necessities of the case. Neither will any or all of these applications combined meet the exigencies of the case, where they are merely local in their application. Rats, as I have indicated, are quick in their instincts to apprehend danger, and prompt in their action to fly from it. Hence, being attacked on one farm, they will in most cases not be slow in making themselves scarce by flying to find refuge somewhere else; and, being able to travel long distances, will be found suddenly to make their appearance in large numbers, it may be several miles distant. It will thus be seen that simultaneous action must be taken in each district if the war against this disgusting pest is to be successful. Let the policy here recommended be generally adopted, and industriously and patiently prosecuted, and there is no reason why we should not shortly hear the last of the rat plague.

V.—*THE GARDEN-SPIDER (EPEIRA DIADEMA)*
AS AN ARCHITECT.

By MR ROBERT STEWART, S.S.C.

(*Read Feb. 26, 1890.*)

At the present time spiders are looked upon with aversion by nearly everybody, and consequently few people can tell one spider from another. How to account for this is perhaps not difficult, if we recollect that one of our earliest accomplishments consisted in being able to repeat, before a select

company of uncles and aunts, the legend of the awful catastrophe which overtook that nice little lady Miss Muffet, when

"There came a little spider,
Who sat down beside her."

We never appear to get over the lesson so ingrained ; and, though we would hardly care to acknowledge it, yet even when we have arrived at years of discretion, and possibly have young "Miss Muffets" of our own, most of us would sooner face a mad bull than allow a spider to run over our face, or even our hands. In ancient times, however, justice was done to the spider. The wise man enumerates it amongst the "four things which are little upon the earth," yet are "exceeding wise." By the formation of such societies as ours, however, throughout the country, an intelligent interest has been developed regarding the habits of a number of the lower animals, with the result that some of those which were at one time looked upon with the greatest aversion by certain individuals, are now the cherished pets of these very people.

There are about a hundred kinds of spiders, and most interesting they are, one and all. Some of them are very beautiful, while the manner in which they weave their webs is truly wonderful, that of the garden-spider being so exquisite in design and workmanship as to earn for the framer the title of the "Geometric" spider. In hot climates spiders attain a great size, and spin webs strong enough to ensnare small birds ; and there is a well-authenticated case of a spider capturing a black snake more than a foot long, and thereafter lifting it into the air a helpless prisoner. It is also said that spiders are the most weather-wise of all creatures, and that by a careful study of their movements, impending changes in the weather can be foretold with great certainty for days previous. They are also exceedingly ingenious, in proof of which a gentleman frequently placed one on a small upright stick, and surrounded the base with water. When the little creature found that he could not escape by the ordinary route, he ascended to the point of the stick and ejected a thread into the air, which soon attached itself to some of the surrounding objects, and along this line the spider effected his escape.

The threads of the spider are produced from small knobs at the extremity of the body, termed "spinnerets." The threads are woven of thousands of delicate films, which, after being forced out of the body in a semi-liquid state, and hardened by the action of the air, are united in one single line by the feet of the spider, and thus great strength is obtained by making the line compound instead of single. My object this evening, however, is not to speak of spiders as a whole, but to record an interesting fact which was noted in connection with a garden-spider who took up his abode and plied his calling on the gatekeeper's box at the entrance to the Royal Botanic Garden, Edinburgh. Naturalists have repeatedly found pieces of wood, and even small pebbles, on the net of the garden-spider—placed there, it was supposed, for the purpose of steadying the web—so that what I have to record is nothing new. But as the little creature in the present instance was observed during the whole process, there is some excuse for bringing the occurrence under your notice. The roof of the box in question projects slightly all round, and on the edge of the projection facing the walk a garden-spider had its floating habitation. The web was quite unattached at the lower extremity, and consequently was affected by every breeze that blew; but the sagacity of the spider in selecting this site was apparent to any one looking into the matter, as not only did the spider secure his own share of those insects doomed to perish in the orthodox manner, but he also secured a large augmentation to his larder in the shape of numbers of small insects which, dropping from the tree overhead on to the top of the box, rolled from thence into the web below. The spider, however, while realising the advantages of the site, appears to have felt that the position had its drawbacks as well, the chief one being a little too much airiness. In what particular manner this defect militated against the interests of the spider we cannot determine with any degree of certainty. It is a well-known fact that if you gently touch a spider's web with anything light, the owner at once puts in an animated appearance; so it may be that the web, prior to the improvement hereinafter narrated, was so airy that the slight tremor caused by a summer breeze may have appeared

to the anxious watcher as the capture of a gnat, while the advent of a common fly may have raised visions in the spider's mind of full-grown "blue-bottles." To provide against such false alarms, the spider resolved to remedy the defect complained of,—but how? We can imagine him strengthening a band here and there, and thereafter carefully testing the result. Such methods all ended in failure; and in this, as in other cases, necessity was the mother of invention. The spider evidently thought that if he could get a weight of some kind attached to the outside of the web, the defect might be cured; but how this was to be done must have occasioned a deal of thought. Ultimately, however, he determined on getting one of the small stones lying about on the walk below lifted to his abode on high, and with this view he let himself down by a rope to the ground, and selected a stone suitable for his purpose. To this stone he made the line fast by attaching a small thread to each end of the pebble, in exactly the same manner as masons fasten a stone with the "shears" attached to a crane. This done, the spider clambered up to his web. He next proceeded to lift the stone into the web, and, when first observed on the morning of the 3d September last, the stone was hanging about three inches from the ground. In less than an hour, however, the distance was increased to over three feet; and before the middle of the day the spider had the pebble drawn up to within about a foot or eighteen inches of his web, when he ceased operations for the day. There it hung the whole afternoon, suspended by the two small threads; and as there was a good stiff breeze blowing, the stone swung backwards and forwards like the pendulum of a clock. Next morning the spider had the stone drawn into the centre of the floating portion of the web, and made fast there.

During the whole of that day the spider had cause for congratulation, as the position of the stone appeared to give the web a certain solidity which was before absent. This satisfaction was short-lived, however, as, like all "castles in the air," this one too was of short duration. That night there was a heavy mist, with slight rain, which, settling on the web, rendered it so fragile that the mere weight of the stone broke it loose from its fastenings, and it accordingly

dropped to the ground. Keen must have been the disappointment of the spider in the morning to find that his ingenuity and labour had come to nought. On realising the situation he appears to have finally given up all idea of using stones in the construction of his web. He, however, of new put his house in order, by making his web considerably smaller, and so perhaps in this way remedied the defect in its structure which the presence of the stone was intended to counteract. The spider continued to occupy the same premises till about the middle of October, when it disappeared from view; but a small coating of tough webbing, about the size of a shilling, in a corner of the box, marks the spot where the spider has retired for the winter, to issue forth when the warm weather brings about the reappearance of the insects on which he feeds. It will be interesting to note how he constructs this season's web, and we may obtain from an observation of his movements some additional light on the vexed question as to whether the ingenuity displayed by so many of the inferior creatures is on their part instinct or reason.

VI.—ON THE ECHINOIDEA OR SEA-URCHINS.

(WITH SPECIAL REFERENCE TO THOSE OF THE FIRTH OF FORTH.)

BY MR JOHN LINDSAY.

(*Read Feb. 26, 1890.*)

SUMMER visitors to our coast-towns sometimes observe, in the "cottage by the sea" which forms their temporary quarters, a quaint chimney-piece ornament, in shape somewhat like a melon, divided into vertical zones, and marked all over with numerous lines and dots. This ornament is generally regarded with a certain degree of wonder by the city-dweller, when seen for the first time; and on inquiry at its possessor, the information may be hazarded that it "once lived in the sea," but beyond that elementary fact, little or nothing to

elucidate its history is usually forthcoming. This "shell," however, is simply the "test" or covering of a sea-urchin, after all the "internal arrangements" of the animal have been ruthlessly scooped out, and the exterior surface of the shell has been stripped of its spines, and then, mayhap, scraped, smoothed, and varnished. In this state it has very little resemblance to the strange and uncanny looking animal itself, when fresh from its native element, with its sharp spines all set on end and in their lovely hues of pink and crimson and rosy-purple. Round the coasts of the Isle of Man the common egg-urchin is very plentiful, and the fishermen eke out their scanty living by collecting them, cleaning them out, and stripping off the spines, when the shells find a ready sale amongst the crowds of tourists who annually visit the island.

Most modern scientific writers on the sea-urchins surround the subject with a mass of technicalities, which renders an otherwise interesting theme almost unintelligible except to the initiated. Having had the opportunity lately of examining and studying a considerable number of these curious marine animals, it has occurred to me that a paper dealing with them in a popular yet accurate manner, and including the results of the latest investigations on the subject, might not be without interest to the members of the Society.

In treating of the sea-urchins, and especially those of the Firth of Forth, I shall first take as a type-specimen the species which is most easily obtainable in our locality, and which yet combines in itself all the important features of the class—viz., the common egg-urchin (*Echinus sphaera*). This species may be said to be plentiful in the Firth of Forth, while a few others, to be afterwards mentioned, are more sparingly found. Let us take a glance at the structure and life-history of the common egg-urchin, and we shall then be in a position to compare it with other Echinoids, as well as with other members of the Echinodermata to which it belongs.

The group of the Echinodermata, or "thorny-skins," includes among its living forms the Asteroidea or Star-fishes, the Ophiuroidea or Brittle-stars and Sand-stars, the Crinoidea or Feather-stars, the Holothuroidea or Sea-cucumbers, as well

as the Echinoidea or Sea-urchins—in many respects the most highly developed members of the group. The name “urchin” is often applied to that familiar animal the hedgehog, the old Scottish form of the word being “hurcheoun,” French *hérisson*, from *hérisser*, to bristle, to stand up on end. The sea-urchin is therefore known also as the sea-hedgehog, as well as the sea-egg. In Prof. Edward Forbes’s interesting book on ‘British Star-fishes and other Animals of the Class Echinodermata,’ amongst the humorous drawings from his own pencil in which the author so greatly delighted, there is a most amusing sketch of two boys at the sea-beach setting a hedgehog at an echinus. The amazement of the two animals, strangers to each other yet with a certain kinship in appearance, is evidently mutual, as each sets its spines on end and prepares cautiously for the fray. Beginning with the *external* structure of the sea-urchin, the covering or box containing the animal first claims attention. The problem has to be here solved of a living creature, thus enclosed, constantly increasing in size, and therefore requiring a house which shall continue to fit its ever-altering conditions. The hermit-crab, as is well known, under such circumstances simply “conveys” the abode of another animal to suit its own needs, but the sea-urchin is far too much “attached” to its early home to permit it to pursue such tactics. Its shell must therefore grow with it, and remain with it during the whole period of its existence—never being cast or moulted like the shell of a crab, for instance. This regular systematic growth is effected by the shell being composed of numerous pentagonal plates, accurately dovetailed together. The thin muscular coats which line the interior and exterior of the shell cross and recross between the joints or sutures of the plates, and secrete from the sea-water the carbonate of lime which composes these plates, and which is constantly being added in a regular manner round the edges of each plate. New plates are also inserted at certain parts of the shell during the process of growth. In one family of living urchins, however (the Echinothuridæ), and in some extinct forms, the plates are not firmly attached by their edges, but are imbricated or overlapping, thus rendering the shell flexible. In the living condition, the whole structure of the common egg-urchin’s

shell or box is found to be perfectly water-tight, having stood the test of a hydraulic pressure brought to bear on it which only stopped short of the bursting point, yet without showing the slightest leakage. At the Royal Botanic Garden of our city the experiment has been made of utilising the shells, by turning them into flower-pots for hanging-plants; but in a comparatively short time these improvised pots always fell to pieces, separating at the joints of the plates. In the English translation of a popular scientific work entitled 'The World of the Sea,' by the French naturalist M. Moquin Tandon, the astounding statement is made that in the shell of the edible sea-urchin (*Psammechinus (E.) esculentus*), a near ally of the common egg-urchin, there are 10,000 plates. One can only make the charitable suggestion that in this case a "nought" has been added by mistake, otherwise the statement is simply absurd. I have, however, counted as many as 800 plates in the shell of a well-grown egg-urchin.

A glance at the test of an echinus further reveals the fact that it is arranged in meridional zones or rays, thus evidencing its affinity with the star-fishes,—with which animals there are, indeed, other points of resemblance or identity, to be afterwards noted. These zones are composed of twenty single rows of plates, or ten double rows—five of the double rows being made up of large plates and five of small plates, so that the zones are of unequal size. The large and small zones occur alternately, while the latter are perforated at their margins by minute openings or pores. These pores in the small rows of plates are for the emission of the tube-feet, or ambulacra, which the animal has the power of protruding and retracting at pleasure. The small zones are therefore known as the "ambulacral areas," while the alternating larger zones are styled the "interambulacral areas." By looking through the empty shell of a sea-urchin from the outside at the oral aperture, and towards the light, these areas and perforations are easily distinguishable. In the common egg-urchin there are *three* pairs of pores in each row, each pair carrying one tube-foot; while in the edible sea-urchin of the Mediterranean, *four* pairs of pores are present in each row. There are other points of distinction between these two species, yet they are frequently confounded; and I notice that in one of the "price-

lists" issued in connection with the Marine Station at Granton, E. sphaera, which, as already said, is plentiful in the Firth of Forth, is absent, while Psammechinus (E.) esculentus, which is not found there, is included. It will be noticed, also, in connection with the pore-bearing zones, that in the egg-urchins these pass from pole to pole of the shell; but in another large group, of which the purple heart-urchin (*Spatangus purpureus*) of the Firth of Forth is an example, they are not continuous, but form a rosette, resembling a five-petalled flower, on the upper surface of the shell.

Besides the pentagonal plates which go to make up the covering of a sea-urchin, two special circular rows of plates are found on the summit of the shell, surrounding the anal aperture—viz., the genital and the ocular plates. The genital plates carry the external openings of the reproductive organs,—large racemose bodies, very similar in appearance in the two sexes. It was not till 1840 that the different sexes of the Echinoidea were discovered, it being previously believed that the various individuals composing the class of the Echinodermata were all either bisexual or solely female.¹ The ova are fecundated in the water, the spermatozoa moving rapidly about by means of their vibratile filaments. One of the five genital plates, besides carrying a duct or opening like the others, has undergone a curious modification, being larger than the rest, and studded with minute perforations like the fine "rose" of a small watering-pot. This modified genital plate is known as the madreporite—a structure also found in the star-fishes, and generally supposed to serve the purpose of filtering the sea-water before it enters the water-vascular system of the animal. This supposition has been strengthened, if not confirmed, by the following experiment. A coloured fluid was injected for several hours, at a high pressure, into part of the ambulacral system of a sea-urchin, when the fluid ultimately passed into the tube or "stone-canal" connected with the madreporite, and issued from the perforations of the latter in a finely divided coloured stream. Wedged in between the five genital plates are the five ocular plates, smaller than the genital plates, and each bearing a pore from which a tentacle is extruded. This tentacle was at one time thought to have

¹ See on this point Van der Hoeven's 'Handbook of Zoology,' vol. i. p. 133 *et seq.*

at its base an eye-spot or organ of vision, but the whole tentacle is now regarded as an organ of touch. I have prepared an egg-urchin shell by painting in distinctive colours the ambulacral and interambulacral zones, the genital and ocular plates, and the madreporite, thus permitting these exterior parts of the structure to be seen at a glance.

Still dealing with the test or covering of the sea-urchin, the spines next claim attention. These are of various sizes and thicknesses—from a mere thread of less than half-an-inch in length, to several inches, with corresponding thickness. In section, many of the spines show rings similar to the annual growths of an exogenous stem, though, of course, their mode of growth is entirely different. These rings vary in number—not, as one would have expected, according to the dimensions of the spine, but by the distance from the base at which the section is made. The disposition of the rings and rays, and the other ornamentation of the spines, give rise to many beautiful combinations. Taking advantage of the beauty and variety of these spine-sections, preparers of objects for the microscope have in some cases produced “type-slides” which are truly works of art, but, owing to the labour involved, they are usually rather costly. In the third volume of the “Challenger Reports,” some seventy different forms of spines are figured in section, besides many others which are shown in profile. Spine-sections, when large, are not very difficult to prepare for the microscope, being treated very much in the same way as sections of bone, or mineral sections; but when the spines are small, as in the egg-urchin, considerable care and patience are required. After repeated failures, I hit on the plan of cutting a number of spines and fixing them together by their sides with strong gum. The mass was then held by the fingers and ground fine at one end, and when reduced to about one-eighth of an inch this smooth end was fixed to a glass slip, and the rough end polished on a fine slate till the whole was quite transparent. The slide was then placed in warm water and the sections separated, when each could be examined and the best specimens mounted in balsam. This process gave very good results, as may be seen from the slides now exhibited under the microscope.

The spines of the sea-urchin are found in greatest number

on the interambulacral zones, and are moved by an ingenious ball-and-socket arrangement or universal joint. Dots or tubercles, hemispherical in shape, are scattered over the shell, and upon the summit of these the spines revolve at their hollowed-out extremity, being attached to the muscular coating of the test by a thin flexible membrane. While the tube-feet can only be used under water, the spines are called into play to aid progression on land; but they also, no doubt, serve as organs of defence, as well as help in scooping out the sand, or even the hard rock, where some species live. The purple egg-urchin (*Toxopneustes (E.) lividus*), common in some parts of Ireland, is found in great numbers living in holes scooped out of rocky ledges covered by the tide at high water. The points of the spines in many species are very sharp, and in the egg-urchins have a reprehensible habit of breaking off and burying themselves in the skin of the hands or feet, to the special discomfort of bathers. One of our members, who lived for some time at Gibraltar, where sea-urchins are very common in the surrounding waters, informs me that he has often seen a number of soldiers, after they got back to barracks from their "dip" in the sea, sitting in a row with knife or needle, busily operating on the soles of their feet, in order to extract the sharp tips of the spines that had penetrated so far as to be almost invisible. The sea-urchins are gregarious in their habits; and members of the Society who have accompanied our dredging excursions will remember that when any appeared in the trawl, there was generally found to be a goodly number of them. It has been calculated that an adult sea-urchin will possess fully 4000 spines; so that when bathers come upon a shoal of them in the sea-bottom, they have to run the gauntlet of a perfect forest of these tiny spears.

During the last few months I have examined a considerable number of sea-urchins, brought up by the trawl near the Isle of May, and have been struck by the variety of form assumed by the common egg-urchin. Many were distinctly globular in shape, but others were much flattened at the poles. The colour of the shell, too, varied considerably, ranging from a dull white to a deep orange. While the size and colour of the shell thus varied, there was a similar variation in the spines. Some were long and sharp-pointed, with a very pale

red tint; others were short, somewhat blunt, and of a deep rosy-purple hue. Indeed there seemed to be enough of variation from the normal type to warrant the inclusion of some in sub-species or varieties.

Scattered about among the spines of the great majority of sea-urchins are found two minute appendages, on which a few words may be said. The first of these appendages are the pedicellariæ or pincers, which have been known to naturalists for over half-a-century, and yet their true function has only lately been determined. They are, in form, small pincer-like organs, scattered all over the shell, though perhaps most numerous near the oral aperture. Each pedicellaria is mounted on a long flexible stalk, capable of swaying to and fro. In some species there are two blades in each pedicellaria, in others four, but three seems to be the normal number. These bodies are also found on the star-fishes, though smaller in size; and Müller, who first described them, regarded them as parasitic animals. Prof. Louis Agassiz at one time thought they were "infant echini, which after their exclusion affix themselves to the skin of their mother." Again, while regarding the pedicellariæ as organs of the animal, Prof. A. Agassiz and others held that they were used for getting rid of excrementitious particles which had become entangled in the spines, and which were handed on, as it were, by one pedicellaria to another until got rid of. Prof. Edward Forbes said of them: "I can by no means consider the question of their nature to be settled, and find myself quite undecided as to whether they are organs of the Echinodermata or parasitic creatures, though inclined to the former opinion." These words were written in 1841, and very little of a more definite nature regarding them was discovered until 1881, when there was read before the Royal Society of London a paper by Dr Romanes, the present Rosebery lecturer, and Prof. J. Cossar Ewart,—"*Observations on the Locomotor System of Echinodermata*,"—where it is affirmed that the true function of the pedicellariæ is at length established.¹ In 1884 Dr Romanes published a work entitled '*Jelly-fish, Star-fish, and Sea-urchins*,' in which the same conclusions regarding the

¹ This valuable paper (the "Croonian Lecture") is now included in the '*Philosophical Transactions of the Royal Society of London*' for 1881.

pedicellariæ are given. These authorities assert their main function to be that of laying hold of pieces of sea-weed, in order to aid progression while the animal is climbing perpendicular or inclined rock-surfaces. This assertion is fortified by the result of many experiments, and other observers have since confirmed its truth. The blades or mandibles of the pedicellariæ are exceedingly sensitive, the slightest touch on the interior surface of any one blade causing the whole mechanism to close instantly. They vary considerably in shape, different forms being found even on the same animal. In the third volume of the "Challenger Reports,"—the 'Report on the Echinoidea,' by Prof. A. Agassiz,—numerous forms are figured. The largest of the pedicellariæ on the sea-urchins are about one-eighth of an inch in length. What seems to be but a modified form of the pedicellariæ is found on the Spatangideæ. These bodies have been named "clavulæ," and are "minute spines with expanded head and a calcareous pedicel covered by ciliated epithelium, attached to minute tubercles which form regular bands known as *fascioles* or *semitæ*."¹

The other curious appendages of the "test" of a sea-urchin are the spheridia, or *sphérides*,—so called by Prof. Lovén, who has issued a beautiful quarto on the Echinoidea, in which various forms of spheridia are figured. They are minute globular bodies, said to be covered with cilia, and mounted, like the pedicellariæ, on long stalks. Spheridia are found on all living sea-urchins except the genus *Cidaris*, and yet it is only very lately that they were noticed at all. What their function is has not yet been absolutely determined, though Prof. Lovén conjectures them to be organs of taste. He bases this supposition on their being found in greatest numbers around the oral aperture. Prof. Lovén says: "Disposés, comme ils le sont, d'une manière constante, aux approches de la bouche et le plus souvent à la base des grands tentacules buccaux, on est donc conduit à leur supposer la fonction de faire connaître la nature des substances que l'eau ambiante tient en solution, et de servir, de cette manière, à guider l'animal dans la recherche de sa nourriture. Ils méritent bien, avec tant d'autres points de l'organisation des Echinoïdées, d'être étudiés

¹ 'Forms of Animal Life,' by G. Rolleston and W. H. Jackson, second edition (1888), p. 558.

d'une manière approfondie." ¹ The calcareous skeleton of the sphaeridia, as well as of the pedicellariæ, is beautifully reticulated in structure, resembling in its lace-like character the spines of *Spatangus purpureus*, so well known to most microscopists. This reticulated structure is peculiar, indeed, to the calcareous parts of the whole group of the Echinodermata, so that even in fossil fragments there is usually little difficulty in determining which belong to this group.

Before leaving the subject of the test of the sea-urchins, and taking a glance at their internal structure, it may be interesting to note that the calcareous shell is covered, as already said, both on its exterior and interior surface, by a thin and highly sensitive membrane,—the interior lining membrane being also richly ciliated, presumably for the purpose of respiration. Both of these lining membranes have been carefully examined by Prof. Ewart and Dr Romanes, with the result that an internal nerve plexus or network is found to be spread over their entire surface. Prof. Ewart, who devoted his attention specially to the lining of the interior surface, found, "after a great deal of trouble," that "the internal plexus spreads all over the inside of the shell, and is everywhere in communication with the external plexus by means of fibres which pass between the sides of the hexagonal plates of which the shell of the animal is composed." ² By this discovery the remarkable phenomenon is explained of all the external appendages—feet, spines, and pincers—moving in sympathetic unison whenever a stimulus is applied to any one of these organs, seeing they are thus all connected with one common network of nerve fibres.

The tube-feet have been already noticed when speaking of the minute openings or pores of the ambulacral zones. The feet are used as feelers, as anchors, and as organs of progression; and they can be stretched out to over-top the longest spines of the animal. The ambulacral system of the whole group of the Echinodermata, which is similar in all its members, is doubly interesting—firstly, because of the ingenuity of its structure; and secondly, because it is found nowhere else in the animal

¹ 'Études sur les Échinoïdées,' par S. Lovén, p. 10.

² 'Jelly-fish, Star-fish, and Sea-urchins,' p. 305 (International Scientific Series, vol. 50).

kingdom. The *modus operandi* of the ambulacra is well described by Dr Romanes in the work already referred to. In the animals which compose the group, the functions of the tube-feet are found to be developed in an inverse ratio to the functions of the rays. That is to say, in the sea-urchin, where the rays are fixed, the tube-feet are most highly developed; in the Brittle-stars, where the rays are extremely mobile, permitting these creatures to indulge in all sorts of acrobatic feats impossible to a sea-urchin, the tube-feet are mostly rudimentary; while between these two extremes are the common star-fishes, where the rays are beginning to assume a mobile character, and the tube-feet are consequently neither so long nor so powerful as in an echinus. The tube-feet of a sea-urchin are extremely serviceable as anchors; and when we remember the globular shape of the animal, and how it is very much at the mercy of waves and currents, we can easily understand how such an anchoring apparatus is necessary. So firmly does it hold on by the tube-feet, when the attachment is properly formed, that it will permit the sucker-discs to be torn away rather than let go its hold. This a star-fish will never do, but will permit itself to be tossed to and fro by the waves, knowing by instinct, so to speak, that it can easily right itself again by means of its rays. Besides the powerful muscular rings present in the tube-foot of an echinus, the tube-walls are strengthened by numerous spicules, shaped like the letter C. The suctorial disc, again, is composed of plates with waved margins, from five to eight in number, which form interesting micro-preparations, and can easily be dissolved out in caustic potash. Prof. Forbes calculated that a full-sized sea-urchin would carry 1860 tube-feet.

As to the *internal* structure of a sea-urchin, the masticatory or dental apparatus first claims attention. The pentamerous arrangement already observed in the structure of the shell again appears here, for the masticatory apparatus is made up, in all, of twenty pieces, arranged thus: Five sharp-pointed triangular teeth; five sheaths or alveoli, in which the teeth are laid, and in which they move freely up and down by means of powerful muscles; five wheel-pieces or rotulæ, which stretch from one sheath to the next, and form a circle; and

five pieces, called the "compasses," which spring from one end of the wheel-pieces, and at their bifurcated ends carry the muscular ligaments which bind the whole apparatus firmly to the five staples set round the interior orifice of the mouth. The whole forms a most ingenious piece of mechanism, and is popularly known as "Aristotle's lantern." As the teeth wear away at their sharp edges they are renewed from the basal end, which gradually loses its soft spongy structure, and hardens as it nears the summit. A similar mode of growth is found in the teeth of the Rodentia. The echini are believed to be mostly "vegetable" feeders, browsing on marine algæ.

From the mouth of the sea-urchin a gullet and stomach conduct to a large convoluted intestine, which winds and doubles round the inside of the shell, and ends in an opening on some part of its surface,—in the egg-urchins, at the ab-oral pole. The oral aperture is always on the inferior surface of the test, but is central only in the "regular" group of the Echinoids, to which the egg-urchins belong. The anal aperture, also, which is in the centre of the genital disc, opposite the oral aperture, in the egg-urchins, is found in various positions in the "irregular" group, as in the pea-urchin of the Firth of Forth, where the oral and anal apertures are both on the inferior surface. A so-called blood-vascular system and heart are also present in the sea-urchins, as well as a complex nervous system, already referred to—a perfection of organisation which we would hardly have expected to find in such a lowly creature in the scale of creation. The interior of the shell is always filled with a fluid which must be something more than sea-water, as it is found to be richly corpusculated, and coagulates when exposed to the air, so that it may represent the blood of higher animals.

The young of the sea-urchins pass through a strange metamorphosis. As in the case of the crab the larval form was long thought to be a distinct animal, and was known as a "Zoëa," so the embryo of the sea-urchins, as well as of the star-fishes, was at one time placed under a separate group of animals, under the name of a "Pluteus." Joh. Müller was the first to notice these singular larval forms, and the name "Pluteus" was applied by him to the embryo—"from its resemblance," it has been said, "to a painter's easel with his

work upon it." This simile gives a very fair idea of the appearance of a pluteus; and it may be added to it that the embryo is very transparent, and only about the one-fortieth of an inch in size, so that although the plutei may swarm in the sea during the months of August and September, they are not easily recognised. Strange to say, it is only in warm and temperate waters that this mode of growth by means of a pluteus obtains; for Sir Wyville Thomson has found that in cold Arctic seas the young echini are produced viviparously from ova, and live as tiny sea-urchins on the body of the mother, by a sort of commensal arrangement, until they are able to fend for themselves.¹ By the kindness of Dr G. Carrington Purvis, there is shown to-night under the microscope the plutei of a sea-urchin, from the marine-station at Naples.

Having thus glanced at the general structure of the Echinoidea, as exhibited by the common egg-urchin of the Firth of Forth and other waters, we may now compare the sea-urchins with the more familiar star-fishes. Taking the common "Five-fingers" (*Asterias (Uraster) rubens*), we note the following points regarding its structure. There is first a disc and five radiating arms, and on the upper surface of these arms numerous calcareous nodules which support short spines. One of these nodules is larger than the others, being the madreporite or strainer which is also found on the test of the sea-urchin; while scattered about amongst the spines of our star-fish will be found the pedicellariæ or pincers already described. On the under surface of the disc, and in its centre, is the mouth; and from it five grooves extend to the tips of the rays, which carry on each side rows of tube-feet. There is here a remarkable similarity to the structure of the sea-urchin; and we are forced to admit the truth of the remark made by Dr Romanes, though at first blush it may be a little startling, that "in all its main features an echinus is merely a star-fish, with its five rays calcified and soldered together, so as to constitute a rigid box."

Passing from the common egg-urchin, I shall now notice briefly the other sea-urchins generally found in or near the

¹ See 'Jour. Linn. Soc.,' vol. xiii., 1876 (Zoology), Art., "Notice of Some Peculiarities in the Mode of Propagation of certain Echinoderms of the Southern Seas," by Sir Wyville Thomson.

area of the Firth of Forth. The first is the purple-tipped egg-urchin (*E. miliaris*), always a small creature, and often mistaken for the young of *E. sphæra*. It has a rose-coloured body with white tubercles, and the primary spines are often much longer than the others. The shell, when stripped of its spines, presents a beautifully radiated appearance, on account of the tubercles of the primary spines being so prominent. Its madreporite is extremely porous, and its pedicellariæ numerous and peculiarly shaped. These features may always help to distinguish it from *E. sphæra*. Our next genus is the green pea-urchin (*Echinocyamus pusillus*), the smallest of all the egg-urchins, and forming the link between the echini and spatangi, having the dental apparatus of the former with the spines of the latter. The specimens exhibited were recently taken from the stomach of a haddock, in which out-of-the-way place I have frequently found them. From amongst a heap of starfish remains and small shells there were picked out on this particular occasion no fewer than fifty-five pea-urchins in a perfect condition. When alive, the colour of the shell is a bright metallic green, which gradually becomes a dull white after the death of the animal. Specimens of the pea-urchin may often be found amongst the shell-sand on the beach, but the creature is so tiny, and so like a small water-worn stone, that it may easily be overlooked.

The only other sea-urchin ordinarily found in the Firth of Forth is the purple heart-urchin (*Spatangus purpureus*)—the largest and handsomest of all our British spatangi. In this class of sea-urchins there is no masticatory apparatus, and the animal burrows by means of its spines amongst the sand, and is also generally found to be filled with this unsavoury substance. The spines of the spatangus, as already said, are well known to microscopists as lovely opaque objects; but it may not be generally known that amongst the sand of the body-cavity there is frequently to be found a wealth of microscopic material. These include minute crystals and portions of quartz and felspar, which often polarise beautifully; fragments of shells; numbers of sponge-spicules and foraminifera; and various well-preserved forms of diatoms. Without knowing anything of the nature of this microscopist's treasury, I lately examined the contents of several spatangi, and felt

well rewarded for the trouble. In a few slides which I sent to Mr William Penman, F.R.M.S., for examination, he has identified species belonging to the following genera of the Diatomaceæ: (1) *Pleurosigma*; (2) *Rhabdonema*; (3) *Coscinodiscus*; (4) *Melosira*; and (5) *Heliopelta*. These were all found among a few particles of sand taken at random from the interior of a spatangus shell, so that a more careful inspection would no doubt result in the discovery of many others.

The species of sea-urchins found in tropical seas are both numerous and varied in form, while many are extremely beautiful. The splendid collection of the Echinoidea brought home by the Challenger, and now described by Prof. A. Agassiz in the third volume of the "Challenger Reports," includes no fewer than forty-nine deep-sea species hitherto unknown to science. The wonderful diversity in their appearance strikes one very forcibly in looking over the numerous plates appended to the volume. The same remarkable diversity, indeed, may be seen in any good museum collection. I have had the good fortune to receive from a friend in Australia, lately a member of this Society, a specimen of what is certainly one of the most curious forms amongst the sea-urchins. In this species the spines have decreased in number, and the primary spines have become much thickened and lengthened, while their colour is frequently a pale brown, lightened up with red at the extremities. This singular appearance of the spines has suggested the name by which the animal is locally known of "cigar-fish." The specimen now shown was captured by my friend on Lady Elliot Island, and afterwards taken to the Curator of the Natural History Museum at Brisbane, who pronounced it to be *Heterocentrotus mamillatus* of Brandt, and the largest specimen of it he had ever seen. Professor A. Agassiz, in his 'Revision of the Echini,' gives as many as fifteen synonyms for this species, so that it must have proved somewhat of a puzzle to the classifiers. The "cigar-fish" is a native of the Red Sea, and of the Sandwich, Fiji, Philippine, and other islands.

Several species of the Echinoidea were well known to the ancients, being mentioned by Horace, Martial, Aristophanes, and

other classical authors.¹ They even seem to have been early regarded as a luxury or delicacy, and were used at table both raw and cooked. Pennant says that in his time they were eaten by the poor in many parts of England, and they are still so used on the Continent. *E. sphaera* and its congener *Psammechinus* (*E.*) *esculentus* are the species mostly in favour. The parts selected for food are the ovaries, which are full of eggs in spring, when the ova are matured, and are said to equal the best fish-roe.

I can only refer, in a sentence or two in conclusion, to the extinct forms of the sea-urchins. These are numerous, and at the same time well preserved. There are nearly 2000 extinct species in all. Prof. Geikie remarks that they "have been so abundantly preserved, that their geological history and development are better known than those of most classes of invertebrates." While marine life is always more abundantly conserved than terrestrial, those animals with hard parts, like the sea-urchins, have, of course, a great advantage in this respect over soft-bodied animals. The Echinoidea cover a very wide area in the geological record, ranging "from the Ordovician period to the present day." It is in the Oolite and the Chalk, however, that they are found in greatest numbers, and these later fossils resemble living genera, while the Palæozoic forms differ considerably from those now existing. Many "quaint and curious" examples, must have burrowed in the sandy bottoms or scooped out the rocky margins of ancient seas. Regarded as a whole, living and extinct, the Echinoidea furnish abundant material for patient study and investigation; and after having made even a slight

¹ Thus Plautus, in one of his Comedies, incidentally mentions the food gathered from the sea-shore, and eaten presumably by the poorer classes, amongst the number being sea-urchins. In the "Rudens," a fisherman, bewailing his wretched condition in a curiously modern fashion, says:—

"Cotidie ex urbe ad mare huc prodimus pabulatum.
Pro exercitu gymnastico et palestra hoc habemus:
Echinos, lopadas, ostreas, balanos captamus, conchas,
Marinam urticam, musculos, plagusias striatas."

Thus translated by Riley—"Each day from the city do we come out hither to the sea to seek for forage. Instead of exertion in the wrestling-school and the place for exercise, we have this: sea-urchins, rock-mussels, oysters, limpets, cockles, sea-nettles, sea-mussels, and spotted crabs, we catch."—"The Fisherman's Rope," Act ii. sc. 1.

acquaintance with them, we feel ready to exclaim, with Prof. Edward Forbes, "Truly the skill of the Great Architect of Nature is not less displayed in the construction of a sea-urchin than in the building up of a world!"

In illustration of the above paper, the following preparations were shown under the microscope:—

- (a) Trans. sect. of spine of *Echinus sphaera*.
- (b) " " " *Flemingii*.
- (c) " " *Heterocentrotus mamillatus*.
- (d) " " *Acrocladia hastifera*.
- (e) Spines of *Spatangus purpureus*.
- (f) Pedicellariæ of *Echinus Flemingii*.
- (g) " " *sphaera*.
- (h) Sphæridia of " "
- (i) Ambulacrum and suctorial disc of *Echinus Flemingii*.
- (k) Plates from suctorial disc of " "
- (l) Plates from ambulacral zone of " *sphaera*.
- (m) Plutei of an echinus, eleven days old.

VII.—THE KAURIE PINE (*DAMMARA AUSTRALIS*).

BY MR HUGH FRASER.

(Read Feb. 26, 1890.)

THIS genus forms one of the large group of trees and shrubs which are scientifically classed in the order Coniferae, the members of which are found distributed over every region of the world. The four or five species with their varieties at present known to botanists are exclusively confined to the Southern Hemisphere, and representatives are found in several of the East Indian islands, New Guinea, and New Zealand. They are all lofty evergreen trees, more or less valued for their timber, and for the useful gums which all the species produce in singular abundance, and which form important articles of commerce. The generic name is that applied by the natives of Amboyna, and adopted on the introduction of *Dammara*

orientalis in the early part of this century. It may be noted, however, that some authorities have since then classed the whole genus under the name "Agathis"—a change for which I have not as yet discovered a reason.

In these notes I confine myself to the New Zealand species, *Dammara australis*, called by the natives "Kaurie," and by the settlers "Cowrie," as being specially interesting to us from the fact that we have had recently importations of its timber, which is being used for cabinet work and panelling, and which will in all probability be in greater demand as its merits become more widely known and tested. In its native wilds, its principal habitats are in the northern parts of the colony, where it is found chiefly in rocky or stony situations, either associated with other trees or forming the prevailing trees in very extensive forests. In order to give an idea of the appearance of these trees as seen at home, I cannot do better than quote a few sentences from a remarkable book recently published by the Government of the colony, written by Mr T. Kirk, and entitled 'The Forest Flora of New Zealand.' Mr Kirk is an accomplished botanist, and writes very graphically. He remarks that "the Kaurie is the monarch of the New Zealand woods," and that "though it does not attain the extreme heights and circumference of the Sequoias of California, it rivals them in the excellence of its timber, which possesses a larger number of good qualities than any other pine known to commerce." "The interior of a large Kaurie forest," he goes on to say, "affords one of the most impressive scenes in the colony. Smooth grey trunks rise on all sides like massive columns, perfectly straight and symmetrical, to a height of 80 or even 100 feet, with a diameter of 4 feet to 12 feet or upwards. If growing in close proximity to each other, they attain a greater height, but the trunk is less massive, and tapers gradually into a small head. If growing some distance apart, the trunk is of large diameter, with but little difference between the base and the crown. The head of solitary trees is large and spreading, the main arms being sometimes two feet in diameter. The broad, leathery green leaves have a most refreshing appearance in the driest weather, and bear no resemblance to the needle-like leaves which characterise the pines

of the northern hemisphere. The glaucous or cinereous hue of the bark under certain atmospheric conditions appears to surround the trunks with an undefined haze, an effect which is only to be found in a Kaurie forest. The bark scales off in large flat flakes, and as it decays forms a mound of humus surrounding the base of each tree, and is highly charged with resin, which exudes from the slightest wound on the trunk or leaves, all parts of the plant being excessively resinous." Though from 80 to 100 feet is the average height of these trees, specimens are to be found here and there very much higher. Some are recorded as being 150 and even 200 feet, with trunks varying from 20 to 60 feet in circumference.

Along with its great value as a timber tree, the Kaurie is important for the immense quantity of gum which it produces, and this is obtained by a different process from that we are accustomed to associate with other trees of a similar character. Instead of tapping as the only mode of obtaining the precious article, Mr Kirk informs us that large quantities are also dug up at a depth of from six to seven feet from the ground once covered by primeval forests of this tree. "Gum digging," he says, "is a standard resource for the industrious, and the Auckland gum-fields have proved, it is said, far more beneficial to the district than its gold-fields, no capital or machinery being required beyond a gum spear or spade." As regards the gum itself, it is described as similar but far superior to copal, which is the produce of the *Rhus coppalina*, a North American tree.

I may add that in this country the Kaurie can only be cultivated under the shelter of a conservatory, and there it forms a peculiarly graceful evergreen specimen, quite distinct from the other shrubs and trees usually seen in such structures.

VIII.—*STRAY NOTES ON THE BIRDS OF ANGLESEA.*

BY MR ARCH. CRAIG, JUN.

(Read March 26, 1890.)

It was with considerable pleasure that, last May (1889), I found myself able to accept of a kind invitation from a friend to spend a few days in the island of Anglesea, the more readily as his account of the bird life of that locality had aroused my interest in no small degree, many of the species mentioned by him being uncommon, and in some instances very rare, to Scotland. The prettily situated town of Bangor was the terminus of our railway journey, but the ultimate destination was an old-fashioned farmhouse on the opposite side of the Menai Strait. Crossing what was at one time considered to be the greatest engineering feat of the age—the Menai Suspension Bridge—but which is now dwarfed and rendered insignificant by the completion of that wonder of the world so close to our own doors, our road ascended in very tortuous fashion up the sloping side of the island, running through a country to a great extent broken up by irregular-shaped knolls that barely rose to the dignity of hills, yet sufficiently pretty to render this part of the journey both pleasant and interesting. Great quantities of whins in full blow grew everywhere, but amidst these quaint-looking snug farmhouses cropped up now and again, surrounded by patches of cultivated land, these in turn divided by stone dykes much in the same style as prevails in Scotland. If we exclude the sea prospect, the whole aspect of this part of the island, with its broken hummocky ground, its crofting-looking plots, and its distant view of the high mountain-ranges of Carnarvon and Denbigh shires, brought one forcibly in mind of similar scenes in the Lennox and various districts of Perth and Argyle shires, where much the same character of scenery is found intervening betwixt the rich agricultural land of the Lowlands and the truly typical mountainous Highland country. The road, like most of those in the island, was very narrow, and bordered on each side by

high, straggling-looking, ill-kept hedges, that added, nevertheless, to the picturesqueness of the landscape; and, after turning and twisting in most unexpected fashion, brought us in sight of a small sheet of water, on the edge of which stood the house which was to be our home for the next few days. The house itself was most peculiar, being enclosed at the side next the road with a high whitewashed wall, and blocked up also by the outer portions of another smaller building, which proved to be the dairy. The door, unlike most other houses, did not open into a passage, but led into the kitchen direct; and in order to reach the upper storey, it was necessary to climb a steep trap-like stair that required rather skilful navigation and some little practice to ascend or descend in safety: in fact, while performing the latter operation, if great care was not exercised, an individual would find his head come in contact with the hard brick-floor of the kitchen before he was aware that his feet had left the upper landing. It is no part of the present purpose, however, to occupy time with further description of the house, or any lengthened account of the scenery of the island, as the latter will be briefly touched upon here and there while referring to the various species of birds to which your attention is to be drawn.

Numerous coots and moor-hens frequented the pond; and towards evening the snipe flew round and round so high in the air as to be undiscernible in the dim light, the only guide to his presence being the strange booming sound that he makes with apparent satisfaction to himself, and no doubt also to his mate sitting upon her eggs amongst the marshy ground beneath. Although there is not much music in this performance, it has by no means an unpleasant effect, particularly upon a calm still night, ere the last lingering touches of the sun's rays have ceased to illumine the surface of the water, and darkness has taken the place of the uncertain twilight. At such a time, whether from a predisposition to take heed to any noise, or from the fact that, most animals and birds having retired for the night, the fewer sounds emitted attract our attention in a greater degree by reason of their scarcity, certain it is that birds' notes in particular seem to be carried to much greater distances than

during the day, and consequently force themselves upon our notice with greater prominence. The strange gurgling notes of the coot, the quivering cry of the curlew, the plaintive and melancholy calls of the peewit and golden plover, the whistle of the woodcock, and the many wild calls of the sea-birds flying overhead, carry with them after dusk a weird and "eerie" feeling that is not easily explained,—any more than we can account for the difference between a person wandering through an empty house during the day, and the same individual repeating the performance after nightfall. In the former case he perambulates the rooms without fear, whereas in the latter he does so with considerable reluctance, often trembling at the sound of his own footsteps; yet if asked to give a reason for the change, there are a hundred chances to one he fails to give even a shadow of such. To return to the snipe. It is always a difficult task to describe a sound, so that another unacquainted with it can form any idea of its likeness; and in the case of the present species, the nearest approach I can think of is as follows. Imagine the distant bleating of a goat, the hum of the nocturnal beetle while on the wing, add to these the sound produced by one of those primitive little instruments that street boys affect so much, called, I think, "mouth harmonicons," mix them all up, and you have some distant sort of notion of the booming of the snipe. This you will no doubt consider a heterogeneous conglomeration, and so it is; but it only exemplifies what has already been hinted, of the difficulty in making any essay to delineate what is wellnigh an impossibility. Before proceeding, it is necessary to remark that the peculiar drumming sound is believed by almost all our eminent ornithologists to be produced by the action of the wings or tail, or both combined, and not by the throat: the ordinary alarm-note is, of course, produced by the latter. The other birds observed as haunting the pool were the little grebe or "dooker" as it is sometimes called, the common mallard or wild duck, an occasional pair of widgeons, besides sundry stray species that flew up from the sea, including a variety of gulls and other maritime wanderers. The whin-covered undulating country was a "happy hunting-ground" for cuckoos—in fact, I never recollect seeing or hearing so many of those birds in a short time in any one district, not even in Perthshire where they

abound. Although hardly so plentiful as to justify comparison with Milton's description of Satan's legions, who lay

"Thick as autumnal leaves that strow the brooks
In Vallombrosa"—

yet their numbers were sufficiently great as almost to become monotonous, the familiar call being audible everywhere, and continuing practically all night, as well as during the hours of sunshine. It would be superfluous to enter into any description of the curious habits of this species,—the parasitical tendencies by which it shifts the burden of rearing its own young upon its willing dupes, in the shape of titlarks, hedge-accentors, &c., being now matter of notoriety to every school child.¹ Long ago many strange fictions were in vogue regarding its ways, one of those being the conviction that it preyed solely upon the eggs of other species,—a very silly notion indeed, and quite untenable, as no attempt seems to have been made to indicate the food upon which the bird subsisted for the several months after other species had done laying. Another statement, commonly promulgated and credited, was that it hibernated in Britain (a fable, it is regrettable to think, not yet exploded as regards the swallow tribe), retiring into caverns, holes in the ground, or the hollows of trees, there to lie dormant during the long winter, until the advent of genial spring called it forth once more. In illustration of this, a tale is told by Aldrovandus, a very old ornithological writer, of a countryman who lived at Zurich, in Switzerland, who, after casting a large log of wood upon the fire, was surprised shortly to hear the well-known call of the cuckoo issue from a cavity in the wood, the presumption being that the heat had awakened the torpid inmate, and made him imagine summer had returned. At night the cuckoo varies his usual *répertoire* by another and totally different call, which, however, having regard to the failure of the endeavour to portray that of the snipe, need not be inflicted upon you.

In addition to the birds already mentioned, a great variety of common species could be seen more or less all over the country—landrails, rooks, jackdaws, ring-doves, but, strangely

¹ Mr Harting, in his work 'Our Summer Migrants,' gives a list of over fifty species in whose nests the cuckoo's egg has been discovered.

enough, no stock-doves, although the locality seemed favourable, common and yellow buntings, linnets, the various species of swallows and warblers, pipits, skylarks, finches, besides many others too numerous to particularise. Without making a list of all these, it may be better just to crave your attention in detail to a few of the more uncommon species; and the first to be noticed is the sprightly little stonechat. This beautiful lively creature, unlike its congeners the wheatear and whinchat, is found in Britain all the year round, although many, no doubt, migrate in autumn, as they are never seen during winter in such numbers, save, perhaps, in certain favoured localities near the sea-shore. If reference is made to most standard works on ornithology, you will doubtless read that this species is common all over Scotland. This statement I humbly beg to differ from, as one may wander for days without seeing a solitary specimen except in isolated quarters, where, perhaps, the surroundings are suitable to their mode of life. The migratory whinchat is often confused with this bird, as at a distance they are not readily distinguished, more especially as the notes are not dissimilar; but in my experience I have always found the *Saxicola rubetra* to be the more numerous of the two. In Anglesea there was no dubiety about the matter, as in almost any direction—excluding, of course, the thick woods—the stonechat was to be seen flirting and dodging about, now swinging on the top spray of a whin, or sitting upon a fence or rock, uttering the peculiar clicking note that resembles two pebbles knocked sharply against each other. This metallic sound is diversified by a clear liquid whistle, and the song, such as it is, is sweet, though rather short. This bird inherits a fashion—peculiar to all the chats, such as the robin, redstart, &c.—of suddenly diving down from its perch, only to reappear after a low flight, with a confident demeanour, at some considerable distance, as if in triumph at having outwitted the onlooker. The male bird in his nuptial plumage is a pretty object when viewed close at hand, and withal seems a trifle conceited, if we are to judge from the airs he assumes when dallying with his lady-love. Waste commons where gorse and stunted bushes abound, open heaths and links by the sea-shore, are favourite habitats; but it by no means confines itself to marine neighbourhoods, as it

may be observed in odd pairs in the very centre of Perth and other shires far removed from the sea—but, it is safe to say, not to anything like the same extent as its relations the wheat-ear and whinchat. One of the most beautiful parts in Anglesea is the estate of Baron Hill, belonging to Sir R. B. Williams-Bulkeley, the representative of an old Welsh family who at one time held a great amount of property on the opposite shore of the Menai Strait, now in possession of Lord Penrhyn and other proprietors. The grounds attached to the mansion-house are laid out with great taste, and, from the immense size and diversity of the woods, harbour a considerable variety of birds, including most of the warbler fraternity, always excepting the nightingale and a few other uncommon species that do not visit North Wales. Starlings flew about in great numbers, working with a will to gather food for their ever hungry broods, which for the most part were concealed in the hollows of huge trees, of which the estate could boast an enormous number. It is extremely doubtful if any species, save the rook, toils so hard and so constantly as the starling: from earliest dawn till darkness sets in he seems always to be busy; and whatever failings and peccadilloes may be laid to his charge, these are indeed trifling in comparison with the good he does in devouring grubs and other harmful insects, which, but for the efforts of the feathered fauna, would ultimately prove anything but a blessing to the agriculturist. In a large clump of trees, close to Baron Hill house, a small colony of blue rock-doves had taken up their abode—the only instance of the kind that has come under my own knowledge, their usual haunts being caves and rocks on the sea-shore; but it seems that this is not uncommon, as they, in conformity with many other species, suit themselves to circumstances. Perhaps the rarest bird that frequented the policy was the green woodpecker. A favourite haunt of this interesting species was a small lawn opposite the door of the house, which was surrounded by a clump of immense trees, whose trunks offered strong temptations to this climbing acrobat. This is a shy bird, and not so readily noticed as one would imagine, considering his size and brilliant plumage, his *modus operandi* being to keep on the other side of the trunk from the spectator, ever and anon taking a sly glance

round the corner or over the top of a branch; and should he consider your presence as likely to be attended with danger, off he flies silently to a safe distance, which having gained, he frequently gives vent to a strange horse-like laugh, as much as to say, "*Chacun à son goût*—but as our tastes differ, I had better give you a wide berth." Taken as a whole, it is an aggravating bird, and rather trying to the temper of one who is desirous of getting to close quarters so as to watch and admire its habits. Other species of Picidæ are rare, and only occur as occasional visitants. One of the keepers, in a distant part of the island, shot what was to him and others an unknown species; and although it was described as correctly as possible, it was not for several weeks afterwards, while on a visit to Peeblesshire, where the specimen was sent, that I had an opportunity of identifying the same. The bird in question was a red-backed shrike—a somewhat sparse visitor to Anglesea, although found in various counties of England. The titmouse and thrush families were well represented by the great, blue, cole, marsh, and long-tailed tits, by the black-bird, missel, and song thrushes; but one missed many favourites, such as the ring- and water-ousels, crossbills, siskins, &c., which, as far as could be learned, either did not inhabit the island, or, at best, only occurred at rare intervals as stragglers. The Hirundinidæ, or swallows, existed in considerable numbers, great quantities of house- and sand-martins breeding in the banks by the sea-shore. But by far the most interesting bird of all was one, sometimes said, although problematically so, to be allied to the genus *Hirundo*—viz., the nightjar, which is deserving of a fuller description than can be given to others with which we are tolerably familiar.

No more curious bird visits the British Isles than the nightjar, arriving about the middle of May and departing southwards again in September or October. On the whole it is nocturnal, or rather crepuscular, in its habits, seldom seen in numbers until the shades of evening are beginning to fall, although in localities where they abound one frequently disturbs them in broad daylight from their resting-place among the fern or heather, but on these occasions they as a rule glide silently off, and settle down again at no great distance. As can be observed from the example exhibited, the plumage

resembles the colours of a moth, and from its combination of tints is most admirably adapted for screening purposes, as when squatted flat on the ground among heather, brushwood, or bracken, they may be passed within a few feet unnoticed. So remarkably close, indeed, do they lie during the day, that one almost treads upon them before they will rise; and on several occasions, while wandering through a straggling sort of covert, at a place pronounced "Voty," divers pairs flew up so suddenly under foot as to be rather trying to the nerves from the unexpectedness of their appearance. Night-jars seldom make any noise until evening arrives, and when they do deviate from the usual rule the sound is not so loud, and seems only to be uttered in a half-hearted way, very different from their bold efforts at night, about which something falls to be said later on. The wings are long and pointed, giving the bird somewhat the appearance of a hawk, and the flight is almost absolutely noiseless, like that of an owl, save when they crack their wings over their back, like the tame pigeons known as "smiters." This latter performance seems to be resorted to when disturbed from their perch, and may be a means of venting their annoyance at intrusion; yet they cannot be said to be timid, as they fly within a few feet of one's head, and will often alight upon a tree or wall in close proximity to human beings. Their hawk-like and owl-like resemblance when flying has been the means of giving them a bad reputation among a certain class to whom the preservation of game is the *summum bonum* of life; consequently for many years they were subjected to persecution as destroyers of young pheasants, &c. But of all the baseless and absurd notions ever indulged in, or made the vehicle of useless destruction, this is surely one of the weakest and least defensible, as night-jars are utterly incapable of injuring game, unless cockchafers and moths can be designated as coming under that category. Their food consists almost entirely of the last mentioned, besides other insects that appear in the evening. The mouth when opened is so big as to be capable of swallowing entire large nocturnal beetles, one of which you will observe accompanies the specimen here exhibited. This was found in his stomach, and from its perfect state must have been newly caught before the bird was shot. The sides of the mouth are

armed with curious bristles, which are supposed to aid the species in capturing its prey; and in common with some other birds, it possesses a quantity of sticky saliva in the glands at the sides of the throat, to which smaller insects adhere in such a manner as to render escape impossible. Various names are applied to this species, as, for example, night-jar, churn-owl, fern-owl, night-hawk, goatsucker, and many other local epithets which it is unnecessary to recapitulate. The two first named evidently derive their origin from the sound emitted by the bird; the fern-owl and night-hawk, from the similarity of flight and appearance to the birds of prey already noted; and now it only remains to explain the meaning of goat-sucker. The Latin name *caprimulgus* literally means a goat-milker, and the title originated in the following manner. When skimming over the fields in search of moths, &c., it very often approaches so close to the goats and cattle lying there, as to have given rise to the belief among the ignorant peasantry, aided no doubt by the uncertain light, that its object was to avail itself of the recumbent position of the animals to extract the milk from their udders,—an idea just about as silly as that it fed upon game; so what between the animosity of illiterate agriculturists and irate keepers, the poor bird was frequently “between the de’il and the deep sea.” Happily now, save among the grossly ignorant, these superstitions are things of the past, and I hardly think we will write “resurgam” over their ashes.

There is yet another strange belief worth mentioning, now also wellnigh discredited. From the position of its eyes, it was supposed that when flying with the gape open it looked through the roof of its mouth, and to enable it to do so the more readily, the upper part was composed of a thin transparent film. This idea seems erroneous, and about as credible as the veracious American story of the negro, the hue of whose skin was so intensely black that charcoal made a white mark upon him. Some authors maintain that it flies always with its mouth open; others again that it only gapes when necessary to capture the flying insect. The latter is likely to be the more correct of the two theories; but when we consider the matter for a moment, both are found to be purely conjectural, as how is it possible for any person to decide such a point

unless he could fly alongside and follow every erratic motion of the bird? The vicinity of the pond afore-mentioned was perhaps about the best place to view the night-jar to advantage, and on favourable nights, when many insects were on the wing, the whole country-side seemed to swarm with the birds. This latter impression was, however, more apparent than real, as the numbers were in reality not great, only as they were constantly shifting their quarters, the sound came from so many different directions as to lead one to suppose that the birds were entirely separate, whereas in all probability four or five pairs at most frequented the immediate surroundings. The note is most peculiar, and perfectly unique of its kind, resembling nothing so much as the "birling" noise made by a threshing-machine, or the droning vibration caused by various kinds of machinery in motion. It has a most penetrating effect, and on a calm night is perfectly audible at a distance of half a mile; but when near at hand it seems to rise and fall, becoming intense at one moment, only to be modulated the next by a sort of cadence, but all the time the vibration accompanies the performance. The note seems to be made only when the bird is sitting, but whether solely confined to that period or also exercised when in flight, is a point upon which I do not feel competent to give an opinion. To be appreciated it should be heard on a still evening just at the darkening, and if for the first time, the result is almost startling, more especially as the sound has the effect of ventriloquism, probably caused by the bird moving its head about while singing, if such a noise can be dignified by that name. In addition to this well-known vocalism, the night-jar gives utterance to a shrill scream, but, judging from somewhat limited experience, I am inclined to believe this is not resorted to save in cases of fear, as it rarely, if ever, vents this note except when approached unexpectedly, and in such a manner as to cause fright.

A very few words about the position of the bird when perched will finish this cursory sketch of an interesting species. Unlike other birds to which we are accustomed in this country, it does not sit across a branch or rail, but squats lengthwise, consequently it is at all times, but more particularly in the twilight, most difficult to observe, as it lies very

flat upon its resting-place, and appears to be part and parcel of the same. It alights without the slightest noise, elevating the wings before perching, apparently to steady itself, but when once the wings are lowered the bird seems to disappear altogether. Just to show how difficult it is to locate them under such circumstances, I may instance the fact that for a number of nights I took up my quarters for two hours at a time close to a solitary bare tree upon which the birds were in the habit of settling, and although they must have perched within fifteen yards of the spot selected upwards of twenty times, only on two occasions could it be said positively that the bird was discernible on the branch. Any one present who has really taken the trouble to study the night-jar's habits will, I feel certain, corroborate this statement. A very great deal more might be said concerning this species, but time would not permit, the only remark now to be made being that the males are distinguished from the females by the two white spots on the outer feathers of the tail.¹

Another species comparatively numerous in Anglesea was the water-rail,—a very shy retiring bird, and not so often seen as its numbers would lead us to expect; but this circumstance is easy to account for, from the fact of its resorting to swampy and marshy ground, ditches, and suchlike, where the thick herbage, reeds, and long grasses effectually conceal it from the casual view. Add to this a natural timidity, a disinclination to take to flight, a skulking habit (features common also to the land-rail), and it will be conceded that it is not an easy task to observe its habits. There were several ponds and marshes where it nested, but very few came actually under my own observation, the accompanying specimen being secured with difficulty, and that while the bird was under water, the bill and upper part of the head only being left above the surface to enable it to breathe through its nostrils. Water-rails are found in many districts of Scotland—such as Duddingston at our own doors, Peeblesshire, Inverness-shire, and in most localities suitable to its habits, although it is much more common in Lincolnshire and other flat fenny parts of England.

¹ The "pectinated" claw is a peculiar feature of this species, but as I am unable to offer any theory upon its use, mention of it has been avoided.

Before concluding these random notes it would be well to call your attention, and that shortly, to one of the most interesting parts of the Baron Hill estate—viz., Puffin Island. This rock, for it is not of great extent, lies about a quarter to half a mile from the shore, opposite the lighthouse at Penmon deer-park, and not very far distant from the partial ruins of Penmon Priory, a curious old edifice which has great attractions for the archæologist. The Priory is said to be of ancient date, but is now partly used as a church and also as a gamekeeper's house, the walls of the latter being panelled with very old oak, to which, however, a somewhat fictitious age is given. We were unable to examine this interesting place thoroughly, as the gamekeeper's wife was dangerously ill, and not expected to recover; and it was with much sorrow that I heard quite lately that the keeper himself, along with three other employees on the estate, were drowned in the Menai Strait by the capsizing of their boat during a squall. The Priory possesses, along with many other similar religious houses, what is known as a "wishing well"—a clear sparkling pool, surrounded by a little chamber cut out of the solid rock; and until lately it was the custom for folks to come and drop a trifling offering into the water, at the same time repeating some wish aloud—the bulk of those, so far as the fair sex were concerned, having reference to matrimonial aspirations.

The coast-line at this point of the island is rugged and precipitous, but the cliffs are not of any great height, and give shelter chiefly to gulls and oyster-catchers, but on crossing the narrow channel to the island we find a much greater variety of sea-birds. Puffins sat in rows on the rugged ledges, or darted out from crevices as if they had been shot from a cannon; guillemots and razor-bills were very numerous, besides herring-gulls, kittiwakes, and oyster-catchers. Among the smaller species were the ringed plover and common sandpiper, rock- and meadow-pipits, while house-martins built their clay habitations under the overhanging crags. A day or two could be pleasantly and profitably spent here, as in addition to the above-mentioned, all of which were observed during a short half-hour, numerous other sea-birds occur. It may interest members of our Society to know that this island is leased by a biological society in Liverpool, the members of which come

down periodically to dredge for specimens. A steam-launch, besides small boats, are kept for their use, and a man in their employ lives constantly on the rock to look after their interests. This, you will acknowledge, is working up natural history on a grand scale. In winter the feathered fauna receive large accessions to their numbers, chiefly in the shape of marine species, such as divers, ducks, geese, sandpipers, &c. ; but having regard to the length this paper has already assumed, I shall not detain you longer, but conclude with the remark that while the district, ornithologically speaking, is a rich one, it is matter of regret that it has been found impossible, with the limited time at my disposal, to do even the scantiest justice to the numerous interesting fauna that have made it their home.

IX.—ROUND ABOUT THE NORTHERN CLIFFS.

BY MR JOHN SUTHERLAND.

(*Read March 26, 1890.*)

READERS of Dr Smiles's delightful biography, 'Robert Dick, Geologist and Botanist,' need not be told that the mainland of the extreme North affords a "happy hunting-ground" for the scientific observer, whether his studies deal with the transformations and inhabitants of the world in remote ages, or with its aspects as seen to-day. Caithness is particularly rich in botany and animal life, especially birds; while its pavements, said to be marked with the footprints of pre-historic man, floor a great part of the civilised globe. Thurso, the centre of this industry, is further distinguished by leading the way in the emancipation of women, as here one of the sex beards the ravenous lion, man, in her own if not in his den—she is a barber! For rod-fishing the river is one of the best in Scotland, an angler being known to catch as many as twenty-one salmon in a single day. There is a ruined castle on each side of the town, which stands on a bay hemmed in by precipitous cliffs that terminate in the bluff promontories of Holburn and Dunnet Heads. The sea sometimes rages with such terrific fury on the coast that spray is sent flying

over the tops of these rocks, which are more than four hundred feet high. At Wick there is painful evidence of its vehemence furnished by the remains of a pier demolished while in course of construction, blocks of stone weighing hundreds of tons having been conveyed to a considerable distance, where they now lie, to the disfigurement of the bay and the danger of shipping. The seaward view from Thurso commands the prodigious western precipices of Hoy in the distance, perhaps the finest cliff scenery in Britain, with the Orkney hills beyond. At Holburn Head a noticeable object is the Clett, a huge detached pillar of rock, which stands sentinel-like and crowned with grey—more, however, the result of sea-bird indignities than the natural hoary-headedness of age. Indeed around the northern cliffs there is much to delight the artist's eye and to worthily employ his hand; while the naturalist, sportsman, and ordinary holiday-maker can each and all find something to suit their respective tastes. Even children may be congenially occupied in gathering the beautiful cowries and other shells met with in the neighbourhood.

A cruise round the cliffs, especially about July, the bird-nesting season, is an experience that must impress any one, however free from ornithological leanings,—for to be indifferent to nature as seen here in her moods of grandest wildness, her frowning face fanned by countless hosts of varied attendants, would be impossible. The small boats of the North are chiefly remarkable for heaviness and breadth of beam, so there is no danger of getting upset; and their consequent slowness of progression, instead of being a fault, is perhaps an advantage, allowing one plenty of time to gaze on the many sights claiming attention. If a person is his own boatman, the case is otherwise, for he is likely to raise his temperature, his temper, and blisters on his hands, before going far. Having done so, he cannot do better than lay the oars aside for a while to peer into the clear depths below, where the sand is formed into small ridges like wavelets, interspersed with clumps of different kinds of sea-weeds and subterranean forests of dense ever-changing olive foliage, that wave in the water as if shaken by a gentle breeze. He may see flounders, coal-fish, and other inhabitants of the ocean; and if not inclined to fish, he can watch a number of feathered fishers, including, at least

occasionally, that large beautiful bird, the great northern diver. Seals, though not so common as formerly, have still a few representatives left, one of which may thrust its round head above water a short distance from the boat, and fix its intelligent gaze on the occupants for a second or two, to disappear upon gratifying what seems to be a natural curiosity characteristic of the animal. Should the weather be warm, a shoal of porpoises may be seen disporting themselves by tumbling over on the surface of the water in a series of short dives. If you are armed with a gun, neither they nor seals, it must be admitted, are liable to appear; and, for similar reasons, should you during a short stay be very anxious to see a whale, you may be disappointed, although they, too, pay flying visits to the vicinity, which by fishermen are regarded as an indication that herrings abound in the course they follow.

On approaching the cliffs, it has often been remarked that they inspire a person with feelings of awe and solitariness, the solitary feeling being as strange as it is unaccountable, for no one could expect such a company of its kind as appears along the route. The welcome accorded is lively in the extreme, if not altogether expressive of good-will,—a thousand throats, each of which gives out its own peculiar guttural sound, joining in chorus at the same time. The teeming community lodges in every fissure and on every ledge, wherever there is a foothold, and the croaks of some can be heard that are themselves invisible. But the numbers seen of different kinds are amazing enough: they are perched everywhere, and in their passage to and from the sea remind one of populous beehives on a hot sunny day. Wherever they are, the place is conspicuous, because there the cliff is stained a chalky white. You were struck by a strong smell of guano as you drew near the noisy region; and if you are allowed to return without being struck by anything more disagreeable, you may consider yourself lucky. Already there is a cloud of sea-gulls wheeling overhead in clamorous complaint, protesting against having their seclusion invaded; but they alone, unless a few crows occasionally, demonstrate in this fashion. The diver tribes—cormorants, razor-bills, guillemots, &c.—show perfect indifference to your presence, and keep the even tenor of their way. Gulls, however, have more to dread, their nests

being frequently in accessible places, while the divers choose situations that would baffle the most skilful climber, and generally beyond gun-shot. At a great altitude razor-bills are ranged along narrow ledges, as close as they can comfortably pack themselves, where in the distance, bolt upright with long narrow bodies and white breasts, dazed and dude-like, they resemble rows of bottles bearing white labels that have been shelved by human hands. In flying down they tilt themselves over with great rapidity, and fall for a foot or two like an inanimate object, before expanding wings that are extremely small for the size and still more so for the weight of the bird. Razor-bills, and indeed all the diver tribes, spend their entire existence in and between the sea and the face of the cliff. They never appear inland, nor even on the summit of the rock. The distance between the water and the cliff is covered in a straight flight at a regular angle, for they seem incapable of making gyrations. Most of them build no nest, nor hatch more than one egg in a season, which is large in proportion to their size. They would, indeed, have difficulty in keeping a second or third warm, their legs being situated so near the extremity of the body that they lie or rather sit over the egg on this part, propped up as it were by the tail. Consequently, when alarmed by any extraordinary noise, such as the report of a gun, which re-echoes from rock to rock and makes a terrific sound, the tail as they leave the nest hurriedly catches the egg, and draws it over the ledge. In this way a shower of eggs may be brought down in the proper, or rather the improper, season. The shells, while extremely thick in some cases, are, as might be expected, invariably smashed, even when eggs fall into the sea.

It is interesting to observe the several customs of the various kinds of birds in their colonies. In the nesting-season many of them seem to reverse the usual order of things,—the gregarious, as crows and starlings, for example, displaying a solitary disposition, while the solitary often build in companies, with the advantage that where a single couple would grievously fail, they are able to repel the attacks of enemies. Among such there is the peregrine falcon, the neighbourhood of whose nest under a projecting ledge at a great height is avoided as a plague spot. Nearly all these rock- and cave-dwellers regard

murder with becoming horror ; but robbery, which is of course an offence of less magnitude, they engage in frequently. Gulls unable to dive and catch fish for themselves watch the professional divers, until one has brought up a fish so big as not to be swallowed without preliminaries, when with larcenous intent they pounce upon the honest fisher, and sometimes deprive him of his prey. He perhaps eludes them for a while by diving from time to time when sorely pressed, his tormentors meanwhile increasing in numbers. After manœuvring against hope as long as possible, the fish is ultimately snatched away by a greedy gull, that is immediately pursued by the whole host of its fellows. There may be a hundred competitors for the fish, and the prize must go to one, so it is amusing to watch the scramble as to which shall carry it off. Although the thieves disagree, the honest diver has no chance of recovering his own, for the struggle is now conducted in mid-air. The gull, holding the fish, endeavours to fly higher and higher, but unimpeded rivals hamper his progress. In the heat of the battle the fish is dropped, to be caught by another gull before it has reached the water. The same tactics are pursued over again, and the fish may have figured in several bills before the matter is settled. When at last a gull with a larger receptive capacity than the rest seems to have ended the contention by taking the fish into its stomach, the others proceed quietly on their course. But all is not over yet. Attracted by the quick shrill cries peculiar to their struggle for food, another robber, not unlike a grey gull in appearance, though much larger, comes upon the scene. This is the skua, who makes a livelihood, oddly enough, by picking up second-hand, or, to be strictly correct, "second-stomach" food, as we shall see. Overtaking the recipient of the ill-gotten fish, the skua proceeds to belabour it unmercifully with its wings, and continues this treatment as long as necessary, which means till the gull has disgorged, when the skua in turn obtains the fish.

Towards the end of August a great many birds disappear from the cliffs: the gulls nearly all go, and practically the whole of the divers. Whether they leave for another country or spend the time at sea appears to be uncertain. Gulls in diminished numbers visit the cliffs all the year round, and a few divers may be observed in the water during any month.

Possibly while keeping out of sight, the great body of them may not be very far away. But it is never safe to express opinions on the haunts of birds unless we have certain knowledge for our guide. In proof of this, who would have imagined that the blue rock-pigeon, one of the shyest of the feathered family, should make its home in the roof of low water-washed caves, in which the waves rise and fall with a booming sound, that even on a calm day reverberates through the place like a succession of distant thunder-peals. Yet this is the favourite abode of the blue rock, and here it builds, while its food is wholly procured inland. In the fields the bird is wary, and a person intent upon pigeon-pie finds it almost impossible to get within range, as they rise so soon. When they are in the caves, on the other hand, the great trouble is to get them to rise at all. After some shouting and knocking of oars against the rowlocks, perhaps a single pigeon darts out in your face—the only occupant of the cave, you decide; but only fire, and a number of others will appear simultaneously. Pigeon-shooting from the boat is excellent sport, which has become fashionable of late, the lessees of moors having now sometimes a boat and boatman engaged for the season, to take them round the cliffs two or three times a week on their leisure days.

Probably before one is aware, the last rays of the setting sun illuminate the sea, and sloping over the tops of the cliffs, they are cast into shadow and deep gloom. It is then that the mighty wall—here perpendicular and bare, there overhanging and threatening, and at another place rent and torn, with its base carved and honeycombed with caves—stands arrayed in all its terrible majesty. But it is already time to return, for dusk has set in, and then you think of the lines with four or five white flies apiece, which generally yield extraordinary results at this time of day. With one end fastened to the stern, the lines are thrown out, and the boat rowed slowly. If the fish are taking on this particular evening, they may keep you drawing them in as fast as you can draw, a fish on every hook of a line being not uncommon. Coal-fish weighing a pound or two form the bulk of those caught, but sometimes there are very much larger fish among them, while codlings and mackerels are also taken occasionally.

X.—ON SCLERENCHYMATOUS CELLS.

BY MR WILLIAM COATS.

(Read March 26, 1890.)

WHILE examining the epidermis of the leaves of the Kaurie pine (*Dammara australis*), after Mr Hugh Fraser's interesting observations on that tree, I noticed that certain sclerenchymatous cells, which had become isolated through maceration, existed in considerable numbers in the laminae of the leaves; and the hope that some of the members interested in the intimate structure of plants might care to see these and one or two allied forms under the microscope, is my reason for now bringing this subject under the notice of the Society.

On the night of our last meeting, I placed some leaves of the Kaurie pine in a strong solution of caustic potash, in which they remained for three and a half days; and as they were then showing signs of being sufficiently macerated, I boiled them in the solution for fully a quarter of an hour, the result being that the epidermis was loosened from the underlying tissue, and the cells in question, on splitting up the leaves and shaking them well in a tube, were detached as they are now seen, apparently unaltered, except that they are stained with aniline green. The epidermis of the leaf showed what, from its hard and horny character, would be expected—viz., that the stomata were in hundreds on the under surface, arranged mostly in parallel rows, while on the upper surface there was only one to be seen here and there.

Sachs gives the name "idioblasts" to those individual cells occurring in a tissue which, otherwise homogeneous, become developed in a manner strikingly different from their neighbours. These "idioblasts" he divides into "simple glands" when they contain resin, oil, or gum; into "lithocysts" when they contain crystals or raphides; and into "scleroblasts" when the cavity of the cell becomes reduced to a narrow canal or a small central hollow. When these scleroblasts are associated in groups or layers, they form the tissue known as "sclerenchyma." Scleroblasts are especially characterised

by outgrowths or irregularity of form. The term "sclerenchyma," introduced by Mettenius, and derived from the two Greek words *skleros*, hard, and *enchyma*, an infusion, indicates those tissue elements which have not only thickened their walls at the expense of the cell-cavity, but have also lost the cell-quality, or the power to assist in assimilation and nutrition. The structure of the walls is in general that of strongly thickened cell-membranes, with their numerous modifications. As thickening and ultimate lignification proceed, the protoplasmic body and nucleus disappear, and of these, and the products resulting from their activity, only remnants are felt, together with watery fluid, partly as undefined granular contents.

De Bary divides sclerenchyma into two main forms, which, however, are not always sharply differentiated from each other—viz., (1), short sclerenchymatous elements; and, (2), elongated elements or sclerenchymatous fibres. "Short sclerenchymatous elements" is the term applied to all forms which have not pointed or tapering ends. Under this term come the "stone elements" or stone-cells—the hard concretions that are found in the succulent tissue of pears, or in groups in the root-tuber of dahlia and in the pith of *Hoya carnosia*. Plums, cherries, &c., owe their name of "stone-fruit" to the fact that the fundamental tissue of the pericarp—that is, the transformed wall of the ovary—becomes separated into two layers, or often three, of which the innermost is the so-called "stone." Although consisting at first of thin-walled parenchymatous cells, they become, by the time they are ripened, strongly lignified. Sclerenchymatous fibres of elongated spindle-like shape, with sharp ends, simple or branched, are the form of strengthening tissue, on the other hand, which is universal in Phanerogams. These are frequently called "bast-fibres," from the definite region of the cortex in which they occur in dicotyledons. In transverse section these fibres are acutely angular when they are closely united into bundles. In those occurring singly, or found in intercellular spaces or in leathery leaves, they are round or nearly so. In Phanerogams they are freely branched, and their form appears to vary with the special tissue in which they occur, the most varied shapes being met with. The

much branched kinds occur in lacunar tissue, known as spongy parenchyma, from its loose texture—their branches, like so many horns, being pushed into the cellular interstices. According to the best authorities, their main purpose is that of imparting strength and rigidity to the tissue in which they lie, from their evident power of binding it together, and in many instances giving also great elasticity. In the long, slender, yet very elastic and firm flowering-scapes of rushes (*Juncus*, *Scirpus*, &c.), and in plants not properly forming wood otherwise, lignified sclerenchymatous strands either run close beneath the epidermis, or a closed ring of that tissue lies near the periphery, and gives the thin column the necessary rigidity, at the same time imparting that wonderful elasticity which enables such plants, on being almost bent into a semicircle by wind-pressure, to recover themselves. In the Nymphaeaceae they project like many-branched stellate hairs into the wide intercellular spaces. They are stellate-branched in the leaves of the umbrella pine (*Sciadopitys*) and the araucaria. They are well seen as dark-brown bands in transverse sections of the common bracken. In the leaves of the Kaurie pine they look in many instances like the antlers of a stag. One point is observable between these cells in the Kaurie pine leaf and those in Nymphaea—viz., that in the former the branches spring from the body of the cell at any point, whereas in the latter there are only three poles or points from which they spring. In the former they are much more numerous, and obviously from their shape, or rather want of shape, bind the tissue elements together in which they lie. In the latter, whatever may be their purpose, they do not look like supporting elements. They have been thought to have in this case an excretory function, being studded with numerous small particles of calcium oxalate, which, from its physiological significance, is a metabolic product, and no longer of use in the economy of the plant.

In the willow-leaved *Hakea* (*H. saligna*) there is on both the upper and under surfaces of the leaf, and lying immediately under the epidermis, a regular network of thick-walled cells. In transverse section, however, it is seen that this network results from the entwining of the long arms or prolongations of erect, oblong, rod-like, very thick-walled cells, dis-

tributed regularly through the entire leaf-surface, and standing at right angles to it, like so many pit-props. When a few of these cells are detached by maceration, they remind one of nothing so much as a barred gate, with both ends of the bars putting out branches and forming an interlacing network. Much elongated forms of these sclerenchymatous elements also occur, the longest of which, from measurements made by Mohl, Weisner, and others, for bast fibres, are found in the *Urticaceæ*.

While the cell-wall itself is increasing in extent and thickness, a further structure becomes visible—viz., the internal thickening deposited in layers in the cell, termed “stratification” and “striation.” This is the result of a regularly alternating distribution of water and solid material within the cell-wall. Dense layers are deposited, alternating with thinner or clearer layers. These layers are thus concentric, forming a band nearly equal all round, and leaving a small cavity or narrow canal in the centre. In other cases this thickening is laid down irregularly, being broader at some points than others. In one of the slides shown (sclerenchymatous cells from *Kaurie* pine), and with the power used ($\frac{1}{8}$ inch), the thickening or stratification appears as alternate dark and light lines.

The lignification of the sclerenchymatous elements marks, along with other changes, a phase of growth in the life of a plant, as it does not occur till the organs and their parts have attained their mature size and form. These thickened walls are perforated frequently by numerous pit-canals, in many cases branched, and in others by slit-like pits. By means of these pores or pits direct communication is kept up between the cell-cavity and the cell-wall. Sachs, in his ‘*Lectures on the Physiology of Plants*,’ holds, with regard to the ascent of water in monocotyledons, that the sclerenchymatous bundle-sheaths are the principal water-conducting organs. He says: “In view of their considerable diameter, it seems probable that the large quantity of water evaporating in the leaf-crown ascends in them;” and that, if this assumption is established—which he holds as more than probable—the sclerenchymatous vascular bundle-sheaths in the stem and leaf-stalks of large ferns must be regarded in the same manner.

With regard to the occurrence of crystals of calcium oxalate, Sachs states that these are absent from, among others, *Dammara australis*. De Bary, on the other hand, states that the branched sclerenchymatous fibres in the laminæ of the leaves of *Sciadopitys*, *Dammara*, *Araucaria*, and *Nymphæa* are characterised by numerous crystals of calcium oxalate, which are imbedded in the outer wall. These crystals are seen in some of the specimens shown. In another group, as in the spicular cells of Gymnosperms, crystals are usually found in the cell-wall. A notable example is to be found in the spicular cells from *Welwitschia mirabilis*.

One object of this note is to show that the intimate or microscopic structure of groups of plants, as well as their outward and visible characters, ought, within certain limits, to correspond. In illustration of the foregoing remarks, I have shown the following preparations under the microscope:—

1. Isolated sclerenchymatous cells from leaf of Kaurie pine (*Dammara australis*).
2. Sclerenchymatous cell in trans. sect. of leaf of Umbrella pine (*Sciadopitys verticillata*).
3. Stellate-branched scleroblasts in trans. sect. of petiole of Water-lily (*Nuphar lutea*).
4. Stomata in epidermis of leaf of Kaurie pine.
5. Trans. sect. of Bracken (*Pteris aquilina*), showing bands of dark-brown sclerenchyma.
6. Sclerenchymatous cells embedded in pith in trans. sect. of stem of *Hoya carnosa*.

XI.—THE TUFTED DUCK (*FULIGULA CRISTATA*).

BY MR A. B. HERBERT.

(Read March 26, 1890.)

THE tufted duck, tufted pochard, or, as it is sometimes designated, the black widgeon, has usually been considered merely a winter visitor to this country; but it is now well known that many pairs breed regularly on islands in some of the Scottish inland lakes. In the drake, the iris is of a brilliant golden colour, and his head is of a dark purple and

green shade, having a few feathers from the occiput prolonged, and forming a graceful pendent crest or tuft. The back is brownish black, and the under part a clear white. The feathers on the back are delicately pencilled, a portion of each of the secondaries of the wing white, forming a white bar or speculum tipped with black. The duck is uniformly dark-brown, except the under part, which is of a lighter shade, the speculum of the wings white, as in the male. The tuft in the duck is merely rudimentary. In this species the feet are inordinately large for the size of the birds, the body is very wide, and when on the water forms almost a circle. They are rather clumsy walkers, but very expert divers. The pair which I exhibit were hatched on the 22d July last, and are therefore now eight months old, and have attained nearly their mature growth. They are rather difficult to rear, but I have watched their progress with much interest. Their food consists of worms, soaked bread, and meal and barley; and the drake is very fond of peas, which the duck will not touch. They are kept in a walled garden, and have one wing clipped. Their pond is a wooden box 5 feet by 4, and 6 inches deep. It was amusing to watch them when very young on worms being thrown into their pond. Both birds were instantly under water, and you could see them searching the bottom till every vestige of worm was eaten. They have become very tame, and will take worms from my hand. I am almost daily in the habit of thrusting a fork into the lawn and shaking it about to bring up worms for them, and they have become so accustomed to this proceeding that when they see me with the fork they follow me immediately, and sit close to it watching for the appearance of the worms. These and slugs, beetles, wood-lice, and earwigs are with them favourite articles of diet, so that they are really useful in a garden. The duck when feeding utters occasionally a low guttural croak; the drake, as far as I have observed, is perfectly mute. I noticed one peculiarity in their habits soon after they were hatched—namely, a strong desire to sit on the back of their foster-mother, a small decoy duck; and it was by no means unusual to see the duck sitting in the sunshine on the lawn, with four little black downy creatures asleep on her back. It occurred to me that probably in a wild

state they may nestle on the back of the parent when on the water in a similar manner to cygnets. I have always thought it a pleasing sight to notice cygnets, when they are first hatched, snugly ensconced in the down on the back of their mother as she swims about, her arched wings guarding them from the wind, and to see with what anxious maternal care she frequently turns her head round to make sure that her precious young are safe.

Tufted ducks pinioned breed regularly in the London Zoological Gardens; and I hope this pair may also breed in the summer, though at present I have observed no indication of their going to nest.¹

At this meeting Mr Thomas Wright exhibited a number of "fairy stones," or claystone nodules, when he remarked that "at one time these stones were worn as charms by the superstitious, and frequently mounted in silver. Their odd shapes had puzzled the country people, and so they, for lack of a rational theory, had set them down as fairy products. They are found only in clay deposits, in streams, or riverbeds, and have been shaped by pressure and the action of water." The specimens shown were obtained at Wetheral, near Carlisle.

XII.—*THE MAGPIE.*

BY MR TOM SPEEDY.

(*Read April 23, 1890.*)

AMONG the many and varied species of birds to be found in the environs of Edinburgh, not the least interesting is the magpie. Though this bird has suffered much persecution at the hands of gamekeepers because of its predatory instincts, considerable numbers are still to be found in Mid-Lothian, and notably at Liberton. How they manage to escape utter extermination

¹ Up to this time (November 1890) the birds have shown no inclination to go to nest.

in this thickly populated district seems a mystery. Notwithstanding the number shot and trapped by game-preservers, and the nests destroyed by schoolboys and idle persons, a good many broods are still hatched every year. These may occasionally be seen in flocks of from half-a-dozen to a dozen in the autumn and winter months. Magpies are regarded by some country people as unlucky birds, and certain numbers of them together are considered ominous of good or evil. Having been brought up in Berwickshire, I recollect when a boy being impressed with a rhyme which was usually applied when a brood of magpies was seen in the district. Mr Muirhead, in his recent work on 'The Birds of Berwickshire,' refers to it thus:—

“One's mirth, two's grief,
Three's a wedding, four's death,
Five is heaven, six is hell,
Seven the devil's ain sel'.”

A version of it may be heard among the school children in many parts of the country, varying in different localities. In the kingdom of Fife it runs thus:—

“Ane's nane, twa's some,
Three's a fiddle, four's a drum,
And five's a curly bogie.”

Why magpies and some other birds are regarded with superstition among the ignorant is difficult of explanation. Last summer a pied blackbird, which frequented the neighbourhood, appeared daily in a friend's garden in the suburbs of Edinburgh, where crumbs were regularly put out for it to feed on. It was watched from the windows with much interest by the different members of the family, and a servant girl from Badenoch was asked to look at it. On observing the beautiful bird she whispered with great solemnity, “Something is sure to happen whateffer, with that black-and-white bird coming so near.” About thirty-five years ago Mary Lorraine, an old nurse in the service of Mr Clay, tenant of Winfield farm in Berwickshire, saw seven magpies together on returning from church, and told her mistress immediately on reaching home that something serious was sure to happen. Within a few days thereafter the stackyard was burned, and the nurse till the day of her death believed that the “birds of evil omen” had foretold

the misfortune. The same superstition pervades the countries of Norway and Sweden, where magpies are allowed to harbour and breed without restraint, it being quite common 'to see their nests on the roofs of the wooden houses of the peasantry, secured between the primitive rhones and the eaves.

Considering their size, magpies make a very large nest, which they cover over with a dome of sticks, consisting chiefly of thorn, with a hole at the side for ingress and egress. From the large size of the nest, which is generally at the top of one of the highest trees, it is easily seen at a distance, and consequently attracts the attention of schoolboys and egg-collectors. The eggs, generally seven or eight in number, are a bluish colour, mottled with greenish-brown. Most of the early nests are thus robbed, but when the foliage of the trees is thickest they make another nest, which frequently escapes the notice of their enemies. Few British birds possess such a rich glow of colour, the brilliancy of the plumage on the tail and wings being of metallic splendour, while the body is a marked contrast of black and white. Magpies in the pairing season are very pugnacious, and determined combats occasionally take place, lasting for a considerable time. Last year I was witness to such an encounter among the large beech-trees in front of Kingston Grange House. My attention was attracted by an excited chattering among a number of the birds in question, high in the air. On looking up I observed two of them attacking each other, while the remainder kept a considerable distance off. Descending among the trees the fight continued, and eventually the combatants came to the ground hanging on to each other like game-cocks, regardless of my presence within twenty-five yards' distance. A noisy chattering was kept up among the branches by the other magpies, who were evidently watching the duel under great excitement. Notwithstanding that the fight continued over a quarter of an hour, neither could be said to have gained any advantage over the other. Both, however, seemed utterly exhausted as they lay on their sides, with their beaks wide open. After getting their breath they evidently had no desire to renew the combat, but flew up and joined their noisy companions overhead.

During the present nesting season I knew of a couple of magpies' nests in places safe from the invasion of boys, and on

these I had resolved to try some experiments. The one was in a tall holly-tree in the garden at the Inch, and the other in the 'policies of Southfield, the property of Mrs Croall. Strange to say, in both cases the birds were attacked by about a dozen rooks, who, after a determined fight, drove the magpies away, tore the dome of sticks from the top of the nest, which was taken possession of by a pair of the rooks, into which they dropped their eggs, and have now entered upon the process of hatching. From a nest in the same holly, in the Inch garden last year, I took the eggs of the magpie and transferred them to a starling's nest in a dovecot. I was exceedingly interested in watching the starling return and sit down, seemingly quite contented, on the eggs, notwithstanding their larger size. As the period of incubation of magpies' eggs is longer than that of starlings, the bird evidently discovered that something was wrong, and ejected the eggs from the nest, substituting four of her own, which she eventually hatched.

In a letter I received lately from Mr Scot Skirving, he says: "I once saw a magpie fly off her nest in a wood in East Lothian, and I climbed the tree, when to my astonishment I found she had flown off six starling's eggs! I was most anxious to see what would be the result, for a magpie could perfectly bring up a starling, but when I next went to the tree I found the feathers of the magpie on the ground, and saw that a keeper had sent a shot through the nest. I regretted I had not asked my friend Sir Alexander Kinloch to order the protection of the nest." Like some of the hawk tribe, should a magpie be shot when hatching, the male very frequently within a day or two brings another mate to the nest. This I have had frequent opportunities of observing. More than once I have shot two female magpies off the same nest within a week of each other.

The food of the magpie varies considerably, as on dissecting them I have found in the gizzard insects, slugs, snails, lizards, mice, grain, eggs, and flesh. It is very destructive to the eggs and young of winged game, and it robs the nests of all small birds, for which it is ever on the look out. I once had a brood of twelve Polish chickens in which I took great interest, having had some difficulty in procuring the eggs. Before

they were a week old nine of them were lifted one day by a magpie, and had I not been fortunate enough to shoot him in the act, the remaining three would have shared a similar fate.

Magpies are easily tamed, and make interesting though mischievous pets. I have brought a tame one with me tonight in a cage, and as his history is a rather remarkable one, I shall now relate it. In the spring of 1881 Mr Kerr, the postmaster at Liberton, found a young bird which had dropped from a nest in the Kingston Grange wood, and was unable to fly. Taking it home, he attempted to feed it, but for two days it could not be induced to open its mouth. On the third day it was compelled by hunger to accept the proffered food, and after partaking of it seemed at once to become reconciled to its somewhat anomalous position. In a short time it became very tame, and much attached to the postmaster's son. It followed him about wherever he went, and he being a joiner, it was his constant companion in the workshop. By-and-by "Jacky," as he is called, became very mischievous, and stole everything he was able to lift. All the small tools disappeared, but by watching his movements the hiding-place was found, and the stolen articles recovered. For some time the boys in the village had proved to be a source of annoyance by playing marbles on the road in the centre of the village. "Jacky," however, soon put a stop to this. As quick as lightning he would dart down among the boys, pick up a marble, and fly off with it to his hiding-place. Enraged at the loss of their marbles, "Jacky" was subjected to revengeful treatment, as stones were thrown at him whenever an opportunity offered, with the result that he has had many narrow escapes, and, as can be seen, one of his legs has been broken in two places. In spite of this, however, he has been the means of entirely putting a stop to boys playing marbles on the street.

"Jacky's" bill of fare is a varied one. Bits of meat, cheese, ham, potatoes, and rice, he seems to relish, and everything that creeps or flies which he is able to kill is devoured, with the exception of earthworms. Unless very hungry he invariably hides his food, burying it in the earth, and after it is carefully covered, he puts as large a stick or stone over the place as he is able to carry. When hungry, he returns, and

with unerring accuracy finds, disinters, and regales himself on his hidden treasure. He devours a large number of wasps; and one day a swarm of bees settled in the woodyard, which afforded a fine day's enjoyment for "Jacky." Not contented with feeding on the bees, he seemed to take special delight in killing them, and every one he discovered crawling about was speedily destroyed. It is somewhat surprising how he manages to swallow wasps and bees without being stung. Young sparrows and other birds which happen to come into the yard meet with a similar fate, and are quickly torn to pieces. Mice seem to afford him great amusement, as he watches and pounces on them with greater dexterity than a cat. When he secures a mouse he begins at the tail and turns the skin up towards the head, completely removing it prior to devouring the carcass. This is at variance with their normal habit when wild, as on dissecting them I have found that mice had been swallowed whole. "Jacky" does not seem to relish a rat, as he only picks out the eyes and brains, and leaves the flesh untouched.

A large retriever dog is kept as a watch in the woodyard, and it is most amusing to see the adroitness with which "Jacky" can take a bone from him. When the dog is eating anything which "Jacky" covets, he flies noiselessly behind him and nips his tail. The dog generally replies by a growl, but after waiting a second or two he gives it another nip, which must be painful, as the dog jumps round, and, with open mouth, seems bent on the destruction of "Jacky." This is what the wary bird has been watching for, and quick as lightning he flies over the dog, seizes the bone, and carries it off in triumph.

Like the wild Indian warrior, "Jacky" takes great delight in bedaubing himself with paint—white, red, or green, as it may happen to be about, when a greenhouse, a fence, or cart-wheels are being painted. Mistaking a pot of melted glue for paint, he one day bedaubed himself with it, which resulted in his feathers all sticking together, and the only remedy was the aid of a pair of scissors.

When plants—either flowers or vegetables—are being bedded out, unless "Jacky" is first secured, it is labour in vain, as he pulls them up as fast as any gardener can plant them.

Pansies, daisies, or other flowers that may attract attention, and be examined by any one, are sure to be nipped off. The slightest change in anything immediately attracts the attention of "Jacky." Mr Kerr having suffered severely from a corn on his foot, commenced with a sharp knife to cut it, with the view of obtaining relief. As frequently happens, the knife went too deep, which caused it to bleed. As a consequence, he could not bear the pressure of his boot for some days, and in order to minimise the pain, cut a hole in the boot opposite the injured part, through which his light-grey Shetland sock contrasted strongly with his blackened boot. This was quickly taken notice of by "Jacky," who flew softly down and gave an unmerciful peck on the tender part, causing him to dance and scream with pain.

"Jacky" robs all the birds' nests in proximity to his premises, and is often besieged by blackbirds, thrushes, and other small birds, while he is amusing himself in tearing their nests to pieces or regaling himself on their eggs. Sometimes several of his own species appear within sight, when he instantly attacks them, and frequently returns ruffled both in feathers and temper. The only member of the feathered tribe with which "Jacky" seems to fraternise is a rook. For hours they may be seen together sitting on the high trees that overhang the woodyard, or flying about apparently without other aim than the enjoyment of each other's company.

"Jacky" has long been the terror of the village children, and does not fail to attack them when they annoy him. Even grown-up people suffer from his shameless impudence. Any one he takes a dislike to he darts at, and generally succeeds in drawing blood from the neck or cheek. Like the Irish assassin, he is cowardly in his mode of attack, as he invariably strikes unexpectedly from behind. Those who are well dressed or of respectable appearance he does not meddle with, unless they annoy him; but if beggars or poorly dressed persons enter the yard, he never fails to attack them.

"Jacky's" mischievous tricks became so serious that he was at one time condemned to death. He had long been in the habit of flying at boys and grown-up people, but never interfered with helpless children. One day, however, he flew at a child, and on the little fellow falling forward, he pecked the

back of his head till the piteous screams brought the mother to the rescue. Such conduct could not be tolerated, and "Jacky," as already said, was condemned to suffer capital punishment. Hearing of the circumstance, I interceded in his behalf, with the result that his sentence was commuted to a couple of months' imprisonment in a cage. Whether his confinement had a beneficial result, or that, as he grows older, he is becoming endowed with more sense, I am unable to state, but he has now given up attacking children unless they molest him.

At this meeting Mr J. W. Tait gave a demonstration on "The Development of the Embryo in a Flowering Plant," aided by diagrams and the blackboard, and was awarded a cordial vote of thanks for his succinct and lucid treatment of the subject.

ANNUAL BUSINESS MEETING.

THE Annual Business Meeting of the Society was held in the Hall, 20 George Street, on the evening of Wednesday, 29th October 1890,—Dr William Watson, President, in the Chair. The Secretary reported that 17 general meetings of the Society had been held during the past Session—of which 6 had been indoor and 11 field meetings. The following are the dates and localities of these meetings—viz.:

INDOOR MEETINGS: 1889—27th November, 26th December; 1890—22d January, 26th February, 26th March, 23d April. FIELD MEETINGS: 1890—26th April, Craigmillar Castle; 3d May, Polton and Roslin; 24th May, Colinton; 31st May, Melrose; 7th June, Lochleven; 14th June, West Linton; 21st June, Inverkeithing and Ferry Hills; 28th June, Lochleven (second excursion); 5th July, Caribber Glen; 12th July, Gosford and Aberlady; 19th July, Balerno.

The Treasurer reported that, including a balance from last account and several contributions to the Publication Fund, the income had been £60, 6s. 8½d., and the expenditure

£54, 5s. 7d., leaving a balance in favour of the Society of £6, 1s. 1½d.

The election of Office-bearers was then proceeded with, and the various vacancies filled up, when the complete list for Session 1890-91 stood as follows:—

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Vice-Presidents.

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ARCHD. CRAIG.

WM. BONNAR.

Council.

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Editor of 'Transactions.'

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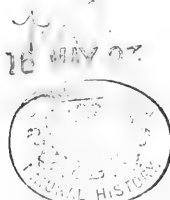
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It was reported that the membership of the Society was this year 186, as against 190 last year,—23 members having withdrawn and 19 members been added to the list during the year, thus showing a decrease of 4. While there was a general expression of satisfaction with the condition of the Society, it was resolved that the members should make it their endeavour to bring its advantages before their friends, and thus help to yet further increase its membership and its usefulness.



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Dr ROBT. BROWN, 1869. Mr R. SCOT SKIRVING, 1869-1874. Mr WM. GORRIE } (deceased), } 1874-1877. Rev. R. F. COLVIN } (deceased), } 1877-1879.		Mr JOHN WALCOT, 1879-1882. Mr A. B. HERBERT, 1882-1885. Mr SYMINGTON GRIEVE, 1885-1888. Dr WILLIAM WATSON, 1888-1890.
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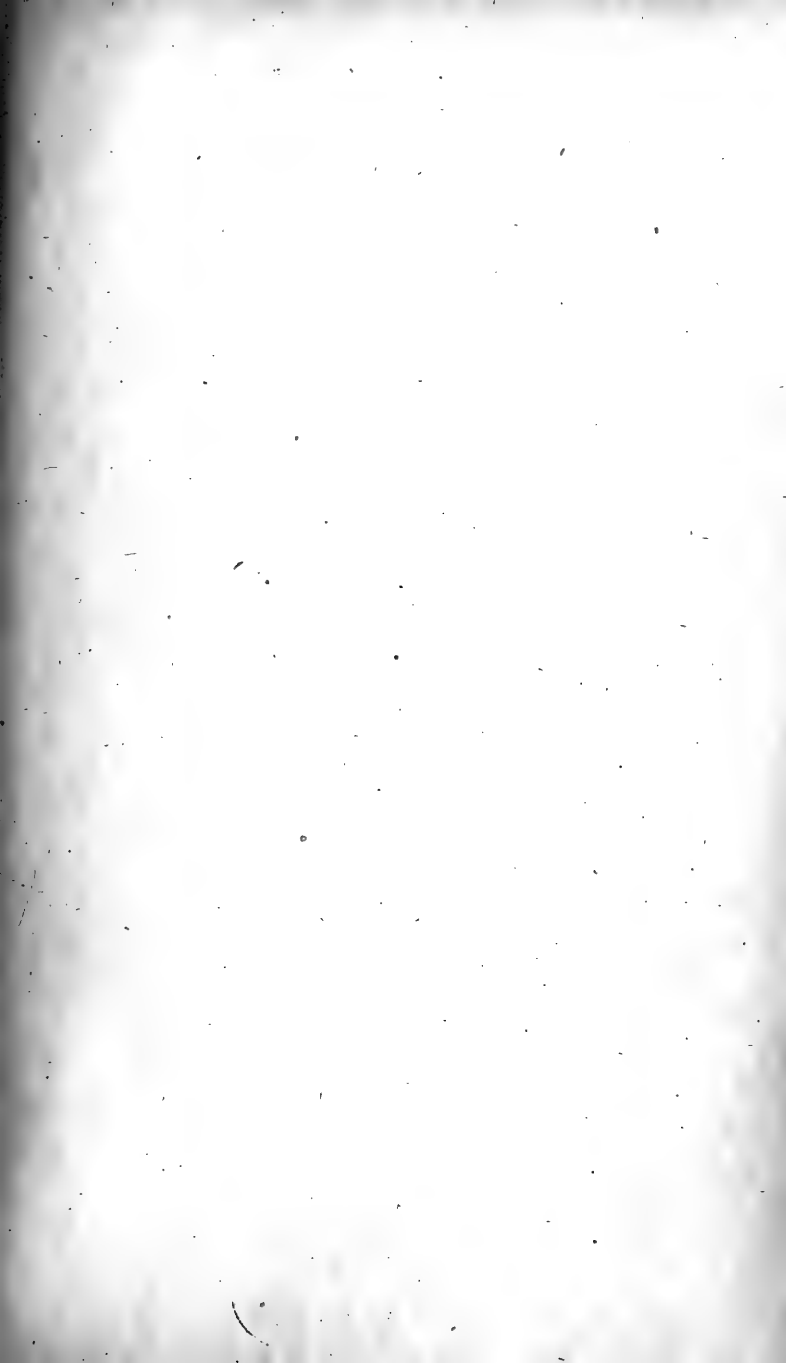
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TRANSACTIONS

OF

The Edinburgh Field Naturalists' and
Microscopical Society

SESSION 1890-91



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Published for the Society

BY

WILLIAM BLACKWOOD & SONS

MDCCCXCI



I.—A DESCRIPTION OF KUMAON, IN THE
CENTRAL HIMALAYAS.

By DR WILLIAM WATSON, PRESIDENT.

(Read Nov. 26, 1890.)

I PROPOSE to give an account of Kumaon, a province of the Central Himalayas, and especially of its capital, Almora. I lived for a number of years at Almora, which is built on a hill about 5500 feet above the level of the sea, and surrounded on all sides by higher hills. To the north, Almora has the oak-crowned summit of Binsur; to the south, the mountains of the outer range, where are the military stations of Naini Tal and Ranikhet, the latter garrisoned by two English regiments. To the east is a hill which has on it a temple of Brinda Bashini Devi,—Our Lady of Dawn;¹ and to the west a hill with a temple to Shama Devi—Our Lady of Darkness. The crest of the Almora hill is occupied by the main street, half a mile long. The houses along it are generally two-storey ones, the lower storey being usually of stone, and the upper of wood, often picturesquely carved. On either side of the main street are parallel streets of poorer houses, and farther down the hill are many villas belonging to English residents and to the richer natives.

Like many other places in the Himalayas, Almora gets its name from a plant, the *Rumex hastatum*, called in Hindustani "Almora," which covers the hillsides in great profusion. In the same way Simla, where the Viceroy resides, is named after the cotton-tree (*Bombax malabaricum*), called in Hindustani "Semal"; while Mussourie, the most popular of the Himalayan hill-stations, derives its name from the shrub *Coriaria nepalensis*, the native "Mussourie." Everybody knows that the Himalayas are the highest mountains in the world,

¹ Literally, "Our Lady of the plant Basil,"—that plant being associated with, and a poetical synonym for, the dawn.

but all are not aware that the scenery of the Himalayas is far inferior to that of the Alps or of our own Highlands. The view of the snowy range, seen from the plains of India, is indeed one of the grandest sights of the world; but once inside the hills, the traveller is disappointed. This is partly owing to everything being on too vast a scale, but chiefly to the absence of lakes and small streams. The cause of the absence of lakes in the Himalayas may here be noticed. Our Scotch lakes are divided by Geikie into four classes: 1st, Lakes of the plains, of glacier origin; 2d, Moraine tarns, such as those round Ben Macdhui, also of glacier origin; 3d, Rock tarns, like Coruisk, also glacial; and 4th, Glen lakes, generally supposed to be owing to local subsidence, connected with a fault in the strata, but possibly, like the other three, really of glacier origin. In Italy we have examples of a fifth kind of lake, that formed by the crater of a volcano; and a sixth kind of lake is sometimes formed by a landslip damming up a stream, of which Mulwa Tal in the Himalayas is supposed to be an example. From this enumeration it may be seen that the great majority of lakes are probably of glacier origin. Now the last glacial period in the northern hemisphere ended some 12,000 years ago. No doubt it left many glacier lakes in the Himalayas, as it did in Scotland, but in Scotland most of these lakes remain to the present day, owing to the comparatively light rainfall. In the Himalayas, on the other hand, the lake barriers have been swept away by the enormous tropical rainfall. Instead of lakes we have now large rivers, far apart from each other, and at a great depth below the average surface of the country. It is easy to understand how the lakes have disappeared. No moraine lake-barrier could stand long against the tremendous rainfall of the months of July, August, and September. A rock tarn would hold out much longer, but in course of time it too would disappear. There are, however, few rules without an exception, and there are still six rock tarns left in the province of Kumaon, though there are none anywhere else in the whole Himalayas. Such, at least, is the opinion of my friend Mr Theobald, of the Indian Geological Survey. It is true that there is around these lakes no other sign of glaciation—no perched blocks, no *roches moutonnées*, no glacial striation; all these have been long ago

washed away by the tropical rains. But the fact remains that Naini Tal is a true rock tarn. It cannot have been caused by a landslip, and it is not the crater of an old volcano. It is, of course, a very difficult thing to say why there are glacier lakes in Kumaon and nowhere else in the Himalayas; but the difficulty would not be got rid of by supposing them to be landslip lakes or volcanic craters. I would suggest that some light may be thrown on the problem by a phenomenon which occurs in the plains, at the base of the Kumaon hills. I refer to what is called the Kumaon *bhabur*. This is a Kumaon word which has been adopted into scientific phraseology as a name for a thing which occurs more conspicuously there than anywhere else in the world. When a precipice rises abruptly from a plain, fragments of the precipice, detached by frost, tend to fall on the plain, and these fragments may either be carried away by streams or may be left lying where they fall. If they are left lying, in process of time a terrace of *débris* accumulates some height above the plain. Any rain which falls on it at once passes through, just as if it were a rubble-drain, and sinks into the plain beneath. Such a terrace is called by the people of Kumaon *bhabur*. There are, of course, neither wells nor springs in it, but after long ages soil forms on it, and it is taken possession of by the saul-tree (*Shorea robusta*), the most valuable tree in India. On leaving the Kumaon hills, you everywhere pass through this *bhabur* land, covered with magnificent saul-trees. Going a little farther from the hills, you arrive at a swamp, called the *terai* or wet land. This swamp is caused by the rain which fell on the *bhabur*, and soaked through it, being here able to make its way to the surface. There are never any trees in the *terai* swamps—nothing but tall grasses, the favourite lair of the tiger. Now there is a *bhabur* country and a *terai* country all along the foot of the Himalayas, except in the extreme east; but nowhere is the *bhabur* so broad and so well marked as it is in Kumaon. I believe, therefore, that the same causes which produced the great breadth of the *bhabur* at the foot of the Kumaon hills, caused the persistence of the glacier lakes which are situated only a few miles off in their interior. What that was—whether their geological structure or their greater height—I am not prepared to say; but

the outer range of Kumaon—that is, the hills nearest to the plains—are certainly higher than the outer range is anywhere else in the Himalayas.

I mentioned that the *terai* is the favourite haunt of tigers. This is where they pass the day sleeping, but at night they visit the *bhabur* and the lower hills. About thirty years ago, at Haldwani, a village in the *bhabur*, there lived a poor widow with two sons. Tigers were then far more common than they are now. The elder son became a letter-carrier or postal-runner between Haldwani and Kathgodam, a place six miles off in the lower hills. One night a tiger killed and ate him. Strange to say, his brother applied for and got the vacant appointment. I suppose the family had no other means of earning a livelihood. Before long he, too, was devoured by the same tiger, almost at the very spot where his brother had been killed. The poor widow, left alone in the world, never hesitated as to what she ought to do. The night after her second son was carried off, she seated herself on the fatal spot, saying to the neighbours, “The tiger has taken my two boys; let him take me too.” She had to wait a week: for seven weary nights she sat alone by the roadside, wrapped up in her tattered blanket. But the tiger came at last; and there was an end of the Haldwani family. I have often walked from Haldwani to Kathgodam, and tried to find out the exact spot where the old woman sat; but no one I met could tell me with certainty, and there were many likely places for tigers along the gloomy road running between a mountain torrent on one side and the high wood-clad precipices on the other.

Besides Almora there is another town in Kumaon—viz., Naini Tal, the summer residence of the Lieutenant-Governor of the North-West Provinces. Naini Tal is built round a lake of the same name. Till 1840 no European knew of the existence of this lake, though there had been a considerable English population in Almora for nearly forty years. The natives concealed the fact of its existence because it was considered a holy lake, being sacred to the goddess Naini Devi—Our Lady of the Beautiful Eyes. One traveller came upon it by accident in 1840, and described it in a newspaper which was then published at Mussourie; but another correspondent of the paper wrote that the story was a fabrication,

as it was well known that there was only one lake in the whole range of the Himalayas, meaning by this Lake Bhimtal. Mr Batten, the then Commissioner of Kumaon, wishing to find out the truth, ordered a native to guide him to the sacred lake. The native replied that no such place existed. Mr Batten picked up a large stone, and, handing it to the man, told him that as he had made a vow to throw a stone into the lake, he (the native) would have to carry it there for him. The native, caught in a trap, replied, "It is no use carrying this big stone all the way from Almora to Naini Tal, for there are far larger stones than this on the edge of the lake." "Then such a place really exists!" was Mr Batten's triumphant exclamation. The Commissioner got to the lake, and built a house there, in which I afterwards lived. In a few years Naini Tal became one of the most popular health-resorts in India. The lake is 6000 feet above the sea, one mile long, a quarter of a mile broad, and eighty feet deep. The water is beautifully clear, and several species of carp (*Barbus*) swim in the lake, and give capital sport to fly-fishers. Every third or fourth year the lake is visited by swarms of locusts from Rajpootana. They fall into it, and the lake becomes covered with their dead bodies. On several occasions I have seen the lake discoloured by *Peridineum*, a species of infusorian; but after a few days the water again becomes clear. On the 18th September 1880 there was a terrible landslip, which destroyed part of the town and killed many people. It had rained continuously for forty hours, and in that time twenty-five inches of rain had already fallen, when, early in the forenoon of the fatal day, a portion of the hill fell on the ground behind the principal hotel, burying alive a native nurse and an English baby she had in her arms, besides four natives who lived in cottages above the hotel. The Assistant Commissioner of Kumaon was a Mr Leonard Taylor,—one of the finest young fellows that ever entered that noble service, the Bengal Civil Service, and one of the most lovable men I have ever known. He at once organised a digging-party, consisting of gentlemen volunteers, private soldiers from the barracks, and a number of natives. For four hours they worked on in the pitiless rain—for one inch of rain continued falling every hour throughout the day. It

was by this time known that all the victims of the first landslip must be dead, and most of the soldiers returned to barracks; but Mr Taylor, Lieutenant Sullivan, Mr Noad, three brothers named Shiels, with others, went on digging to get out the dead bodies. Suddenly, without a moment's notice, the whole hillside slipped down and fell into the lake, burying for ever the working-party. Thirty brave men passed in one instant from time into eternity. Two years afterwards the ground was consecrated as a cemetery, and there, fifty feet below the surface, lie the bodies of the Assistant Commissioner of Kumaon and his band of volunteers, white men and black together. His superior, the Commissioner of Kumaon, Sir Henry Ramsay, had a narrow escape. While his Assistant was digging at the upper end of the lake, he was at the lower end, superintending a party who were deepening the outlet, with a view to letting its swollen waters escape. When the hill fell into the top of the lake it sent down a great wave, which swept over the party working at the outlet. Three men were drowned, and the Commissioner's life was only saved by a private soldier, who pulled him up the bank, not a moment too soon. Besides these, many other people were killed, either on the main road or inside five buildings which were buried by the landslip. These buildings were the Victoria Hotel; the principal shop, called Bell's shop; the Volunteers' orderly room; the public library and assembly rooms; and the Hindoo temple, sacred to the goddess of the lake. The total number who perished in this terrible calamity was 151—43 British and 108 natives.

In describing further the district of Kumaon, I shall now proceed to speak of its

DISEASES.

Plague, which I mentioned in my account of Gurhwal,¹ is more common there than it is in Kumaon. Goitre, leprosy, and cholera are equally common. Goitre is generally met with in limestone countries, as was first proved by Dr Cleland of the Bengal Medical Service. Of leprosy I had great experience, as I had medical charge of the Almora Leper

¹ See *ante*, p. 305 (Sess. 1889-90).

Asylum for nearly ten years. The average number of lepers in this asylum was over one hundred. I treated the lepers at first with cashew-nut oil, the South-American treatment, and latterly with Gurjun oil (*Dipterocarpus turbinatus*), as recommended by Surgeon-Major Dugald, who was the medical officer of the Andaman Islands Hospital, but without much success. With regard to the origin of the disease, I entirely agree with the great London surgeon, Jonathan Hutchinson, who lately lectured on this subject in Edinburgh, in attributing it mainly to the use of a too exclusive fish diet. The fact that the heroic Father Damian became a leper is generally regarded as a proof that leprosy is contagious; but it should be remembered that at Molokai, the Sandwich Island leper-settlement, he had to share the poor food of the lepers, and that, as a Roman Catholic, he would live during Lent exclusively on a fish diet.

The origin of cholera has been fully explained by Koch and others, though the explanation has not yet been generally accepted. In popular language, it may be stated as follows: Cholera is a non-infectious disease. Nobody gets cholera in any way except by swallowing cholera germs; but, curiously enough, even if one does swallow cholera germs, he is none the worse if a sufficient quantity of gastric juice is present in his stomach. The gastric juice kills the germs. For all practical purposes, therefore, a man is pretty safe during a cholera epidemic, provided he never drinks a large quantity of water when his stomach is empty; but, of course, this is the very thing one is tempted to do in the hot weather in a tropical country like India. The risk is increased if he puts any brandy or other alcoholic spirit in the water. I have seen a case which apparently originated in a single glass of brandy taken in a tumblerful of water by a man who was tired, and who had eaten nothing for some time. Possibly the same effect would have been produced by the water alone, but of two risks it is wise to chose the lesser; and if a man is very thirsty he is safer, when cholera is about, if he drinks the water plain than if he mixes it with alcohol. Of course, if he can possibly help it, he should do neither. It is thirty years since I came to the conclusion that cholera was not infectious through the air, and I was satisfied of it in the

following way. At that time the army in India was very numerous, and cholera cases were common. I found from the statistics that the average number of medical officers and hospital attendants who died of cholera was not greater than the average of military officers and soldiers. When I pointed this out nobody listened to me, and everybody repeated the parrot-cry, "Cholera is very infectious." The one sensible man who opposed my views was the Commissioner of Kumaon, one of the greatest and best men in India. He recognised the fact that medical officers do not die of cholera more often than other people, but explained it by saying that a special providence protected medical officers in the discharge of their duty. I did not at first know how to answer him, till it occurred to me to consult the statistics of deaths. There I found that medical officers died from typhoid fever more than other officers, and from plague very much more than other officers. My conclusion, therefore, on the whole, was, not that there is any special interference in the case of cholera, but simply that cholera is not an infectious disease, and that typhoid fever probably, and plague certainly, are infectious diseases.

In September 1873 there was an epidemic of cholera in Eastern Kumaon. A medical missionary was very fortunately travelling at the time in that district, and reported to Government the necessity of a Government medical officer being sent to treat the numerous cases. I was sent at once. There was in the centre of the infected district a military cantonment where a European officer, a bachelor, and a company of Sepoys was posted, and I hoped to be allowed to live in one of the houses, of which there were several near the regimental barracks. But the officer wrote me that as I was engaged in cholera duty, and as there was no cholera among the Sepoys, he could not allow me to enter the cantonments; so I had to pitch my tent under a tree, about a mile from the barracks. I found the epidemic a very bad one, many deaths occurring daily in the scattered villages. The history of its origin, as given me by the inhabitants, was as follows: "Some time previously the goddess of cholera, tired of the plains, had resolved to visit the snowy range, probably with the view of going as a pilgrim to the sacred lake of Mansarover.

Finding that a party of Thibetans were returning from India to Thibet, she accompanied their camp. But when about one-third of the way from the outer range to the snowy range, the Thibetans were robbed by the villagers; and the goddess, being angry, established herself in the country, instead of going on to Mansarover. I hinted that this was very weak and capricious conduct on the part of the goddess, but the villagers saw no difficulty in it. They said, "Women are always doing unaccountable things"! Being now satisfied as to the origin of the disease, I began my treatment, which I need not inflict on you. People took my medicines, but medicine was not what they chiefly trusted in. All over the infected district prayers were constantly going on, and goats were being sacrificed in all directions to the goddess herself, and to the innumerable local deities, especially to the god Symdeo, the chief local god in Kumaon,—a deity not known in the Hindoo pantheon, and utterly repudiated by the Brahmins. All was in vain. Medicine was only a partial success, and the prayers and goat sacrifices were a total failure. All at once a deliverer appeared. One day a crowd of suppliants had assembled before a temple of Symdeo which had fallen into ruins, and which they intended to rebuild to propitiate the god. A woman suddenly stepped forward and addressed the crowd in vehement tones. Her name was Harli, and she was twenty-eight years of age, the wife of the village postal-runner,—a poor man, and of no social importance. Harli informed the crowd that it was useless rebuilding the temple or sacrificing any more goats; that the goddess of cholera had appeared to her, and told her what ought to be done: She herself was to be dressed in red and carried in state from village to village, and wherever she went cholera would cease. This the goddess had promised. The plan was adopted with enthusiasm. A sedan-chair was procured, and Harli, seated in it, and carried by ten or twelve men, commenced her round of visits to the dead and dying. I met her next day entering a village which I was leaving. In front was a band of musicians, and behind a long train of people carrying red and white flags. Harli was reclining in her sedan-chair, and took no notice of me as I stood aside to let her pass. Never was prophetess more

successful. The cold weather was coming on, and cholera disappeared as if by magic. Three days after, I packed up my things and started for home. I heard subsequently that when the cholera had completely disappeared, Harli returned to her old village life and her obscure position. I never saw her again.

While resident in Kumaon, the bird-life of the district was to me a most interesting study: I shall therefore now go on to notice somewhat particularly the

BIRDS.

In Britain, in olden times, one of the most popular amusements was hawking; but this sport is now so completely forgotten in these islands that few people know anything about it, beyond, perhaps, what they may have read in Sir Walter Scott's charming novel, 'The Abbot.' In India, however, hawking is still as popular as it was in our own country in the middle ages. Every Indian noble, whether Nawab or Rajah, Mohammedan or Hindu, keeps hawks, and in the days of the East India Company many English officers also kept them. Most of the hawks are brought from Afghanistan, but a considerable number are caught in the Himalayas. Indian falconers divide these birds into two groups: (1), "Siyah Chashm," or black-eyed—the falcons; (2), "Goolab Chashm," or red-eyed—the hawks. Of the falcons the peregrine is most esteemed. There are two species of peregrine, the common and the royal, which are trained to hunt herons, egrets, storks, cranes, and partridges. Next to the peregrine in value is the lanner, with a longer tail than the former. It is chiefly trained to hunt crows, egrets, partridges, and florikin. Among the smaller falcons there are three common species: (1), the hobby, with dark plumage; (2), the merlin, with light plumage; (3), the claret-coloured kestrel. Of these, the merlin is the only one much used for hawking purposes. It is flown at quails, partridges, minas, and the Indian jay. The Indian species is called the red-headed merlin, and is a little larger than the English merlin. Of the hawks there are two great groups—the large hawks, re-

presented by the goshawk; and the small ones, represented by the sparrow-hawk. The goshawk is the best of all birds in falconry. It is trained to strike bustards, ducks, cormorants, and herons; and, above all, it is used for catching hares. Of sparrow-hawks there are three kinds: (1), the "shikra," with *short* tarsus and toes; (2), the "besra," with *long* tarsus and toes; and (3), the "basha," the European sparrow-hawk. Of eagles, the golden eagle, one of the dark-eyed section, is also trained by the Tartars to catch antelopes. The price of a trained bird is said to be two camels. Besides the golden eagle, twenty-seven other species of eagles are found in India, as well as six species of buzzard and five species of harriers. Of all these I will only allude to one, a species of eagle—the ring-tailed fish eagle (*Haliastur fulviventer*). A pair of these birds have established themselves on each of the Kumaon lakes, feeding chiefly on fish, but they are fond of carrying off a wounded duck shot by a sportsman. Dividing the owls in the same fashion, there are in India seven species of dark-eyed owls and fourteen species of light-eyed owls. They are all birds of ill omen, though the cries of many of them are exceedingly beautiful. Of the Fissirostral birds, *Hirundo erythroptgia* is the most conspicuous, and the wire-tailed *Hirundo filifera*. Of the swifts, the most common is *Cypselus affinis*, called by Europeans the "pagoda swift," because it often builds in temples; but in Kumaon it builds in verandahs, making a nest of straw, feathers, and bits of paper, glued together by its saliva. An allied bird is the goatsucker, whose cry, heard chiefly at night, is like the sound of a stone scudding over ice. This bird causes as much terror to the hill-men of Kumaon as its congener causes to the Highlanders of Scotland. The next group of birds is the hornbills, remarkable for the appendage on their upper mandibles, and for the fact that the male builds the female into her nest, leaving only a tiny opening, and feeds her with fruits, while she is sitting on eggs. The cry of this bird is said by the natives to be a sure sign of rain. They think that, owing to the appendage on its bill, it cannot drink from streams, and can only swallow rain-drops. It is therefore often very thirsty, and cries out for joy when rain is coming. The green parrots of India are well known. They were the only parrots known to the

ancients, and were first sent from India to Greece by Alexander the Great and his generals. Another characteristic group are the barbets. The great barbet (*Megalaima virens*) cries all summer in the Kumaon forest. Its loud, continuous wailing cry is, according to the natives, not owing to a love disappointment, as one would expect, but to its having lost a lawsuit. The blue-throated barbet (*Cyanops asiatica*) is equally noisy, but in the *Uhabur* forests, not the hill forests. Its cry is syllabicated by Mr Blyth as "Kuru wùk, kuru wùk." To me it sounded like "Put her out, put her out." Next come the cuckoos, which are very numerous in India, both in species and in individuals. There are fifteen species at least in India, but I will only mention the Kumaon ones. These are—(1), *Cuculus canorus*, the European cuckoo; (2), *C. himalayanus*; (3), *C. poliocephala*; (4), *C. micropterus*, known to every native in Kumaon, because it says most distinctly "Kaphul pako," meaning, "The kaphul" (*Myrica sapida*) "is ripe," and it says this just when the fruit really is ripe; (5), *Hierococcyx sparveroides*, which says "Pi kahan?" "Where is my sweetheart?"—exactly the same cry as the *Hierococcyx varius* of the plains, but it is a bigger bird. In the forest these five birds may often be heard calling within a few minutes of each other, as also the so-called plaintive cuckoo (*Polyphasia nigra*)—a humbug of a bird, whose cry is a poor imitation of that of *Hierococcyx sparveroides*. Lastly, the green-billed *Eudynamis orientalis*, or "koil," so called from its cry. It has, however, another cry, sounding exactly like the English words, "Who are you?" which it repeats persistently. The male is black, the female green spotted and banded with white. This bird deposits its eggs in the nests of crows—generally of the common crow, more rarely of the carrion-crow. I had a nest of the common crow, with a young cuckoo in it, taken from a tree, and carried to a verandah. The parent crows were quite fearless, and fed their spurious offspring most diligently till it was able to provide for itself.

With reference to crows, I may here notice one great difference between British and Indian ideas. In a delightful book, 'Birds of Iona and Mull,' recently published, there are the following passages: "The hoodie-crow has got a terribly

bad name, and his best friend could not say much in his favour, supposing he ever had a friend, which I do not suppose is possible. . . . A greedy, cowardly, destructive creature, with an ugly look and a hateful voice." Such is a British naturalist's opinion of crows. In India it is very different. To a native the crow is the type of moral excellence, as the cuckoo is of selfishness. The crow is the *anyabhrit*, the nourisher of others; the cuckoo is the *anyabhritus*, the parasite, the mean accepter of other people's charity. The crow is also the type of propriety, decency, morality, and religion. The Persian poet Sadi, writing on the misery which the good experience when compelled to associate with the wicked, describes it under the image of a crow shut up in the same cage with a parrot. The crow exclaims: "It is bad enough for a holy man to be in prison, but it is worse to be in the same cell with a parrot. Would that I were back on a garden wall, where I could talk seriously with some reverend brother dressed like myself in black, instead of having to listen to the silly prattling of this green-mantled fop!"

A beautiful group of Kumaon birds is the sun-birds, sometimes erroneously called humming-birds; but they have strong feet, and are modified passerine birds, not modified swifts. The most common is the purple honeysucker, with a red-and-yellow epaulette. Next come the creepers. The *Certhia himalayana*, one of them, is, I think, the most common bird in Almora. Not so common, but pretty abundant, is the *Tichodroma muraria*, which looks more like a butterfly than a bird. The hoopoe is a common bird in Kumaon. It is venerated by Mohammedans on account of its having been the messenger of Solomon; but it is rather dirty in its habits, as it spends most of its time searching for beetles and grubs among cow-dung. Of fly-catchers, the most common and most beautiful is the Paradise fly-catcher. The adults are pure white, with two very long tail-feathers. The young birds are black and chestnut. Not very common, though figured by Royle, is the "now-rang" or nine-coloured bird (*Pitta bengalensis*). This bird is not only conspicuous by its beauty; it has also a very well-marked cry, saying distinctly, "Ayittam, ayittam"—"My dress, my dress." It seems that it formerly had a fine train, as well as a pretty bodice, but

the peacock stole its train. Why it speaks Cingalese, and not Hindustani, I cannot say. Another common thrush is the brown water-ousel (*Hydrobata asiatica*), which plunges into water in search of water insects. I used to call it the curtsy-ing bird, for it has a habit of sitting on a stone in the river, and making a series of very pretty curtses. I mentioned last year the yellow-billed whistling thrush (*Myiophonus Temmenckii*),¹ so shall say no more about it now.

Of the Crateropod family, Malacocircus, one of the most common birds in the plains, is rarely seen in Kumaon. Here the commonest Crateropod is the white-crested laughing thrush (*Garrulax leucolophus*). It assembles in flocks of twenty or more, and receives the astonished visitor to its forest haunts with roars of laughter which are extremely infectious, for one can hardly help laughing one's self. Another common and familiar Crateropod is the streaked laughing thrush (*Trochalopteron lineatum*), which, however, does not laugh at all—at least, I never heard it. Its note is like that of two pebbles struck together. It often builds under the eaves of houses in Naini Tal.

Of the short-legged thrushes, the most conspicuous is the "guldum" (*Otocompsa leucogenys*)—a lovely bird, with bright yellow under its tail, which sings, "Speak to me, speak," the refrain of a once well-known English ballad. Common, but not nearly so common, is the green iora, which says "ioree" not "iora," as it should say, and has also for its note a double C—the low C with its octave. Next come the joyous orioles. Of all birds I know, these have, I think, the most exhilarating and joyous cry. The note of the laughing thrush inclines you to laugh; the wail of the green pigeon almost makes you weep; but the cry of the oriole causes you to reck little of the steep ascent before you. Every pedestrian in the Himalayas must love the oriole. Of the warblers, the most conspicuous is an aquatic form, the plumbeous water-robin or plumbeous red-tail, which lives on the wet rocks in the streams, and passes a great part of its life in fighting with a wagtail (*Enicurus Scoulerii*) which has similar habits. I have often sat watching them at war. They are well matched, but the robin has generally the best of it. The true wagtails, called by the

¹ See *ante*, p. 295 (Sess. 1889-90).

natives "dhobins" or "washerwomen," are fairly common up to 4000 feet. They are apparently anxious about what they are to have for dinner, as their cry has been syllabicated, "Aj to nahin rasil?"—"Is it enough cooked to-day?" Of the tits, the most conspicuous is the white-eyed tit (*Zosterops palpebrarum*), found everywhere in Kumaon. Equally common is the *Parus monticola*, distinguished by its wearing a Gladstone collar. The common crows are *Corvus culminatus* and *Corvus splendens*. The latter, as before mentioned, is the favourite victim of the "koil," though the crow is perhaps the wisest bird in India. This is not to be wondered at. Among the human race, the wise and good are the favourite prey of charlatans, and why should it not be so among birds?

I pass over the many jays, mentioning only the Indian magpie, which is very common, dressed in black hat, brown coat, and grey trousers, with a cry like the scraping of a pan. Hearing this bird cry is an omen that you will soon have a visit from a beggar, wanting food or money from you. The hill mina (*Eulabes intermedia*), the most articulate speaker of all birds, far excelling even the parrots, is unfortunately not a Kumaon bird; but it is abundant in the neighbouring province of Nepal, on the other bank of the river Surjoo. It is caught there, and sent all over India. In Naini Tal in 1881 I had a mina in a cage. It had been taught to say "Pray to Rama." A poor blind woman had come to beg. When she heard the bird shouting out "Pray to Rama!" she stopped, and, turning her sightless eyes to where the sound came from, she said, "O great king, I have prayed to Rama." The bird, hearing her voice and footsteps, got more and more excited, and kept shouting out louder and louder, "Pray to Rama! pray to Rama!" while every now and then the poor old woman said, in a soft low voice, "O king, I have prayed to Rama." We gave the old woman a small coin and sent her away. I do not believe she had the least idea it was a bird that had been speaking to her, yet I do not know whether she supposed it to be a human or a supernatural voice,—probably she thought it was the latter. Of the larks, the only one common in Kumaon is the *Alauda gulgula*, almost identical with the British skylark. I have already alluded to the plaintive wail of the green wood-pigeon (*Sphenocercus sphenurus*). To my ear this is the most

beautiful, and at the same time the saddest, cry of any bird on earth. Of all my remembrances of Kumaon, the wailing cry of this bird is most deeply impressed on my memory.

Last year I described the pheasants at sufficient length. Of the partridges, two species are the most common. The first is the black partridge (*Francolinus vulgaris*), which, according to the Mohammedans, says, "Subhan teri kudrut," meaning, "Great is thy power"—supposed to be an address to the deity. The other species is *Caccabis chucor*, allied to *C. græca*. Both these partridges are excellent eating, and are shot in great numbers by hill sportsmen. There is also a tiny partridge, the "peura" (*Arboricola torquola*), which is also very good to eat, though small. It is often captured in nets by the natives, who imitate its whistling call. Of the lapwings, the red-wattled lapwing (*Lobivanellus goensis*) is ubiquitous, and is even more vociferous than the European lapwing. It appeared to me to speak broad Aberdonian, saying, "Fat did he dee o'?" Curiously, a very different bird, *Sibia capistrata*, a Crateropod, has to my ear a similar cry, but whispered, not shouted, and quickly answered by its mate. It lives in the forest, not upon the ground like the lapwing. The common snipe and the painted snipe are well known as birds of passage. They make a stay of a few days on their way up and down from Thibet, especially the return journey. They are then shot in great numbers; but the snipe-shooting season is a short one. Geese and ducks seldom stop in Kumaon, but make their way from the plains to Thibet and back, without halting. A few are, however, occasionally shot in the lakes and elsewhere.

The characteristic bird of the Kumaon lakes is the bald-coot (*Fulica atra*), which, according to my friend, Dr Walker, author of a book on fishing in the Kumaon lakes, has a cry exactly like the click of an angler's reel. This often surprises a fisherman on the Kumaon lakes, who fancies he has the lake all to himself, and who could not hear a more disagreeable noise than the sound of another man's fishing-reel running out at the rate of fifty miles an hour.

Regarding the people of Kumaon, I must now, in conclusion, say something. As a whole they are inferior, physically and morally, though not intellectually, to the people of Gurh-

wal to the west, and to those of Nepal to the east. Many of them are polygamists. In the plains of India polygamy is lawful, but it is so exceedingly rare that I only once knew a man who had two wives. In Kumaon, however, I knew many men who had two wives, and one man who had as many as seven. In the temples, also, they have women called Paturs, or hereditary temple slaves—a thing unheard of in the rest of Northern India. In Britain the fact is not sufficiently recognised that there are different races in India. A native of Kumaon is unlike a native of the plains of the North-West Provinces in many ways. One thing particularly struck me in my experience of the two races as vaccinators. When a hill vaccinator did anything wrong, I soon heard of it, as his brethren were all ready and anxious to tell tales against him. In the plains it was very different: vaccinators generally tried to shield each other, and would tell any number of lies to get a friend or neighbour out of a scrape. When a hill-man told lies, it was to get a neighbour into a scrape, not to get him out of one. Faction fights were, until lately, very common in Kumaon. At fairs and markets the people divided themselves into two parties, called “Mahar” and “Fartial,” and fought for hours with sticks and stones. This practice also is South Indian, not North Indian; and I think it may safely be inferred that there is more Turanian than Aryan blood in the veins of the people of Kumaon, for in everything but language they agree with the Tamul races, not with the Hindu. One single fact, which alone is almost sufficient to prove this, is the practice, only recently put down by the English Government, of men who were rich, or at all events well off, actually selling their own daughters as slaves to be taken to the plains. To a Hindu of the plains this appears worse even than it does to an Englishman. The poorest Hindu would infinitely prefer death to committing such a crime. He might kill his daughter to save her from disgrace, but he never would sell her into slavery. However, if the people of Kumaon have little pride and self-respect, they have plenty of vanity and self-conceit. As sanitary commissioner, I had a clerk a native of Kumaon. This man, on a salary of £60 a-year, thought himself defiled by having to sit in the same room with me. Before going home from the office at night, he always went to a Brahmin

and had some prayers said and holy water sprinkled over him, in order that he might not carry defilement to his wife and family. It is sad to think how little we are appreciated in India. All other conquering races have treated the vanquished as slaves: Athens, Carthage, Rome, and Holland are examples. England has treated India, not as a master treats a slave, but as a mother treats a child. When the English first landed in India, the country was in a state of terrible misery, owing to the total breaking down of the corrupt Mohammedan rule. Life and property were everywhere unsafe. We have made India peaceful and prosperous, and yet among all the millions of India there is not a man who loves our rule or wishes it to continue. Not only is the Government unpopular, but individuals also are too often disliked. The missionaries are beloved, and they well deserve it; and possibly some, or even many, of the civil administrators are liked; but the military and trading classes are hated. It is inevitable that the black man should dislike the white, and the conquered the conqueror. Perhaps the Hindus are right, and the time has come, or nearly come, for us to quit India. We have done our appointed work, and it may be time for us to loose the leading-strings and leave India to walk alone. That India should be free ought to be the desire of every lover of liberty—unfortunately I cannot say of every Liberal, for that name is now claimed by the friends of mob tyranny and priestly superstition. Many will say, India is unfit for freedom, and if we abandon her she would either be conquered by some other European Power or would fall a prey to intestine anarchy. This is what our fathers were told would happen to Italy, and what our grandfathers were told would happen to Greece. In both instances the prediction has proved false. I venture to hope that our sons, or at least our grandsons, will know that the prediction has proved equally false with regard to India. If we have to withdraw from the great peninsula and allow it to govern itself, it may partly console us that there are few brighter pages in history than the story of the century of British rule in India, from 1760 to 1860; few names in all history more worthy of reverence than those of Cornwallis, Bentineck, Malcolm, Sleeman, and Outram.

II.—*THE KINGFISHER.*

BY MR TOM SPEEDY.

(Read Dec. 24, 1890.)

THE kingfisher is the gaudiest of British birds. To many such brilliant plumage is associated only with the tropics; but no country can produce amongst its birds a more resplendent azure and other beautiful tints than we find in the kingfisher, living at our own doors. The kingfisher is mixed up with a deal of superstition. It is supposed to be the "halcyon" of the Greeks, of which bird many curious stories have been told. The kingfisher may be found on the banks of almost every stream in the south of Scotland, but I have never seen it in the Highlands. Mr St John, however, in his admirable book, 'Wild Sports and Natural History of the Highlands,' records having twice seen one in Morayshire, remarking that their visits to the northern parts of our country are very rare.

The kingfisher generally constructs its nest in a hole on the bank of a stream. Whether it also makes this hole itself, or takes possession of that of a water-rat, I am not prepared to state, but I am inclined to think that the latter is its normal habit. A section of a river-bank, showing the nest of a kingfisher, is to be seen in the South Kensington Museum, and is very interesting. The floor of the hole where kingfishers make their nest is always covered with the disgorged bones of the small fish which constitute their food. It appears that they are incapable of digesting the bones and scales of fish, which they throw up again in the same manner as owls are known to eject pellets of fur and other indigestible substances. It has frequently been asserted that the nest is made of fish-bones. This, however, is not the case. The bones and scales of fish are found in profusion in the hole, but that they are put there for the purpose of building the nest I do not believe. The nest is lined with a sort of down, apparently derived from some plant such as the cotton-grass. The eggs, of a pinkish tint, are from five to seven in number.

When bird-nesting in my boyhood, I one day observed a

kingfisher, with a small fish in its bill, frequently flying up the brook which divides the Ladykirk and Milne-Graden estates, in Berwickshire. Following the stream, I saw the bird disappear under a large tree, the roots of which grew down outside the bank, forming a kind of arbour. Observing a hole in the bank under the roots, I thrust in my arm, and found half-a-dozen birds nearly fledged. Having examined them, I returned them to the nest, which appeared to be in strange contrast to the beautiful plumage of the birds. The stench was intolerable, and it was days ere I could get rid of it on my hands and clothes. The excrement of kingfishers being of a liquid consistency, the parent birds are unable to carry it out, as is the habit with water-ousels and some other birds which breed in holes; and this, along with the bones and scales of fish which constitute the castings, decomposes, and emits a most obnoxious effluvium.

During the last twenty years I have taken a great interest in observing kingfishers beside the brook which flows past my cottage. After the severe winter of 1880-81 they disappeared for some years; but, much to my delight, they have again returned. It is only in winter that they may be said to dwell with us at Liberton, as in spring they migrate to more secluded localities to breed. Notwithstanding the shortness of their wings, the velocity of their flight is very great, their brilliant hues flashing in the sun, as they dart past, like a "living emerald." Sometimes I have seen one sit for a long time on a twig of a hedge or bush, or on the grassy bank a few yards from the stream, till sighting some small fish, when he would dart like lightning into the water, remaining a second below the surface, but returning, if unsuccessful, to the same spot, to await another opportunity. At other times I have seen them hovering in the air like an osprey, then swooping down in an instant on perceiving a fish. Most naturalists assert that they are generally unerring in their aim, and seldom fail in making a capture. This, however, does not comport with my own observation, as I have seen them over and over again unsuccessful. When they do catch a fish, they fly to a post or stone—at The Inch a water-gate is a favourite resort—when they seize the fish firmly, beat it violently till they kill it, when it disappears head first down their throat. When feed-

ing, they invariably beat the fish, in order to kill it before swallowing it, according to hereditary instinct; and it is most amusing to see my pet bird beating a bit of beef in the same manner as a live fish. Minnows, sticklebacks, small parr, and trout constitute the staple food of the kingfisher, though I am of opinion that they also eat aquatic insects. It has frequently been asserted that they devour ova, and consequently are destructive to salmon. This I do not believe, as while the bird which I now exhibit will eat fish, flesh, or fowl, it cannot be induced to eat salmon-roe. It is, however, extremely dangerous to rest any theory upon an experiment when dissociating birds from their natural environments, and placing them in captivity; and as I have never killed kingfishers for the purpose of dissecting them to discover what the gizzard contained, I shall not dogmatise on this point.

[Mr Speedy then proceeded to show a tame kingfisher in the act of killing and swallowing sticklebacks, as above described. It may be added that this pet bird died a few weeks after being thus exhibited to the members of the Society, having succumbed to the effects of a sudden and intense frost.]

At this meeting a number of interesting microscopic objects were exhibited by the following members of the Society: Dr Arthur E. Davies; Messrs Coats, Crawford, Forgan, Lindsay, Wright, and A. Moffat, secretary. Mr A. B. Herbert also exhibited a viper and a live slow-worm.

III.—*THE COMMON LUMP-FISH.*

BY MR SOMMERVILLE GRIEVE.

(Read Jan. 28, 1891.)

THE lump-fish (*Cyclopterus lumpus*), locally known as “cock paddle” and “lump-sucker,” is a native of the northern seas. It is an odd and clumsy fish, with a deep body covered by spinous processes, and has its sides adorned with bony scales,

giving it a very antiquated appearance. The colour of the body is a brownish black, but it varies slightly according to the season. From three to five pounds may be considered its average weight, although it has been known to attain much greater proportions. A very singular provision of nature is found in the arrangement of the ventral fins. It might indeed at first sight be thought that they were entirely absent, from the way in which they are modified. Couch says: "The pectoral fins are continued to the ventrals, the latter encircling a disc which is organised in such a manner as to enable these fishes to adhere firmly to a solid substance." This sucking-organ will therefore be seen to be of much use to this inert and awkward fish when close to shore in stormy weather. As an instance of the power of its sucker, one writer mentions that "on placing a fish of this species just caught into a pail of water, it fixed itself so firmly to the bottom that on taking it by the tail the whole pail by that means was lifted, though it held some gallons, and that without removing the fish from its hold." The food of the lump-fish is partly animal and partly vegetable. Small crustaceans have been found in their stomach, and from the physiological nature of their internal organs it is evident that a portion of their nutriment is also derived from marine algæ.

During a visit to Fife last June, I was surprised to find the remains of this fish scattered in considerable quantities along the shore. At first I was at a loss to account for the singular abundance of the dead forms of the lump-fish, until I questioned one of the local fishermen. He said they were a source of great annoyance and trouble to the men who had charge of the salmon stake-nets. The numbers caught during the early summer were great, and of course were destroyed. One writer mentions that in the northern seas the lump-fish is much preyed on by seals and large fish, which swallow all but the skins, quantities of which are found floating about. This fact is also chronicled by a naturalist who observed skins of the lump-fish floating off the west coast of Scotland. The stake-nets may, however, be considered to be undoubtedly the cause of the numbers found along the Fife shore.

The majority of fish deposit their ova and then leave it to take its chance of development, without any further solicitude

for its welfare: not so with the lump-fish. I was fortunate in observing a beautiful exemplification of this trait in a small but deep pool in the rocks near Elie. This pool was close to low-water mark, and would be only a couple of hours or so out of the twenty-four uncovered by the sea. The water in this depression of the rock was beautifully clear, and on peering into it I was rewarded by the variety of marine life brought under my eyes. There were many lovely forms of algæ, and the bottom of the pool was alive with myriads of shell-fish slowly moving to and fro. In this natural aquarium my attention was directed to a lump-fish, that appeared as if it were under some hypnotic influence. My approach did not awaken, so far as I could judge, any fear; and even the gentle contact of a walking-stick to the side of its body did not induce the fish to change its position. My curiosity was accordingly further quickened, and after a minute examination of the pool I discovered the cause in a slight depression on the side of the rock, near the surface of the water. This was filled by a tough gelatinous substance, which I found to be the ova of the lump-fish. It was evidently being carefully guarded, as when I dipped my hand into the water and approached the ova, the fish at once rose. Doubting its good intentions, I gently introduced into its open mouth the end of my walking-stick, thereby preventing a practical demonstration of its power to protect its ova. I was fortunate by this means in bringing away a small portion of its charge, which I now exhibit. The ova, as I have said, was placed in a slight depression of the rock near the surface of the water, and out of reach of crabs and such ground cannibals.

Couch states that after the deposition of the ova it swells, and that a cavity, which has been termed a nest, is then formed for the reception of this treasure. It is not improbable that the sucking-organ is of some service in this important operation. Being anxious to observe the development of the ova, as well as to watch the parental solicitude evinced by this lump-fish, I visited the pool after the lapse of two days, and found the fish and its belongings just as before. Three days passed, and again I went to the pool, but only to find that the lump-fish and its charge had disappeared. The ova had evidently attained maturity, and then vanished with its guardian,

as a great multitude, into the world of waters. The lump-fish, according to Yarrell, makes a very speedy escape from the egg; and that authority further states that the young after birth fix themselves to the sides and back of their male parent, who launches forth, thus loaded, into deeper and safer retreats.

IV.—*PLANT MULTIPLICATION.*

BY MR MARK KING.

(*Read Jan. 28, 1891.*)

THERE are two ways in which plants may be multiplied or propagated—(1) the artificial and (2) the natural method. In the first, a portion of the mother-plant containing a leaf-bud is placed under conditions suitable to make it develop into an individual in every respect resembling the parent plant. These detached parts have various names, such as cutting, graft, bud, or layer; while a modification of grafting is known as inarching. A cutting, when properly selected, and placed under such favourable circumstances, emits roots; in this way a plant may be multiplied to any extent corresponding to the number of parts suitable for division. The art of grafting is of great antiquity, but by whom it was invented is not known. It is mentioned by Pliny, Virgil, and other ancient authors. The Chinese are adepts at this contrivance: its introduction among them is ascribed to Roman Catholic missionaries. In our own country the monks for ages were the only gardeners, and among the many departments of the gardener's skill, grafting in its various modes was successfully practised by them. I now exhibit several examples of these methods of plant multiplication, for which I am indebted to Mr James Grieve, of Messrs Dicksons & Co. In budding, the manner of performing the operation varies, but the mode generally chosen is by making a T-shaped slit in the bark and inserting the bud underneath. The operation can only be performed successfully when the sap is in full

circulation. Moist warm weather greatly facilitates the union of the bud with the stock. Layering consists in a branch or shoot being bent into the soil and held in position by pegs: there are several ways of performing the operation, the principal being by twisting, by tonguing, by strangulation, by ringing, and by circumposition. Inarching, sometimes called grafting by approach, is also accomplished in various ways, but in every case both parts are nourished by their own roots, and thus co-operate in forming a union. Root division is another method of plant multiplication. I believe the greater number of the plants of ipecacuanha now growing in certain parts of India were originally propagated in this manner by Mr Robert Lindsay, curator of the Royal Botanic Garden, Edinburgh. The weeping willow (*Salix babylonica*) is distributed over a large area, both in the British Isles and in North America, by its shoots or buds. Only the female plant has yet been recognised. It is supposed that all the individuals of this willow have originated from a single parent tree. Some plants extend themselves by their own inherent tendency to multiplication. I would refer in this connection to that singular plant, *Anacharis alsinastrum*, which was originally discovered in this country by the late Dr George Johnston, of Berwick-on-Tweed, in the lake of Duns Castle in 1842. It was again found by a lady botanist in 1849 in a canal in Leicestershire. Later, it was noticed in other localities, till now there is scarcely a stream or lake in the country which is not infested with it. The plant is too well known to need description. The male flowers were first noticed by the late Mr Douglas in a pond on the Braid Hills, in 1880, and were described by him in 'Science Gossip' for that year; while Mr Tait Kinnear recorded their continued flowering in the same locality in a note which will be found in the first volume of this Society's 'Transactions.'¹ Aquatic birds are frequently the involuntary agents in the dissemination of water-plants, by carrying detached parts of the plants from one part of the country to another attached to their plumage or feet. The universality of the duckweed (*Lemna minor*), the smallest flowering-plant known, may be thus accounted for. Wherever there is standing water, this

¹ See 'Trans. Edin. Nat. Field Club,' vol. i. p. 81.

tiny representative of the vegetable kingdom will be found: in this case, however, the entire plant is carried away.

I now take up the second part of my communication—viz., the natural multiplication of plants, or their propagation by sexual reproduction. The seed is, in fact, a living plant in suspended vitality, until fitting circumstances occur to call it into active life. The examination of seed-vessels and their included seeds will show the great differences presented by them in size and form—such as large, medium, and small; some with hooks, and others with gland-tipped hairs; many smooth, and some viscid or glutinous. Now there is a reason for all these peculiarities. Many seeds require protection, for instance, from birds or insects; hence the shell or pericarp of the walnut and filbert are composed of a firm hard substance. The burdock (*Arctium majus*) has a wonderful mechanism for the dispersion of its seeds. The scales of the involucre all end in minute firm hooks, which seize hold of everything that passes by. Goose-grass (*Galium aparine*) has weak stems several feet long, adhering by their hooked prickles to every object in their way. The seed of the beech (*Fagus sylvatica*) is enclosed in a spiny four-lobed capsule. In many of our wild roses the fruit and stalk are furnished with glandular hairs. Various plants of humble growth have the calyx closed over the seed-vessel when the flower fades, and open when the seeds are ripe. In the coltsfoot (*Tussilago farfara*) the stalk is upright when the flowers have just expanded, is close to the ground after the flowers have faded, and rises again when the seeds are ripe. In the poppy the calyx falls off immediately on the expansion of the petals. To compensate for this, the capsule is furnished with a star-shaped lid projecting over the seed-vessel, with a series of apertures at regular intervals somewhat like a pepper-box—with holes not on the top, however, where rain might get in, but under the rim, to keep the contained seeds dry, when every breeze that blows scatters them about. The stalk of the screw moss (*Funaria hygrometrica*) has the remarkable property of twisting like a wire-spring in dry weather, and again unwinding when moistened by dew or rain—evidently for the dispersion of the spores. In the genus *Cyclamen*, the flower-stalk curls itself up into a spiral after the flower has faded,

burying the capsule in the ground. The broom (*Sarothamnus scoparius*) and whin (*Ulex europæus*) have their seeds projected from the parent by the sudden bursting and spring-like twisting of the valves of the pod. The squirting cucumber becomes distended with mucus, and when ripe expels the seeds through the aperture where the stalk was inserted with amazing force. In some species of balsam the capsule bursts elastically, and throws the seeds from three to four feet. The common wood-sorrel (*Oxalis acetosella*) scatters its seeds in a similar way.

All our native geraniums have their seed-vessels pointed and clothed with short hairs: if the capsule falls to the ground in dry weather it remains still, but as soon as it gets wet the seed-vessel commences to move, and, raising the capsule into an upright position with its point downwards, forces the seed into the ground. Sometimes the whole plant is blown about—like the celebrated Rose of Jericho, tossed about by the wind in the desert—till it is deposited in a damp place, when the pods open and allow the seed to escape. The seeds of a South African plant are said even to destroy lions. In rolling about the sandy plain, seed-vessels of this plant often become attached to the lion's skin, causing great pain, when the animal tries to tear them off. In this way the prickly seed-vessels often get into the lion's mouth, causing a wound which may prove fatal. In this connection a common British grass, the wall-barley (*Hordeum murinum*), the spikelets of which are rough, and readily adhere to the passing traveller or animal, is transported from one part of the country to another miles apart. In the Compositæ there are three species of groundsels which have a curious distribution in our country. *Senecio vulgaris* is everywhere found; *S. sylvaticus* is abundant in many situations; while *S. viscosus* has a more limited diffusion—a fact which is both interesting and peculiar, when we take into consideration that this species is provided with the crest on the seed similar to its congeners. Once more, the crocus exhibits efficient means of perfecting its seed at the proper season. This plant has the ovary underground, with a long slender style. As growth proceeds, and the soil stores up warmth, the ovary with its contained seeds arises from its subterranean concealment and ripens the seeds. The cocoa-

nut has been found on the shores of the west coast of Scotland, transported by ocean currents from the tropics. The fruit of the mahogany tree has been known to perform long voyages without injury to its vitality. The capsule of the sycamore, on becoming detached from the parent tree, falls to the earth with a series of revolving motions similar to the propeller of a steamer, fixing the seed-vessel, with its contained seeds, in the earth. In *Trifolium subterraneum*, the pods burrow in the earth when ripening their seeds, and in that manner make sure of a succession of individuals of their own kind. A peculiar phenomenon of plant multiplication is "mimicry." In some of the pod-bearing tribes the seed-vessels look so exactly like caterpillars that birds are induced to peck at them, and thereby scatter their seeds. A few species of flowering-plants are viviparous—the seeds sprouting within the ovarian cavity, and falling to the ground in every respect the same as the parent. This wonderful provision is obviously both for the propagation and spread of the species, as it is only in alpine and exposed situations that this propensity is developed. Lastly, in several instances plants produce numerous seeds, yet never open their flowers. *Lamium amplexicaule* and *Viola canina* are familiar examples.

It will be seen, from the few scattered examples which I have given—first, that the natural contrivances for the propagation and dispersion of plants are nearly as numerous as the plants themselves; and, second, that we everywhere find certain laws in operation which indicate special adaptations of means to end.

V.—*THE "GREEN BALLS" OF LOCH KILDONAN.*

By MR T. B. SPRAGUE, M.A., F.R.S.E.

(Feb. 25, 1891.)

MR T. B. SPRAGUE brought under the notice of the members of the Society several specimens of "green balls" gathered from the bottom of Lower Kildonan Loch, in South Uist.

Extracts were also read from letters which had passed between Mrs Sprague, the Rev. Dr Stewart, Ballachulish, Professor Spence Moore, and others, regarding these balls; and a *résumé* was given of a paper in the 'Proceedings of the Royal Society of Edinburgh' for Session 1885-86, by G. W. W. Barclay, Esq., F.R.S.E., in which the algoid nature of these lake-balls was shown. Professor Moore identified those sent to him from Loch Kildonan as *Cladophora Ægagropila*, Kütz., figured and described by Cooke, Hassel, and Dillwyn in their respective works on British fresh-water algæ. The balls were described as "lying in a depth of two to three feet, and covering areas of many square yards, showing conspicuously by their dark colour against the light sandy bottom. They lie alongside of one another in great numbers, and vary in size from about a quarter of an inch to three or four inches in diameter. In some cases a complete small ball is found inside a large one," as in the specimens exhibited. It is supposed that these balls are formed by the long filamentous alga of which they are composed being rolled by wind-currents along the bottom of the shallow water in which they are found. So far as yet known, they are not present in any Scottish loch except that of Lower Kildonan; but, according to Professor Fischer of Berne, they are met with in several European lakes, chiefly in Sweden, Norway, Northern Germany, Austria, and Upper Italy. Professor Fischer states that he also possesses an English specimen, from Ellesmere, in Shropshire.¹ The interior of the balls, when examined under the microscope, is sometimes found to be filled with diatomaceæ. Dr Stewart has sent three specimens to the Inverness Museum, with instructions that they should be labelled thus: "*Cladophora Ægagropila*, from Loch Kildonan, South Uist, 1890. Presented by Nether-Lochaber."

¹ These "green balls" are also found in several of the other Shropshire meres. The following passage refers to Colemere, in the same district as Ellesmere, where some specimens seem to be very large: "They saw that the bottom"—about three feet in depth—"was covered with balls of various sizes, from that of a nut to some eighteen inches in diameter. . . . It is supposed that there are eddies and currents at the bottom of the mere that roll up the sunken moss and leaves into these balls, and sweep them all to the side of the mere."—'Rambles and Adventures of our School Field-Club,' by G. Christopher Davies, p. 81 (second edition, 1881: C. Kegan Paul & Co.)—ED.

VI.—NATURAL HISTORY NOTES.

BY MR ROBERT STEWART, S.S.C.

(Read Feb. 25, 1891.)

AT this season of the year, when blackbirds, mavis, and starlings visit our back-greens, and pick up the early worm; when robins disappear from our ken, and when the ubiquitous sparrow keeps up an incessant medley in the solitary evergreen—we naturally look back with longing to the time when business cares were an unknown quantity, and when we were so situated that we could transport ourselves at pleasure to the open country, and there experience all the delights of a nest-hunting expedition. Though this pleasure is now impossible to most of us, still it is quite practicable to revisit in spirit the scenes of our former exploits, and for a few minutes, therefore, let us try the experiment.

Leaving the town, we get without difficulty to a real old-fashioned country road, flanked on either side by a thorn hedge. We climb over a gate into one of the adjacent fields, with the view of searching the hedge from the field side, being aware that the well-known ingenuity of the nest-builders will have been principally concerned in protecting their habitations from the gaze of those passing along the highway. We have hardly gone a few steps before a nest is observed, and without much trouble it is reached, and found to contain four small blue eggs, while the owner thereof, a hedge-sparrow, hops fussily among the twigs almost within our reach. Proceeding a little farther, we come to a dry ditch, out of which a bird gets up unexpectedly, and it is only after a search, which we had almost given up as hopeless, that the nest of the yellow-hammer is found, cunningly hid amongst the long grass at the side, and containing two eggs, with their peculiar pencil-like markings. The "deil's bird" is in no favour with country people, and consequently many nests are wantonly destroyed, but in this instance we leave the nest undisturbed, to the great relief of the owner, who flits anxiously around. There are several old and decayed trees growing by the side of the road

which next claim our attention, in a hole in one of which we find the nest of the redstart with its beautiful eggs, in colour resembling the hedge-sparrow's, but smaller and finer in every way; and as this is a rare find, our collection is enhanced by the addition of a specimen. While engaged examining the redstart's nest, we observe a bird like a blackbird coming out of the fork of a large ash-tree a short distance ahead, and on examination we find a nest with three light-coloured blue eggs, but the entrance to the nest is so narrow that to examine its contents will necessitate another visit, when, provided with a spoon tied to the end of a stick, we may become the proud possessor of our first starling's egg. Though these birds are now so common everywhere, we well remember the time when—in some districts, at all events—the finding of a starling's nest was something to be proud of.

The recent gale has blown down one of the large trees at the side of the plantation which we have just reached, and a search among the hanging roots discloses a small hole which proves to be the entrance to the dome-shaped nest of the common wren. We have room only to insert a finger, and at first it appears there are no eggs in the nest; but this afterwards proves to be a mistake, for what we took for the feather lining of the nest turns out to have been the owner herself, who quickly makes her exit the moment the finger is withdrawn. We then find that in the nest there are seven or eight tiny eggs of a whitish colour, plentifully speckled all over with small red spots. Almost within reach from where we stand, snugly ensconced near the end, and beneath the spreading branch of a spruce fir-tree, we find one of the most beautiful nests possible—namely, that of the golden-crested wren—containing several of the smallest of all British birds' eggs. One has a difficulty in even handling these tiny curiosities; and when it comes to be a question of preparing a specimen for our collection, the very greatest care is required. Every bush and tree here seems to be vocal, each songster appearing to claim a preference for its own lay, while the smell of the fir-trees makes the mere fact of living a real pleasure. We now come to a road leading down to large farm-offices, and as there is a fine beech-hedge on either side thereof, a search there well repays our trouble. Every

few steps we come upon a nest of one kind or another, but principally green-finches, who appear to have a liking for this kind of hedge. What we see now, however, is something very different. We have come to the hedge round the fruit-garden, and here we find the nest of the bullfinch, beautifully built of tiny twigs interlaced with one another and the surrounding supports. The hen is sitting on the nest, so we shall not disturb her, but we have leisure to admire her glossy black head and bright intelligent eye; while the male bird, sitting on an adjacent apple-tree, looks as though he was quite aware of the fact that he is perhaps the handsomest of British birds. At the same time, it must be confessed that a good deal can be said for the view held by his neighbour the cock chaffinch, namely that, whatever may be thought by others, *he* knows a bird every bit as good-looking as Mr Bullfinch. While watching the two male birds we observe the nest of the chaffinch, quite exposed to the view of any one passing underneath the branch on which it is placed, but the little builders have been so cunning in the selection of the materials employed by them that one might look and look again without the nest catching the eye.

Why hen birds should, as a rule, be so modest in their apparel, in comparison with their male companions, is perhaps difficult to account for; and they also fall far short of their lords and masters in the way of accomplishments. The fact, however, which is undoubted and easy of proof, might be applied with some force in connection with the much-debated question of woman's proper sphere. But we have no wish to touch such debatable ground. Rather let us follow the mill-lade which we here cross, and see if we cannot come upon something new in the way of nests. A quantity of brushwood lies in the yard to our right, and it may be worth our while to try here for the nest of the blackbird—though in all probability we will find that we are too late in the season. A few minutes' search discloses a nest of young blackbirds, but ere we are aware they scatter here and there, and are lost to sight. Getting back on to the road, and following the mill-lade, we see some dry grass protruding from among the ivy on the wall, and quickly ascertain that we have come upon the nest of the yellow wagtail, who puts in an animated appearance, bobbing

up and down, and protesting against any interference with its dwelling. The nest is composed of straw, and nicely lined with hair. It contains only one egg, which we leave untouched, though the desire is great to add it to our collection. As we pass the sluice at the mill, we carelessly pitch a stone into the burn, and are astonished that this results in the appearance of a dipper, who flits a certain way down the stream, and then perches on a stone in the middle. We cannot find any nest in the bank on either side, though certain hollows between the piles suggest that the bird might have been prospecting. We take the liberty, however, of interfering with the miller's arrangements for a couple of minutes, by putting down the sluice, and so shutting off the water, when, strange to say, a search discloses the dipper's nest behind what was a minute ago a heavy fall of water, through which the birds would have to pass and repass every time they visited the nest. The inside of the nest is dry and warm, though a portion of the covered roof is quite wet, but the dome was so made that no damp could find its way into the interior. The eggs are about the size of a blackbird's egg, and quite white.

Taking now a short cut through some waste land, we nearly put our foot upon the nest of the skylark, neatly placed in a small tuft of grass, and containing three dark-marked eggs. Farther on we come upon the nest of the peewit, if the hollow where the four eggs are placed can be so called. The eggs taper very much, and are placed with the large end towards the outside of the nest. They thus occupy very little space, and harmonise so beautifully with the surroundings that the nest is difficult of detection. Notwithstanding the stimulus given by the cry of the lapwing,—“Peewit, peewit, harry my nest and awa' wi't,”—we leave the contents undisturbed, not having then acquired a taste for plovers' eggs. In some marshy ground we come upon a snipe's nest, and find also on a fallen tree, the top of which rests upon a small pool of water, the nest of the water-hen, built of rushes, and filled with its reddish-coloured eggs. While further exploring the long grass and rushes, we almost tread upon a duck, which appears to have a wing broken, and to which, in consequence, we turn our attention. A stern chase is proverbially a long one, and this is no exception to

the rule. The first rush finds us dripping wet from head to foot, and the result is *nil*, unless we can call the possession of a tail-feather anything. Our blood is now up, however, and for the next five minutes it is hot work. Twenty times we thought we had that duck, and as often we were disappointed, until, thoroughly worn out, we ceased operations for a while. Imagine our feelings, then, when the bird, finding itself unmolested, and its purpose now served, takes to itself wings and flies away—not, however, before disclosing its true character in its parting “quack, quack,” in which description we cordially agree.

It is a curious fact that when one finds himself in a ridiculous position at any time, he may rely on the presence of a spectator. Such was the case here; and the “orra loon,” whose present duty appears to be the herding of some cattle as rough-looking as himself, proceeds, before we can recover our breath, to read us a lecture on natural history, with special reference to the habits of the wild-duck when a stranger approaches too near its nest. The wound is still too fresh to bear touching, however; so we adroitly turn our friend’s attention to the fact that the adjacent heap of stones is occupied by a weasel or weasels, who appear and reappear with startling suddenness. This immediately leads to a discussion on “whuttrets,” and we learn that in the previous autumn, when harvest operations were in full swing and all hands at work, he and some of the others employed were alarmed by the loud cries of a child of one of the women engaged in harvesting operations, which had been placed by his mother on a shawl, and laid on the bank at the side of the field. A rush was made for the child, who continued to cry loudly, all the time holding his hands in a frightened manner before his face. The cause of the child’s fright was soon apparent; for on the boy’s bare knee, and looking as though it might at any time spring at his throat, sat a weasel, and so angry was the animal at being disturbed, that it appeared as though it meant to dispute the right of the new-comers to interfere. A short chase at last ended in the death of the weasel; and the curious sequel was, that when presented to the child, the boy took the dead animal in his hand without hesitation, never apparently realising that it was the same beast which had so terrified him

only a few minutes before. The distracted mother, therefore, on hurrying to the spot, found the boy with the dead weasel in his lap, and he fondling and caressing it.

Having done justice to our friend's descriptive powers, we next learn the interesting fact that " 'whuttrets' are no *a'* bad." This is deduced from the fact that one summer he came upon a weasel carrying a young one in her mouth. He is exceedingly hazy as to how the young one got killed, and does not appear to care to go into particulars, so that we take it he is not proud of his own share in the transaction. The young one, however, *was* killed somehow, and, when taken in the hand, felt, as our friend expresses it, "for a' the world like a butter-ba'." The weasel, which had stuck to her young one as long as possible, had ultimately to take refuge in a hole, from which she presently emerged, and fearlessly ran up to within a few feet of the narrator, who, not exactly relishing the aspect of things, threw the dead young one to the mother. She at once took it tenderly in her mouth, and proceeded to carry it away. It was now very evident that she had much greater difficulty in managing the dead body than when the little creature was in life, and our friend's courage having once more returned, she had soon to drop it again, as a mere act of self-preservation, and take refuge in an old stone-dyke. But she immediately reappeared, and followed the boy again, when he, not liking the look of the "whuttret," finally gave up the dead. "So you see," he concludes, " 'whuttrets' are no *a'* bad."

As our friend at this stage exhibits a tendency to return once more to his interrupted lecture on the habits of the wild duck, we think it best to bid him a hurried farewell, and retrace our steps to the town. The young naturalist calls after us to look in at the keeper's cottage in passing, and examine a funny rabbit's head he has there. This we do, and find that, owing to a malformation of two of the front teeth in the upper jaw, which appear to have grown backwards into the animal's mouth, the two corresponding front teeth in the lower jaw have grown straight out, giving the animal the appearance of possessing tusks. It then occurs to us that if the upper teeth grew at the same rate backwards as the lower ones outwards, the death of the animal in a short time would result. We examine the head more carefully, and find that

the upper teeth, from some cause or another, after having grown so far into the mouth, turned outwards again, and then backwards, until at last they formed a complete circle. We arrange with the keeper for the head, and take it with us for exhibition to the members of the Edinburgh Field Naturalists' and Microscopical Society; and now produce it to convince them that there is a substratum of fact in our short imaginative expedition into the country.

VII.—*THE STRUCTURE AND LIFE-HISTORY OF A SPONGE.*

BY MR JOHN LINDSAY.

(Read Feb. 25, 1891.)

THE various species of sponges throughout the globe that have been classified and described up to the present time are very numerous. The Challenger Expedition alone has added a large number hitherto unknown to science, and many more, no doubt, will yet be discovered. Even the number of British marine and fresh-water forms now known is considerable. As evidencing the advance which has been made in our knowledge of this single group of animals during the last half century, it may be mentioned that while Dr George Johnston, in his 'History of British Sponges and Lithophytes,' only enumerates some sixty species, the fourth or supplementary volume of Bowerbank's 'Monograph of the British Spongiadae,' published by the Ray Society in 1882,—after the author's lamented death,—under the editorship of the Rev. A. M. Norman, contains a list of no fewer than 284 species. While such advances have been made at home during that period, there have been corresponding additions to the number of foreign species. Amongst so many forms,—ranging from our native burrowing-sponge (*Cliona celata*), a mere dot of a creature, which bores its way into oyster and other shells, to the large tropical species known as Neptune's drinking-cup

(*Poterion Neptuni*), measuring from three to four feet across,—there is a corresponding variety of habit, structure, and appearance. Sponges are usually not very interesting objects to an unscientific observer, with their pale-green or Isabel-white hues; yet some possess beautiful tints in the living state, as in the genus *Halisarca*, where we find such colours as blue, carmine, purple, and rosy red. Again, as regards their mode of growth, some spread over the surface in lichen-like patches; others grow in large amorphous masses; while the characteristic forms of northern latitudes throw out branches or large finger-like processes, as in the well-known “Mermaid’s glove” (*Chalinula oculata*) of the Shetlanders. But there is withal a certain similarity in their outstanding features, sufficient to enable even the non-scientific observer to say with confidence, “*That is a sponge!*” What is now attempted is to give an outline of the typical structure and life-history of these lowly and familiar objects, referring to the accompanying microscopic preparations in illustration of most of the statements made. Such an outline may, it is hoped, at once give a fair idea of the subject, and prove interesting to members of the Society who have not yet paid much attention to this branch of natural history.

A glance may first be taken at the place which sponges occupy in the wide realm of nature. From the apparent simplicity of their structure, and the fact that they are always found, in the living condition, attached or rooted to some foreign object, it was for long a moot-point whether sponges were to be regarded as plants or animals; and they were frequently hustled backwards and forwards across the border-line which is generally believed to divide these two great groups. Not only have different authorities held conflicting opinions regarding them, but the same naturalists, at different periods, have inclined now to one side, now to the other. Thus Linnæus, in the earlier editions of his ‘*Systema Naturæ*,’ classed them amongst the cryptogamic algæ, but in the twelfth edition of that work, published in 1767, he ranked them with the zoophytes. Though Aristotle, 2000 years ago, placed them in the animal kingdom, it is plain he too regarded sponges and some other bizarre forms as partaking also of the nature of plants—for which nondescripts, indeed, the convenient

term of zoophytes, or "animal-plants," was invented. Following on the careful scientific methods of modern times, sponges have now been conclusively relegated to the animal kingdom, though a few obscure forms of life among the Infusoria, to some of which sponges are closely allied in their minute structure, remain as yet very much of a puzzle to zoologists. Still, modern scientific research has supplied us with indubitable evidence of the true nature and affinities of this large family of the sponges. The elements of the sarcode or sponge-flesh, for example, with which the fibrous or mineral skeleton is invested and filled up during life, and which are also the active agents in building up these horny and solid parts, are found to be identical morphologically with the fresh-water amœba, or the gelatinous contents of the Polycistina, the Foraminifera, and allied forms. The further fact, that for the first time in the animal kingdom true differentiated tissues are here met with, has removed the sponges from the simple unicellular Protozoa to the higher Metazoa or multicellular animals. But here a new difficulty has arisen, for some are still inclined to include sponges among the Cœlenterata, or "Zoophyte" group, in the modern scientific meaning of that term. Most naturalists, however, have agreed to place them, provisionally, in a separate class, between the Protozoa and the Cœlenterata, and at the bottom of the Metazoan sub-kingdom, under the class-name of Porifera or pore-bearers.

Having thus glanced at the true affinities of the sponges, and the position which they occupy in the scheme of nature, we may now go on to consider briefly their structure. Workers with the microscope among "pond-life" are familiar with a curious tiny creature, commonly present in stagnant water, which seems to be little more than a speck of animated jelly. The various shapes which this creature assumes as it glides over the field of the microscope are very amusing, here throwing out a foot or a hand and there elaborating a mouth from any part of its surface indifferently. This Amœba, or Proteus Animalcule, as it is termed, is structurally identical, as already said, with the fundamental tissue or vital element of the sponges, by whose aid the whole superstructure is built up. It is remarkable, indeed, that in nature beautiful structures are so often reared by apparently insignificant causes, as exemplified in the Diatomaceæ, where the contained

protoplasmic dot executes the delicate fairy-like sculpturing of the frustules; or in the Polycistina and the Foraminifera, where the amœboid gelatinous speck just referred to elaborates the varied forms of beauty to be found among the "shells" or coverings of these minute organisms. *How* it is done will, no doubt, for ever remain one of the mysteries of life. The protoplasmic mass which forms the basis of sponge structure is morphologically a collection of these amœboid cells set in a living matrix, each cell possessing its nucleus and granular contents. The whole mesoderm or middle layer of a sponge is made up of this gelatinous mass, the imbedded cells varying in appearance and performing different offices. Thus, while some are stationary, and combine to subserve the functions of muscular fibres or connective tissue, being connected by their pseudopodia, there are others which "wander in the tissue, and frequently contain large granules, looking like fat or starch, serving no doubt as food reserves." Any one who has collected our commoner sponges must have observed their slimy appearance while growing, and the quantity of this gelatinous substance which sometimes pours from them when they are gathered. The constituent cells of this viscid fluid, when seen under the microscope, behave in exactly the same way as the fresh-water amœba, throwing out their pseudopodia in all directions. Besides these amœboid cells of the mesoderm, there are found on examination the flattened polygonal pavement-cells of the ectoderm or outer layer, which cells, besides, line the inhalant canals, to be presently noticed; and also the cells of the endoderm or inner layer, which line the exhalant canals, and, with one exception, are of the same structure as the epithelial cells of the ectoderm.

The sponges of commerce have made every one familiar with the ramifying and interlacing horny fibres which constitute the framework of a sponge, and the numerous canals and passages thus formed. But by far the greater number of sponges have other skeletal features, in the shape of mineral particles, which are imbedded in the sponge-flesh and in the horny fibres in varying numbers,—sometimes almost superseding the fibrous framework, as in the case of the common British forms, *Halichondria*, *Grantia*, and *Tethya*. Some sponges, again, have their framework *wholly* composed of

silicious particles or spicules; while in another type, *calcareous* spicules make up the entire skeleton. Professor Grant was the first to point out this fact, that while the spicules in some sponges were silicious, in others they were composed of carbonate of lime. We are thus furnished with a natural and convenient grouping of the sponges into four well-marked divisions—viz.: 1st, where the sponge-skeleton is composed of horny fibres, and where spicules are entirely absent, as in the economic sponges; 2d, where the skeleton is composed extensively of silicious or flinty elements, but where the horny fibres are still present; 3d, where no horny framework is found, and the skeleton is made up wholly of *silicious* particles; and, 4th, where the horny framework is still absent, but the skeleton is wholly composed of *calcareous* spicules. The various shapes of these spicules have also been made use of in classifying the sponges. They are generally very minute, though varying as much in size as they do in shape, reaching their largest dimensions in the now well-known hexactinellid sponge, *Euplectella aspergillum*, where the spicules, at first free, become ultimately cemented together or vitrified, and form the lovely interlacing network popularly known as “Venus’s Flower-basket.”

As spicules are favourite objects with many microscopists, a short description of them may be interesting. They are amongst the earliest developed organs of the sponge, and are “composed of an organic basis (spiculin), densely impregnated or chemically combined with a mineral salt—carbonate of lime in the case of calcareous spicules, silica in that of silicious spicules.” Over two hundred forms are figured by Dr Bowerbank in his ‘*Monograph of the British Spongiadæ*,’ grouped under a natural classification—viz., spicules of the skeleton, of the membranes, and of the ovaries and gemmules. To enumerate the diverse shapes of sponge-spicules would be a difficult task. While many are needle-shaped or rod-like, others are variously radiate, hooked, anchorate, globular, branched, and so on in numberless modifications. Those present in the mesoderm are smaller, and show a greater complexity of shape, than those which aid either in forming or in strengthening the framework. The vast number of spicules found in some sponges, as already mentioned, is astonish-

ing. A good example is furnished by the well-known British sponge, *Grantia compressa*, found on so many parts of our coast, and named by Professor Fleming in honour of Professor Robert Grant. The spicules in this sponge are calcareous, and are of two forms, clavate and tri-radiate, the latter predominating. The whole of the sponge-body is crowded with these spicules, as may be seen in the section shown under the microscope. Another example is the "crumb-of-bread sponge" (*Halichondria* or *Amorphina panicea*), common in the rock-pools of both shores of the Firth of Forth, and many other parts of the British coast. The needle-shaped silicious spicules of this sponge are also so numerous as to form nearly its entire mass.¹ But it is not only amongst the sponges that these spicular elements are found, for they are present as well among the related forms of the Cœlenterata and Echinodermata, as in *Gorgonia*, *Plexaura*, *Alcyonia*, and *Synapta*. The calcareous spicules or sclerites imbedded in the soft parts of these animals also assume beautiful and varied forms, and are often of brilliant colouring, forming lovely objects when seen under the microscope. The bihamate or double-hooked shape of spicule is found in several sponges, and reappears again in the tube-feet of the echini, as mentioned last session in my paper on the Sea-urchins.² Thus, as has been well remarked, "we find in the spicula only, a series of links in the chain of animal development, immediately connecting the Spongiadae with the higher tribes of animals."

The water-system of the sponges, which may now be noticed, forms a very interesting study. Professor Grant, in 1825, was the first to witness the beautiful phenomenon of

¹ *Vide* Note on "Sea-fyke," at the end of this paper, p. 437. The late P. H. Gosse, in one of his extremely interesting popular works on natural history, describes the spicules in the living sponge in such a simple yet apposite manner, that I am tempted to quote the passage here. He says: "If you have ever shaken up a box of dressing-pins, and have then endeavoured to take one out, you know how by their mere interlacement they adhere together in a mass, so that by taking hold of one you may lift a bristling group of scores. Somewhat on the same principle are the calcareous and silicious pins (*spicula*) of a sponge held together by mutual interlacement. Yet their cohesion is aided by the tenacity of the living sarcode which invests them; for I have found that specimens of *Grantia*, . . . when long macerated in water, so that the sarcode is dissolved, have very slight power of cohesion among their spicula."—'Evenings at the Microscope,' by Philip Henry Gosse, F.R.S., pp. 385, 386 (ed. 1884: S.P.C.K.)

² "On the Echinoidea or Sea-urchins," *ante*, p. 351.

the incurrent and excurrent streams of water in a sponge, and his account of what he then observed has been often quoted. The apertures on the surface of a bath sponge, for example, may be readily seen not to be all of the same size, the smaller being the pores opening into the inhalant canals, and the larger the "oscula," or mouths, carrying off the water after it has penetrated the sponge mass, and had extracted from it what was necessary to build up the living structure and repair waste. The oscula are often raised above the general surface of the sponge, as if to prevent any of the expelled water, with its waste products, finding its way back through the pores. The mechanism by which this constant circulation is kept up in the interior of a sponge was for long a mystery, but has now, thanks to the aid of the microscope, been clearly established. Professor Grant, indeed, had, by a kind of "happy guessing," arrived at some knowledge of the true solution, when he said that he considered it "very probable that the pores and canals are lined with minute vibratile cilia"; but though he made diligent search for these, with the help of the best objectives then obtainable, he never was able to detect the presence of such cilia, though still of the belief that they were present. Dr Johnston, however, entirely missed the explanation of this wonderful phenomenon, ascribing it to Dutrochet's law of osmosis, then promulgated for the first time. In accordance with this law, Dr Johnston argued that, "from the unequal densities of the mucilaginous secretion of the sponge and the circumfluent water, there must be unceasingly going on an oozing out of the one and an entrance inwards of the other." One cannot help feeling sorry, somehow, that these two enthusiastic early workers among the sponges never witnessed the exceedingly interesting sight of the monad-like cells clustered in the flagellated chambers of a sponge, by whose movements this unceasing ebb and flow is carried on. When speaking of the endoderm, it was remarked that it exhibited the same structure of polygonal epithelial cells as the ectoderm, with one exception. The exception consists of these cells of the inner tissue, known as the "flagellated chambers." The exhalant canals where they begin to widen out are lined with these flagellated cells, seated on the fundamental tissue in

cup-like cavities, and with their circle of flagella all pointing inwards, and driving forwards the currents of water till they are finally discharged by the oscula. The "crumb-of-bread sponge," already referred to, shows these flagellated chambers particularly well when a small piece of the sponge is taken from its native rock-pool and immediately plunged in osmic acid in order to be hardened, and then sectioned. This sponge also shows the incurrent and excurrent streams of water very clearly, even in the rock-pool by careful observation, or under the microscope in a zoophyte-trough or watch-glass among a little sea-water. The flagellated cells have a striking structural resemblance to certain monads known as the collared flagellate infusoria, as was first pointed out by Professor James Clark in 1866. So close is the resemblance that, according to Professor Sollas of Dublin University, they in all probability "feed in the same way, and we may consequently describe the feeding of the sponge-cell after that of the infusorian. The flagellum of each sponge-cell creates currents in the water towards itself, and the floating particles borne along with these come in contact with, and adhere to, a delicate film which surrounds the long neck of the cell like a collar; the protoplasm of the collar is in a state of active circulation, streaming up one side and down the other like an endless band; the adherent food-particles are thus carried by it to its base, where they come in contact with the neck, sink into its substance, and find their way into the basal part of the cell."¹ Here, according to Professor Sollas, digestion is carried on, and the waste residue is ultimately eliminated by the outflowing currents. An interesting discovery has recently been made, in connection with the flagellate cells, in the presence of a fenestrated or porous membrane uniting the rims or collars in a circle, and serving, it is believed, as a filter or trap to catch food-particles. The membrane in question has been named "Sollas's membrane," after its discoverer.

It has been already stated that the mesoderm or middle layer of a sponge is largely made up of a mass of amœba-like cells: we have here, therefore, the unique occurrence of two distinct forms of life combining together to construct, as it were, a

¹ Cassell's 'Natural History,' vol. vi. p. 315—"The Group Spongiaë."

new and more complex organism. It has been happily remarked, on this point, that "perhaps no more striking illustration could be found of the truth of the adage that 'union is strength,' than here in these two lowly, and, in their isolated individuality, helpless beings, yet who, in their combination, raise themselves in the scale of life; . . . having no stomach, yet perfect digestion and assimilation; no heart, yet free and full circulation; no lungs or gills, yet complete aëration and respiration; no manipulatory organs, yet building up a structure combining all the requisites of strength and endurance, with the most wonderful lightness and flexibility."¹

The process of reproduction in the sponges is effected in two ways—sexually and non-sexually. In winter the mesoderm is usually found filled with small, yellow, oval bodies, known as the winter-eggs or gemmules. These are launched forth in spring into the water, when they swim about in a lively manner by means of the cilia with which each gemmule is provided, ultimately settling down on a rock or stone, or on a piece of growing alga, when the eggs burst at the hilum or pore-like opening, and the contained granules, thus scattered, form a new sponge colony. This is the asexual or non-sexual mode of reproduction. These winter-eggs were first noticed in *Spongilla fluviatilis*, and were thought by Dr Johnston and others to be confined to fresh-water species, but they have now been found also in marine forms. In the sexual method of reproduction, certain cells of the mesoderm are converted into ova, and others into spermatozoa, when the impregnated ovum undergoes segmentation in the usual manner, and ultimately develops into a free-swimming embryo, before becoming fixed like the winter-eggs. In this latter case, however, each embryo is of course a perfect individual. Ova and spermatozoa have not yet been observed in the same sponge-mass, and it is hence concluded that the ova are fertilised by spermatozoa which gain admission with the inflowing currents of water. Some very interesting observations on this head are to be found in the 'Quarterly Journal of Microscopical Science' for Jan. 1891, in No. III. of a series of papers by Mr Arthur Dendy, of Melbourne University, on "Studies in the Comparative Anatomy of Sponges." Mr

¹ 'Vignettes from Invisible Life,' by John Badcock, F.R.M.S., p. 151.

Dendy says: "It is probably a general rule in sponges that the ova are fertilised while hanging from the walls of the canal system, and that they migrate first of all through the canal-wall to be fertilised, and then back again into the gelatinous ground-substance to undergo development; hence the necessity for the amoeboid movement so characteristic of sponge ova."

Before leaving the subject of reproduction in the sponges, it may be interesting to state that besides the natural modes, there is a method of artificial reproduction, somewhat after the manner of plant-cuttings, which has been pursued in the case of the bath sponges, as follows: "The sponge is cut into pieces, about an inch cube, care being taken to preserve as much of the skin and to squeeze out as little of the flesh as possible. The cuttings are then skewered on a strip of cane, and fastened into a wooden frame, constructed to preserve them from the access of mud and excess of light: they are then sunk in the sea at a depth of five to seven yards. In about seven years' time a crop of fine regularly globular sponges is ready for the market."

I have thus attempted, as stated at the beginning of this paper, to give an outline of a large subject—the structure and life-history of a sponge. Now that I have finished, I am deeply conscious that it is, in reality, but a meagre outline that I have been able to give. Yet it may prove sufficient to incite some one to study more particularly this humble and commonly despised form of animal life, a sponge, with all its busy activities, suggesting the name which Professor Huxley has applied to it of "a subaqueous city."

NOTE ON "SEA-FYKE."

A curious use has been made by our juvenile population of some of the silicious sponges, under the name of "sea-fyke," which deserves passing notice. In the 'Life of James Clerk Maxwell,' by Professors Lewis Campbell and William Garnett, two schoolboy letters of the great scientist are given, in which reference is made to this mysterious substance. One of these letters contains the following passage: "There was a boy that brought sea-fyke to the school, and put it down the boys' backs, for which he was condemned to learn 12 lines for 3 days." The school referred to is Edinburgh Academy; and in a footnote the learned authors describe the substance as "often found on the sea-shore." They go on to say: "It is

of a honeycombed structure, and consists, in fact, of the egg-capsules of the common whelk (*Buccinum undatum*). When dried and pulverised, it has an irritating effect upon the skin. Hence the local name—'fyke' = 'fidget.' We have here a curious mixture of truth and error, for sea-fyke, while it undoubtedly has the effect here attributed to it, does *not* consist of the egg-capsules of the whelk, but is a sponge of the genus *Halichondria*! A racy book entitled 'Chronicles of the Cumming Club, and Memories of Old Academy Days,' by Lieut.-Col. Fergusson, was privately printed a short time ago, in which the dire effects of sea-fyke among the Edinburgh Academy boys are duly chronicled; and it is stated that Professor P. G. Tait, himself an old Academy boy, had sent a specimen, procured from a Newhaven fisherman, to the Edinburgh University experts, who pronounced it to be *Halichondria coralloides*. A portion of this specimen, duly labelled, was afterwards "deposited in the chest containing the archives of the Cumming Club, and is at the disposal of whatever competent scholar may show evidence of a desire to approach the subject in a proper spirit." *H. coralloides*, however, though found in the Firth of Forth, is a deep-sea sponge, *not* "found on the sea-shore," as the biographers of Professor Clerk Maxwell assert sea-fyke to be, and not at all common as a British species; whereas the ubiquitous *H. panicea* is equally valuable for the purpose specified, and is more easily got, being a rock-pool dweller. Dr Johnston, in his 'History of British Sponges and Lithophytes,' gives for this latter species the synonyms of "*Spongia urens*, Ellis, *vel urtica*, Risso," and adds: "When dry, the sponge is friable, and the powder has the property of producing an intolerable itching when rubbed on the skin, as is well known to mischievous boys." The youth of Newhaven, however, do not seem to be aware of the fact that the easily procurable "crumb-of-bread sponge" possesses this valuable property, as I find that those of them who know anything of "sea-fyke" are of the opinion that, according to the traditions of the village, the only genuine article "comes out of the deep sea," and is got from the fishermen's lines. Perhaps it might be a humane act not to disturb this ancient belief!

In illustration of the above paper, a large number of sponge spicules were shown under the microscope, as well as spicules from *Gorgonia*, *Alcyonaria*, *Plexaura*, &c. The following preparations of British sponges were also exhibited:—

1. Section of *Pachymatisma Johnstonia*, named in honour of Dr George Johnston, showing needle-shaped and radiate silicious spicules, with gemmules scattered through the tissue.
2. Section of *Grantia compressa*, showing clavate and tri-radiate calcareous spicules.
3. Section of *Tethya Lyncurium*, Lamarck, showing needle-shaped silicious spicules in bundles, and also the beautiful stellate spicules of the ectoderm.
4. Section of *Sycon ciliatum*, showing the flagellated cells lining the exhalant canals.
5. Gemmules or winter-eggs, from *Geodia* sp.

VIII.—BIRDS OF THE GREAT GLEN.

BY MR ARCHD. CRAIG.

(Read March 25, 1891.)

THE Great Glen, as is well known, is that long and lovely valley that runs diagonally across part of Inverness-shire from the capital town to Fort William, where the three lochs—Ness, Oich, and Lochy—have been united and made to serve as a highway for vessels by means of the Caledonian Canal,—an undertaking of considerable magnitude, and in its day thought of sufficient importance to aspire to the title of wonderful. Description of the canal or the tourist route is, however, no part of the present purpose; and as the attempt to grapple in a single paper with the ornithology of such a wide area would be impossible, I purpose, with your kind permission, rather to draw attention to the bird life of a portion, and that the richest—viz., the vicinity of Loch Ness, with Glen Urquhart as a centre. Other glens branch off—Loch Ness, including Glen Moriston, Pass of Inverfarigaig, &c.; but by far the most varied, alike in scenery as in interest to the naturalist, is Glen Urquhart. From long acquaintance with this favoured spot I can fearlessly say that, taking the year all over, so as to embrace both summer and winter migrants, there is no part of Scotland where such a number of species can be observed; and further, as it is hoped the sequel will show, there are few localities so admirably suited to the shelter and upbringing of the smaller fauna. A very few sentences will roughly delineate the outstanding characteristics that make it so conducive to bird life. At the entrance Loch Ness recedes in the form of a small bay, the only break in its long line of twenty-four miles—the high hills during the rest of its length dipping straight down to the water's edge, and giving little or no scope for the formation of marshy ground that is such a *sine qua non* to many species. Two rivers—the Enderick and Coiltie—here empty their contents into the loch; but in course of time, through the intervention of spates and bursting of banks, many new channels have been formed, and

in consequence the surrounding parts are wet and swampy, clumps of alder and rushes springing up here and there amidst the erratic wanderings of the rivers, like bits of dry ground in a peat-moss, adding not a little to the picturesque aspect. Here, then, we have an area suited to the habits of the coot, the moor-hen, the teal, the mallard, and many other aquatic families, besides the sedge-warbler, black-headed bunting, and others to be mentioned later on.

The valley is divided into two sections, the glen and the strath. The glen proper runs westward for about nine miles to Corrimony, where it begins to dip down into the romantic Strath Glass with its magnificent background of high mountains, including the giants Mam Soul and Ben Attow. The strath, again, with its richly cultivated farms, interspersed with dense clumps of wood, only stretches for about four miles to the base of a line of swelling hills that gradually rise in brown moorland, ultimately to culminate in Mealfourvounie, the highest mountain in the Loch Ness basin, and forming a portion of the extensive deer-forest of the Seafield family. It is currently reported that this Mealfourvounie is the first land sighted by mariners when entering the Moray Firth from Scandinavia, but whether this is a fact or a tradition prompted by the vanity of the natives is more than I can tell. Taken as a whole, both glen and strath form a most extraordinary combination of different kinds of scenery. In the low grounds we have the well-tilled fields of the apparently successful farmer, saved, however, from monotony by the scattered trees and thickets. On the slopes of the hills, at many parts, may be seen the curiously irregular crofting plots, running upwards for several hundred feet, divided from each other by, in some cases, dilapidated lichen-covered dykes, speaking to great amount of labour and expense in reclaiming what must at one time have been virgin soil, covered in all likelihood with peat bog or forest. Again the eye rests on great ranges of natural wood, hazel or birch, that fringe the rivers and run up for varying distances on the hill-sides, only to give place to the more symmetrical but decidedly less picturesque plantations of firs, which of late provident proprietors have found it to their advantage to cultivate. Far above the woods is a vast expanse of barren ground covered with heather,

bog-myrtle, coarse grasses, &c., that seems to extend endlessly in waves upon waves, each one higher than the last, until the undulations die away dimly in the distance and merge into the great peaks of Glen Affaric and distant Ross, enveloped in haze or mist. Amidst these barren wastes lie numerous tarns, and from them issue tiny streams that ultimately reach to the dignity of burns, and, in winter or heavy rainfall, to roaring torrents. Such localities give ample scope for the breeding of peewits, golden plovers, snipes, curlews, various kinds of gulls, redshanks, ducks, and so on. Come lower down and you find the clumps of whins and junipers tenanted by the common and mountain linnets, ring-ousels, and other small species, while in the depth of winter the snow-bunting revels amidst those sterile and deserted wilds. Lower down still we observe, in summer, the wheatear haunting the dry-stone dykes, the titlark chirping uneasily on the open moor, hence its Scottish patronymic of moss-cheeper; while in the portions nearer the glen yellow buntings, chaffinches, corn-buntings, robins, and whinchats are by no means rarities.

The glen is populous: several fair-sized villages exist; and, in fact, almost everywhere cottages crop up singly or in groups, called in Gaelic "bailtean," many of them in situations to charm the eye of the artist, although it is problematical if any idea of æsthetic effect ever entered into the heads of the builders when choosing their respective sites. Being almost completely surrounded by high mountains, this valley escapes to a great extent those biting easterly and northerly winds that are so detrimental to tree and plant life, and, as a natural result, birds find a greater corresponding wealth of shelter and facility for rearing their young compared with many less favoured localities. Having regard, however, to the fact that this paper is intended to illustrate the ornithology of the district, and not to be devoted to its amenity, nothing more need be said by way of prelude, as half-a-dozen papers, at least, would hardly suffice to adequately portray the beauties of the glen.

To recapitulate separately all the various species would be wearisome, so instead of that I propose to append at the end of the paper a complete list of all those that have actually come under my own observation, including, in addition, all

others whose existence can be vouched for by competent parties. Meanwhile, let us glance more particularly at any of the more uncommon species which may naturally be expected to have greater interest for a body of naturalists like our Field Club.

To begin, as in duty bound, with what are called the nobler species—viz., Raptores or birds of prey—so far as this part of the country is concerned, one might cry “Ichabod!” with something like reason, as what with shooting, trapping, and relentless persecution in general, the numbers are sadly reduced, and in some instances certain species are now extinct. In fact, it is almost no exaggeration to say that it would be as difficult for a hawk or other bird that the sporting fraternity are pleased to designate “vermin,” to get rest for the sole of its foot as it was for the poor dove that Noah let out of the Ark. It would be unwise to enter upon the vexed question of hawk *versus* grouse, as so much evidence can be adduced on both sides in favour of their extirpation or preservation; but one may perhaps be pardoned if a remark be made in passing to the effect that I fancy there are few lovers of nature, worthy of the name, who would not prefer to watch the graceful falcon or hawk sailing or hovering in the air, than to have the opportunity of seeing a set of hen-reared pheasants prowling about the woods like tame chickens waiting to be slaughtered. In despite of shooting-tenant and keeper, however, many species show face now and then. The golden eagles bred for some years on the precipitous slope of one of the spurs of Mealfourvounie, and to the credit of the then Earl of Seafield be it said, they were forbidden to be disturbed; but unfortunately one of the pair got killed in a trap set for a fox or wild cat, and the remaining bird, contrary to the usual custom, did not return to the eyrie with another mate. This happened a good many years ago, but my information is not of so recent a date as to say for certain whether any of those birds still rear their young in the old locality. The kite, before the mania for game preservation took such a hold upon the local magnates, was not so uncommon a resident as to be thought a *rara avis*; but from the most authentic reports the last pair were ruthlessly shot off the nest a year or two prior to 1865. I knew the man well

who shot them: he is dead now, so we need not comment upon his conduct. The buzzard, if allowed ordinary peace, would not be rare, and, even with the drawback of inveterate enmity to its presence, still continues to put in an appearance, but unfortunately it seldom does so without falling a prey to the watchful guardian of the precious game.

Another buzzard has been observed at odd intervals, which I take to be the rough-legged buzzard, judging from the somewhat vague descriptions vouchsafed. A much commoner visitor, and even occasional resident, is the peregrine falcon. It has bred in the vicinity of Mealfourvounie, and also in a wild district to the north of Loch Meikley, among the hills trending towards Strath Glass. The remaining hawks most commonly met with are the merlin, kestrel, and sparrow-hawk. The former is rare, but builds not unfrequently in the Abriachan district,—a beautiful rocky country, about which something falls to be said subsequently. The two latter are almost able to hold their ground, the kestrel being by no means so detrimental to game as either of the other two, and not so uniformly harassed. The sparrow-hawk lacks nothing if boldness will attain its object. You may observe it sitting on the high part of a tree commanding a good survey of the pheasantry, until, deeming the moment favourable and the coast clear, down it flies with great velocity, and leaves the pheasant-rearer minus a chick, from which performance there is a certain amount of satisfaction to be derived by an onlooker other than a sportsman.

Turning for a moment to the Strigidae or owls, four species have undoubtedly occurred, and another is reported, although on somewhat slender authority. Both the short and long-eared birds have been noticed, but needless to say they are far from numerous. The barn-owl again, at one time, was not unusually found, though never so often as the tawny species. The last refuge of the barn or white owl seems to be Craig-Mony,—one of those strange conglomerate masses that rise abruptly out of a thick pine-wood, and on the summit of which are traces, indistinct however, of an ancient hill-fort. The rock at the top stands out precipitously from the wood, and amidst the dark masses of pine-tree along the base this owl finds a comparatively safe retreat. A curious tradition, of

which there are several versions, lingers around this hill, perhaps as veracious as the most of similar tales, of some young lady who either was or was not in love, it does not matter much either way, who preferred to make her bed on the rough rock face to sleeping more comfortably in the glen below. The ledge upon which she reclined is pointed out, but only the most romantic and quixotic imagination could believe that it was possible for any human being, far less a lady, to repose in such an inaccessible, not to say draughty situation. The barn-owl is now so scarce, that a visitor might almost be excused for inferring that its existence was as mythical as the female with the peculiar notions about sleeping accommodation. This owl makes at times a hideous screech, somewhat trying to the nerves when passing along a dark tree-skirted road, and in the days of superstition many evil omens were construed out of its weird-like cry. I must candidly confess not to have been altogether free from those myself when a boy of eleven or twelve years old, having experienced the greatest fright that ever occurred in my life from one of those nocturnal gentry, when sent upon some pressing errand late at night along one of the blackest roads in this very glen. The tawny owl is common pretty well all over the wooded parts, in despite of pole-traps and other engines of destruction, and on the still calm nights of autumn their melancholy hooting can be heard for miles around. Some people dislike this sound, but to my mind there is a peculiar charm attaching to its eerie call that accords admirably with the appropriate surroundings. A not unfrequent resting-place during the day is the clump of alder already mentioned as growing in the Urquhart Bay, but they are oftener to be met with in a long expanse of forest that covers part of the southern slopes of the strath. The other owl supposed to have been identified is the snowy species. The sole authority for its existence is a friend of mine whose general accuracy of statement on ornithological matters there is no reason to impugn, but in this particular instance he may have been mistaken. He says that when passing through a very wild part of Abriachan a white owl of unusual size started out of a tree and glided quickly into a dense thicket out of sight, and that he had no doubt whatever that it must

be the snowy bird, as it was so much larger than the barn-owl. This assertion is only given for what it is worth, as I cannot guarantee it further than by quoting his report.

The next in order to be taken are the Corvidæ or crows. The largest example, the raven, is not so often seen as in some other parts of Scotland; but still it crops up now and then, and a few years ago a pair were believed to be breeding about Mealfourvounie: let us hope they are there still. Last year, when in Ross-shire, I had an opportunity of seeing a pair of those interesting and scarce birds. While crossing the muir near Strome Ferry with a friend, our attention was attracted by a hoarse croak, and looking up a pair of ravens were noticed winging their way towards Loch Alsh, but at such a height that they looked no larger than blackbirds; and were it not for the harsh sound, they might have passed unobserved. They breed somewhere in the unfrequented country about the head of Loch Long, a district not much penetrated save by pedestrians desirous of viewing the famous Falls of Glomach, the highest and, in some respects, grandest waterfall in Scotland. The carrion crow is not so numerous as the hooded or grey species. The latter manages to survive the constant warfare waged against it, and continues annually to build somewhere about the glen. Far up among the hills that swell around Mealfourvounie is a little loch called Aslich, and upon some stunted trees that partially cover a rocky island in the midst of the water, this bird used to breed regularly. There is a shooting bothy on the rock, where the deer-stalkers sleep overnight; and latterly the crows deserted the nest, as they found to their cost that, so far as their young was concerned, the site was in too close proximity to the keeper to be altogether pleasant. In the choice of a situation for its habitation this crow displays an extraordinary amount of cunning, the tree fixed upon usually commanding a view of every possible approach, so that the female sitting upon the eggs has plenty of time to glide off before the intruder can get within range. Except when the young are newly hatched, it is almost impossible to get within firing distance; but under the former circumstances she sits rather close, and keepers occasionally shoot both old and young through the bottom of the nest. The exterior of this is very

coarse and rough looking, but not so the interior, which is warmly lined with feathers, wool, and other soft substances, forming a marked contrast in this respect to the dwelling of its congener the rook, who seems not to have so much notion of personal comfort as his friend with the grey jacket. I sometimes think, though it may be imagination, that this bird fabricates the outside of its nest so as to give it the appearance of being an old and disused structure. At least I have often been deceived into believing the same to be deserted, when shortly after, on passing the spot again, the bird has flown off. The number of eggs is usually four, and sometimes no two of them are of the same shape, some being conical, and others short and thick. Although there is now no rookery in Glen Urquhart, those birds are exceedingly numerous, and apparently come from the Beaully district, where there are several colonies.

The jackdaw or kae, to give it its Lowland Scotch appellation, inhabits one of the wildest gorges in Abriachan, about which a few words may be said at this juncture. The road from Inverness runs through this locality, skirting the shore of Loch Ness, now rising, now falling, according as the engineers had to cope with the inequalities of the ground, and forming one of the most lovely and romantic highways of which the Highlands can boast. At some parts the hills are covered with natural wood—birch, hazel, gean, bird-cherry, holly, &c.; while at others, immense masses of broken rock lie piled one upon another, and threaten at every moment to tumble down upon the passer-by. Numerous burns tear down the declivity, and in course of ages have formed deep gullies, a description of one of which will suffice for all. About four miles from the entrance to Glen Urquhart proper, there is a narrow ravine that ascends for about 1800 feet, only to culminate in a deep wild gorge, the sides of which are as perpendicular as the walls of a house, and apparently, to form a guess, about 200 feet in height. A noisy waterfall plunges from the more level ground above into this dark hole, and you can hear the waters churning and chafing below amidst an accumulation of fallen *débris*, loosened by rain and storm from the sides of the precipice. In the clefts of the rock a few trees struggle for existence, while in crevices graceful ferns and

creeping plants have taken root, and, with their lovely tints, go far to subdue the cold and stern aspect of the surrounding rock. Here the jackdaw, with his usual "'cuteness," has elected to fix his abode, and a safer asylum from the inroads of predacious boys, on egg-hunting thoughts intent, could scarcely be found. Few urchins, however bold, could scale this chasm, and even if they could, there is no possibility of reaching the nests, as they are placed in holes under the overhanging shelves, as safe from intrusion as if they were built on the snow-capped summits of the Himalayas. A gun fired into the abyss makes a reverberation almost deafening, and brings out the sable inhabitants *en masse*, to fill the air with a perfect storm of caws. It is pleasant to sit upon the edge of the gully and watch their habits. For a time there is perfect silence save for the rushing of the burn as it tumbles over the cliff, or the sighing of the wind among the trees overhead: then one individual contributes a solo, consisting of two or three caws; another follows suit, then silence prevails again, when, without the slightest warning or apparent premeditation, uprise the entire inhabitants, vying with each other who shall make the greatest noise, cawing away as if their very existence depended upon it, to sink as suddenly as they arose, only to repeat the performance at apparently stated intervals. A friend and I went one day to this spot to shoot a jackdaw for the sake of its skin: we might as well have attempted to annihilate an elephant with a pea-shooter!

The last of the tribe to be mentioned are the magpie and jay, now both virtually extinct. The last-named beautiful species has not been seen for years, but was resident once, as is evidenced by the stuffed specimens in the mansion-house of Balmacaan. The former yet occurs as a straggler.

We arrive now at the smaller fauna, and begin with the Paridæ or titmice. Having already devoted an entire paper to this interesting family,¹ nothing need be added but to mention the names of the species that exist in Glen-Urquhart and other glens of the district. The great, blue, cole, and long-tailed members are all numerous, but the marsh tit (*Parus palustris*) is scarce. Personally I never saw it here, although it is quite common in many parts of England; but it

¹ See 'Transactions,' vol. ii. pp. 41-51 (Sess. 1836-87).

was identified in 1866 and 1867 by Mr George Muirhead, factor for the Earl of Aberdeen, and a well-known naturalist. The crested tit does not exist, but, curiously enough, is fairly plentiful on another of the Seafield estates—viz., Castle Grant, in Strathspey. Not far from Balmacaan House there is a lonely little burial-ground, surrounded by a few dark spruces, and the whole hidden in a birch wood, where repose sundry members of the Grant clan; and close beside is a stagnant pool of water edged by dwarfed bushes and rank vegetation, bearing a Gaelic name that, when literally translated, is not such as we would use in polite society, but for present purposes may be rendered the Pool of Blood. Around this linger legends of some desperate fights between rival clans, such as disgraced the annals of ancient Scotland, and it is supposed that the blood of the victims originally formed the pool. To-day the scene is changed, and hallowed as the place is by the near presence of the dead, not to mention historic associations, there is no spot in the whole district where the ornithologist can pursue his favourite study to such advantage. In early morning and towards evening great numbers of small birds come to drink or perform their ablutions, and one has nothing to do but sit quietly down and watch the stream of lively little beings constantly changing—halting for a few minutes to flirt about the trees or descend to slake their thirst, only to fly off and be succeeded by another batch on the same errand. It is not overestimating the numbers to say that on a favourable day over forty species may be counted, and this does not take into account the odd birds that might happen to pass casually. Tits, creepers, finches, goldcrests, siskins, bullfinches, greenfinches, warblers, all take their turn, besides redpoles, swallows, buntings, and others that it is needless to recapitulate.

A very common species here is the siskin—a most engaging bird, and exceedingly easy to tame in confinement. Some seasons great numbers incubate in the glen among the fir plantations, but the nest is hard to find, being usually laid upon the upper portion of a spruce branch, so that it is completely concealed from below by the density of the needle-like foliage, and unless one can reach a point where the tree may be looked down upon, search is mostly unavailing. No

species, save perhaps the bullfinch, seems to be such a favourite cage-bird with the natives, perhaps because in spring they are easily captured by means of a call-bird and limed twigs. This process is rather interesting to watch. Should the call-bird be a female, the male who is attracted by her cry gyrates round and round overhead with wings outspread and quivering, pouring out his song with his utmost power, gradually narrowing the circle, only to alight occasionally upon a tree or wall where he continues to sing. Then off he sets again, until finally he settles upon the cage or twigs, in the latter case to lose his liberty. Sometimes he runs round the cage at considerable speed, whistling with energy and making vain endeavours to find an entrance through the bars. So readily do siskins take to confinement, that with careful and kindly treatment I have managed to familiarise a bird with its altered circumstances to such an extent, that it ate off the finger a few hours after capture. The otherwise sweet warbling is marred to a certain extent by an interjected harsh screech, which readily distinguishes it from any other small bird. Bands of siskins and redpoles often accompany the crossbills in their wanderings among the coniferæ, no doubt profiting by the latter's superior facilities for opening the cones to extract the seed from those that are left unfinished by the larger and stronger species. Crossbills abound in some years, but are scarce in others, the years 1880-81 being exceptionally favourable for observing their habits. As in the case of the titmice, nothing more need be said anent this species, the subject having been already discussed in a previous paper now included in our 'Transactions'; and while referring to this, it may be as well to state that I purpose as far as possible avoiding a description of any particular species that has already been brought under your notice in former years, which decision will materially assist in limiting the length of the present paper. The beautifully plumaged bullfinch used to be, and still is, fairly frequent, but a few severe winters thinned their numbers grievously. Another cause for diminution, outside the bird-catcher, is the hostility displayed by gardeners, who in some respects are as inimical to bird-life as the game-preserve. The bullfinches certainly have a partiality for fruit-buds, and although some authorities attempt to

defend their conduct by asserting that every bud attacked contains an insect, yet it is to be feared this is not absolutely correct, and that the little fellows are sinners in this respect, undoubtedly doing some damage to fruit. In consequence of this many are annually shot, although it is a moot-point whether it is worth while to sacrifice such pretty creatures for the sake of a few sour apples that in many instances are not worth the trouble of pulling. Even granting that this accusation is correct, the results are not nearly so serious as horticulturists would have us believe, otherwise how do geans, sloes, &c., flourish and bear fruit, for it is notorious that the bullfinch is fond of those buds for a viand? Prejudice dies very hard with some folks, and I remember a gardener who systematically tore down the nests and broke the eggs of hedge-sparrows, as he conceived that they ate his vegetables. Being to a large extent an insectivorous bird, this operation had neither reason nor justification for its enforcement; but argument with a person of this kind was out of the question, so nothing could be done but to let him rest in the enjoyment of his ignorance.

The linnets are represented by the common linnet, the twite or mountain linnet, and the redpole. The first is by far the scarcest, but the other two may be met with constantly. The twite frequents the higher and more muirland districts, and is distinguished from the ordinary species by the fact that it has no red or carmine on the breast or head during the period of incubation, the only trace of this colour being upon the rump, but it is not so bright as that on the breast of the other. The names grey, brown, yellow, rose, and whin linnet all refer to one bird—viz., *Linota cannabina*—the different designations having originated, in the four first mentioned, from the circumstance of the plumage varying at different seasons and ages, and the last from its fondness for gorse as a haunt and nesting-place. The twite or “heather lintie,” as it is dubbed in Scotland, is a gentle and withal a sociable bird, as even at the breeding-time little bands of six or more may be seen playing and feeding together.

Before passing on to the remainder of the fauna, the following may be of interest to some of our ornithological members. While upon the muir one day in the month of May, about ten

years ago, I noticed a pair of twites building their nest on a steep brae covered with heather, and while watching them through a field-glass, another pair came up, and all four apparently began to assist in raising the fabric. Unless entirely deceived, this seems rather a curious incident, as one would almost infer that it was a habit with this species. Of course it may only have been an isolated instance, but being able to produce another witness to the transaction, I deemed it worth recording at any rate. Instances, besides, are on record where two female twites laid their eggs in the same nest, and after hatching, all four birds assisted in feeding the young.

Of the migratory warblers, the following may be included in the list of summer visitors: blackcaps (scarce), garden warbler, wood warbler, sedge warbler, whitethroat, and willow warbler. For years back it never could be ascertained definitely if the chiff-chaff had been noticed as a resident or occasional visitant, but all doubts upon the point were set at rest last June (1890), and this identification I consider the most important item recorded this evening from an ornithological point of view. The chiff-chaff, so like the willow warbler in outward aspect, has an entirely different and unmistakable note; and although numerous in England, is exceedingly rare in the north of Scotland. It was with great pleasure, therefore, that, when walking through the Pass of Inverfarigaig during the month of June last, I both saw and heard a pair. They were among a flock of tits and goldcrests haunting a small fir-wood not very far from the spot where Dr Bryce, the geologist, was killed, while upon an expedition among the rocks of this most grand and picturesque of Highland defiles. The pass runs inland to Strath-Erick from the east side of Loch Ness, and is crossed at the entrance by the old military road attributed to General Wade and his body of engineers. Although possessing all the advantages of rock, wood, and water, with an almost entire absence of human dwellings, the variety of birds, though considerable, is as nothing to what may be found in the more diversified glen opposite, to which reference has been principally made.

Mention may now be made of a few odd species that assist in forming the list of feathered fauna. The spotted flycatcher

is in summer a familiar object on the dykes and wire fences which enclose the fields, and readily marked by its curious habit of darting out a few yards into the air after an insect, and as quickly returning to its perch when the capture is completed. If near enough, on a calm day the snapping together of the mandibles is quite audible. The other flycatcher, known as the pied, cannot be included, though of late years it seems to have become a more regular visitor to the Lowland counties, having bred several times in Peeblesshire, Berwickshire, &c. The kingfisher, from the statements of many residents, would appear to have at one time frequented the river Ennerick. This, however, is one of those cases where dubiety exists, as the water-ousel often goes among country people by that name, and it is pardonable to suppose that this may be the species referred to, and not *Alcedo ispida*. A pair of hoopoes were seen a good many years ago by a gentleman while fishing in the river Glass, near Beauly, but it is superfluous to say they can only come under the category of infrequent wanderers. The tiny little creeper is no stranger, and that favourite with poets, the cuckoo, abounds chiefly among the higher slopes of Abriachan, though observed more or less everywhere in the neighbourhood. The nightjar occurs almost every season, but is by no means so plentiful as in many parts of the West Coast, such as Argyleshire or Dumbartonshire. The Hirundinidæ are represented by the swift, chimney swallow, house-martin, and sand-martin. The house-martin builds among the ruins of old Urquhart Castle, locally known as Strone Castle, and one of the landmarks of the place. This venerable pile is now fearfully dilapidated, and stands upon a rocky knoll jutting out into Loch Ness. There are traces of a deep fosse and drawbridge spanning the same, so that when the ditch was full of water the whole was converted into an island, and, judging from the extent of the battered remains, when in its glory it must have been a hold of exceptional size and strength. An able pamphlet was written upon its history by a well-known citizen of Inverness, in which its foundation was traced back to so remote a period that, to the unfortunate wight to whom Gaelic literature is a sealed book, it seemed to be contemporary with the days of Joshua, the son of Nun. Without relegating

its origin to such an early era, suffice it to say that it is of great antiquity, and was a place of strength long prior to the days of Wallace and Bruce. There is a certain amount of dreamy pleasure to be derived from sitting amidst the broken ruins of such a castle, and to ruminate upon the stirring events of which its walls have been witnesses; but when we remember the cruel acts and deeds of blood perpetrated, we cannot help thanking heaven that we live in happier days, and in a country where a recurrence of similar scenes is well-nigh impossible. Of the wagtail and pipit brotherhood only five can be accounted as habitual sojourners. Those are the pied and grey wagtails, and the meadow, rock, and tree pipits. Another wagtail, known as the white, has beyond doubt been recognised, but not often, although it may be more frequent in its visits than one would suppose, considering its similarity to *Motacilla lugubris*. That it is a distinct species there can be no shadow of doubt, but it must be acknowledged that unless two fully matured specimens of each are compared close together, it is not an easy matter to distinguish them, especially when young, and at a distance. The rock pipit is a constant resident on the sea-shores, but a few appear among the uplands—sparsely distributed, however, in comparison with the meadow pipit. The last named is always a pleasing little object, despite its unpretending dress. You can hardly fail to knock up many pairs while walking on the grassy hill-slopes or wide muirs, and as they rise with a jerking sort of motion they utter a peculiarly plaintive chirp as a protest against intrusion, but this sound always seems to me to have more of the piteous complaining than of the angry querulousness common to many birds when disturbed by strangers. It possesses a similar habit to the tree pipit of sailing down from a height in a slanting direction with outspread wings, and singing with gusto until it reaches the ground, with this difference that the arboreal species alights upon a tree, whereas the titlark lands upon *terra firma*. The tree pipit is a summer migrant only, while the other inhabits Scotland all the year round.

Time would not permit of doing more than glancing rapidly at the remaining number of small species before finishing up with the water and game birds. The following are fairly abundant: the skylark, corn bunting, yellow bunting, reed

bunting, about the marshy swamps of Urquhart Bay, snow bunting on the high grounds during severe winters, chaffinch, mountain finch during the winter months, greenfinch, and of course our old and somewhat impudent friend the house-sparrow. As to the tree-sparrow (*Passer montanus*), this rarer bird may with safety be scheduled, as I am perfectly positive I saw a pair at a place called Pitkerrald, near Drumadrochit village, the slightly smaller size, and different wing and cheek markings, being easily recognisable, and stamping them at once as being clearly not the common variety. Over the brightly plumaged goldfinch the wail of the coronach might well arise: it no longer exists, and this is all the more to be regretted, as from twenty to twenty-five years ago it was a constant source of delight to the lover of nature. No doubt the improved farming, and consequent destruction of thistles and other weeds upon which it partially fed, had much to do with the diminution in its ranks; but the crowning stroke was perpetrated by a band of professional bird-catchers, who, by their mercenary and wholesale clearance, deserved to be consigned to a choice nook in Dante's Purgatorio in order to expiate their sins. Though practically unknown now in Glen Urquhart itself, a few may be met with in other offshoots from the Great Glen, hence its inclusion in the list. Running rapidly over the rest, we have the starling gradually increasing, and, from being a rarity, becoming a numerous species, nesting in holes of trees, roofs of houses, and among rocks. The dipper, or water-ousel, is sparingly scattered here in comparison with our Lowland burns and rivers, and it does not seem to be upon the increase. The Turdidæ or thrushes are typified by the stay-at-home missel thrush, mavis, and blackbird; as also by the partial dwellers, the fieldfare, redwing, and ring-ousel,—the latter summer visitor being far and away the most interesting. We must not omit to mention the sober little hedge-sparrow, the self-satisfied robin, the brightly plumaged but somewhat wary redstart, and the lively wren. The last-named, in addition to the woods, seems to have a great hankering after solitary places beside the river, and among jumbled rocks, far removed from human habitation; and it is sometimes startling, when sitting quietly amidst such surroundings, to hear this little creature

suddenly wake the echoes with his loud sweet song—a sound out of all proportion to the size of his body, and reminding one, to a certain extent, of a powerful-voiced canary. The only two *Saxicolinæ* are the whinchat and wheatear, the latter about the first migrant to appear in spring. Strange to say, the black-headed, red-breasted stonechat does not exist, notwithstanding that many portions of Glen Urquhart are suited to its tastes and habits; but among the whin- and broom-covered parts nearer Fort Augustus it may be observed. Nevertheless, there is no blinking the fact that, take it all over, this is a much scarcer bird than the two former. Last of the minor woodland birds is the goldcrest, the smallest native European species, so difficult to discover amongst the thick spruces, and so baffling in its feeble mouse-squeaking sort of note as almost to lead to the belief that it possesses ventriloquial powers. The latter assumption, however excusable, is hardly correct, as the effect is produced more by the bird shifting its quarters unobserved, than by any special gift in the nature of polyphomism.

The corn-crake in summer makes himself heard, though not seen, by his unmusical and strident voice; and the wood-pigeons are, of course, familiar objects, greatly to the delight of the agriculturist, whose grain suffers from their depredations in corresponding ratio to the size of the fields and the number of the robbers. Game birds, as might be inferred from the systematic onslaught on so-called “vermin,” are not the least conspicuous of the winged tribe. Black grouse and red grouse are on the muirs, ptarmigan upon the upper reaches of Mealfourvounie, partridges and woodcock in the lower parts of the glen, snipe in the bogs, and any number of pheasants in the woods. Reeves’s pheasant, with its magnificent long tail, was numerous some years ago, and various other varieties of the ordinary species were met with, including the piebald and Bohemian, as also a bird crossed between the golden pheasant and *Phasianus colchicus*. The capercaillie or cock of the wood, so far as the indigenous race is concerned, is a thing of the past, some of the last survivors having been killed in Glen Moriston; but the imported bird was attempted to be domesticated by Lord Tweedmouth in the vicinity of Guisachan, his residence in Strath Glass, with what success at the present time I am not aware.

It would be simply impossible at this late stage to do justice to the numerous aquatic and moorland species that yet remain to be mentioned, or to call your attention to the marshy swamps and the silent and lonesome muirland where they haunt; so I shall not attempt to tax your patience further at present, but will merely conclude with the remark, which perhaps you will endorse, that a district which can boast of almost 120 species may truly be styled an elysian field for the ornithologist.

LIST OF THE BIRDS OF THE GREAT GLEN.

(The nomenclature of the latest edition of Yarrell's 'British Birds' is used.)

- | | |
|---|--|
| Golden eagle, <i>Aquila chrysaetos</i> . | White wagtail, <i>Motacilla alba</i> (doubtful). |
| Kite, <i>Milvus iclinus</i> (almost extinct). | Grey wagtail, <i>Motacilla sulphurea</i> . |
| Buzzard, <i>Buteo vulgaris</i> . | Rock pipit, <i>Anthus obscurus</i> (scarce). |
| Rough-legged buzzard, <i>Buteo lagopus</i> . | Meadow pipit, <i>Anthus pratensis</i> . |
| Peregrine falcon, <i>Falco peregrinus</i> . | Tree pipit, <i>Anthus trivialis</i> . |
| Merlin, <i>Falco aesalon</i> . | Skylark, <i>Alauda arvensis</i> . |
| Kestrel, <i>Falco tinnunculus</i> . | Corn bunting, <i>Emberiza miliaria</i> . |
| Sparrow-hawk, <i>Accipiter nisus</i> . | Reed bunting, <i>Emberiza schœniclus</i> . |
| Short-eared owl, <i>Asio accipitrinus</i> . | Yellow bunting, <i>Emberiza citrinella</i> . |
| Long-eared owl, <i>Asio otus</i> . | Snow bunting, <i>Plectrophanes nivalis</i> . |
| Barn-owl, <i>Aluco flammeus</i> . | Chaffinch, <i>Fringilla œlebs</i> . |
| Tawny owl, <i>Strix aluco</i> . | Mountain finch, <i>Fringilla montifringilla</i> . |
| Snowy owl, <i>Nyctea scandiaca</i> (doubtful). | Tree - sparrow, <i>Passer montanus</i> (scarce). |
| Raven, <i>Corvus corax</i> . | House-sparrow, <i>Passer domesticus</i> . |
| Carrion crow, <i>Corvus corone</i> . | Greenfinch, <i>Coccothraustes chloris</i> . |
| Hooded crow, <i>Corvus cornix</i> . | Goldfinch, <i>Carduelis elegans</i> (very scarce). |
| Rook, <i>Corvus frugilegus</i> . | Siskin, <i>Carduelis spinus</i> . |
| Jackdaw, <i>Corvus monedula</i> . | Common linnet, <i>Linota cannabina</i> . |
| Magpie, <i>Pica rustica</i> . | Mountain linnet, <i>Linota flavirostris</i> . |
| Jay, <i>Garrulus glandarius</i> (almost extinct). | Redpole, <i>Linota rufescens</i> . |
| Great tit, <i>Parus major</i> . | Bullfinch, <i>Pyrrhula europæa</i> . |
| Blue tit, <i>Parus cœruleus</i> . | Crossbill, <i>Loxia curvirostra</i> . |
| Cole tit, <i>Parus ater</i> . | Starling, <i>Sturnus vulgaris</i> . |
| Marsh tit, <i>Parus palustris</i> (scarce). | Water-ousel, <i>Cinclus aquaticus</i> . |
| Long-tailed tit, <i>Acredula caudata</i> . | Missel thrush, <i>Turdus viscivorus</i> . |
| Spotted flycatcher, <i>Muscicapa grisola</i> . | Fieldfare, <i>Turdus pilaris</i> . |
| Kingfisher, <i>Alcedo ispida</i> (doubtful). | Redwing, <i>Turdus iliacus</i> . |
| Hoopoe, <i>Upupa epops</i> (very rare). | Mavis, <i>Turdus musicus</i> . |
| Creeper, <i>Certhia familiaris</i> . | Blackbird, <i>Turdus merula</i> . |
| Cuckoo, <i>Cuculus canorus</i> . | Ring-ousel, <i>Turdus torquatus</i> . |
| Nightjar, <i>Caprimulgus europæus</i> . | Hedge-sparrow, <i>Accentor modularis</i> . |
| Swift, <i>Cypselus apus</i> . | Robin, <i>Erithacus rubecula</i> . |
| Chimney swallow, <i>Hirundo rustica</i> . | Redstart, <i>Ruticilla phœnicurus</i> . |
| House-martin, <i>Chelidon urbica</i> . | |
| Sand-martin, <i>Cotile riparia</i> . | |
| Pied wagtail, <i>Motacilla lugubris</i> . | |

- Stonechat, *Saxicola rubicola* (uncommon).
 Whinchat, *Saxicola rubetra*.
 Wheatear, *Saxicola œnanthe*.
 Blackcap warbler, *Sylvia atricapilla* (scarce).
 Sedge warbler, *Acrocephalus schoenobaenus*.
 Garden warbler, *Sylvia salicaria*.
 Wood warbler, *Phylloscopus sibilatrix*.
 Whitethroat, *Sylvia rufa*.
 Willow warbler, *Phylloscopus trochilus*.
 Chiff-chaff, *Phylloscopus collybita* (very scarce).
 Wren, *Troglodytes parvulus*.
 Goldcrest, *Regulus cristatus*.
 Wood pigeon, *Columba palumbus*.
 Capercaillie, *Tetrao urogallus*.
 Common pheasant, *Phasianus colchicus*.
 Piebald pheasant (var.)
 Bohemian pheasant (var.)
 Reeves's pheasant, *Phasianus Reevesii*.
 Black grouse, *Tetrao tetrix*.
 Red grouse, *Lagopus scoticus*.
- Ptarmigan, *Lagopus mutus*.
 Partridge, *Perdix cinerea*.
 Woodcock, *Scolopax rusticola*.
 Snipe, *Gallinago caelestis*.
 Land-rail, *Crex pratensis*.
 Golden plover, *Charadrius pluvialis*.
 Peewit, *Vanellus vulgaris*.
 Curlew, *Numenius arquata*.
 Heron, *Ardea cinerea*.
 Common sandpiper, *Totanus hypoleucis*.
 Ringed plover, *Ægialitis hiaticula* (scarce).
 Redshank, *Totanus calidris*.
 Widgeon, *Mareca penelope*.
 Mallard, *Anas boschas*.
 Teal, *Anas crecca*.
 Tufted duck, *Fuligula cristata* (very scarce).
 Water-hen, *Gallinula chloropus*.
 Coot, *Fulica atra*.
 Black-headed gull, *Larus ridibundus*.
 Common gull, *Larus canus*.
 Kittiwake, *Rissa tridactyla*.
 Herring gull, *Larus argentatus*.

Mention has been avoided of the various geese, ducks, gulls, divers, and other maritime species that may have been occasionally driven inland by stress of weather, as those can hardly be accounted even partial residents.

IX.—THE ANDROMEDA FAMILY.

By MR HUGH FRASER.

(Read March 25, 1891.)

BELONGING to the Natural Order Ericaceæ, and consequently allied to the heaths, arbutus, kalmias, rhododendrons, and many other families of interesting trees and shrubs, the *Andromedas* exhibit a rare combination of those qualities which are most desirable in hardy flowering-shrubs. The neat and for the most part dwarf bushy habits of growth, elegant foliage, and showy flowers of the various species have long been appreciated, and have secured for them prominent positions in most collections of peat-soil shrubs. The various

species are widely distributed over the colder regions of Europe, Asia, and America, our own island possessing in its native flora one of the prettiest of them. The genus was named by Linnæus in allusion to the fabled Princess Andromeda bound to a rock, and exposed to the attacks of a sea monster; and it may be interesting to quote a few sentences from his 'Lachesis Lapponica,' as translated by Sir J. E. Smith, to illustrate the fact that the great naturalist was not only a devoted scientist, but a man who could look upon the beautiful with all the enthusiasm of a poet. Speaking of *Andromeda polifolia*, the species on which the genus was founded, Linnæus says:—

Andromeda polifolia was in its highest beauty, decorating the marshy grounds in a most agreeable manner. The flowers are quite blood-red before they expand, but when full-grown the corolla is of a flesh-colour. Scarcely any painter's art can so happily imitate the beauty of a fine female complexion, still less could any artificial colour upon the face itself bear a comparison with this lovely blossom. As I contemplated it, I could not help thinking of Andromeda as described by the poets; and the more I meditated upon their description, the more they seemed applicable to the little plant before me, so that if these writers had it in view they could scarcely have contrived a more apposite fable. Andromeda is represented by them of most exquisite and unrivalled charms, but these charms remain in perfection only so long as she retains her virgin purity—which is also applicable to the plant now preparing to celebrate its nuptials. The plant is always found on some little turfy hillock in the midst of the swamps, as Andromeda herself was chained to a rock in the sea, which bathed her feet as the fresh water does the roots of this plant. Dragons and venomous serpents surround her, as toads and other reptiles frequent the abode of her vegetable resembler, and when they pair in the spring throw mud and dirt over its leaves and branches. As the distressed virgin cast down her blushing face through excessive affliction, so does this rosy crimson flower hang its head, growing paler and paler till it withers away. Hence as this plant forms a new genus, I have chosen for it the name of *Andromeda*. . . . At length comes Perseus in the shape of summer, dries up the surrounding water, and destroys the monsters, rendering the damsel a fruitful mother, who then carries her head [the capsule] erect.

Some thirty species of *Andromeda* have been introduced from time to time to this country, and, with very few exceptions, these have proved hardy enough for cultivation in the open air. They are for the most part evergreen, and produce their lovely, wax-like, bell-shaped blossoms in spring and summer with the greatest profusion. As regards their

culture and general management, little more need be said than that, along with a moderate allowance of peaty soil, they should have a greater amount of root-moisture than most other peat-soil plants. They luxuriate in a marshy, swampy situation, in which rhododendrons and azaleas could not exist for any length of time. It is therefore important to keep this peculiarity in view when it is intended to plant them in beds or clumps by themselves—an arrangement which, though not very generally adopted, is nevertheless very effective, from the great diversity in foliage, height, and general appearance of the plants. This preference for a damp situation need not, however, deter any one from associating them in mixed borders with the other peat-soil shrubs. They adapt themselves to such circumstances with the greatest facility, though their vigour will be promoted, and they will flower much more freely, if supplied with water when the situation is naturally dry, especially during the growing season.

All the species being interesting, and well worthy of cultivation, especially to those who are lovers of hardy shrubs, it is somewhat difficult to make a selection of what are usually termed the most desirable varieties. I would therefore recommend those who intend planting, and who have the necessary accommodation, to grow as many different sorts as they can procure, fully assured that no more ornamental and pleasing hardy flowering-shrub can be introduced into a garden or pleasure-ground than the *Andromeda*, under whatever specific name it may be known.

X.—ON VEGETABLE IVORY.

BY MR THOMAS WRIGHT.

(*Read March 25, 1891.*)

VEGETABLE IVORY is obtained from the fruit of a palm-like tree, *Phytelephas macrocarpa*, a native of the north-eastern

district of South America. The tree is described as very handsome in appearance. The stem is somewhat procumbent, due partly to its own weight and partly to its aerial roots, and thus forms a creeping caudex, which is frequently 20 feet long, but seldom higher than 6 feet. A magnificent cluster of light-green pinnatifid leaves, used by Indians for thatching huts, crowns the tree top; and being of an exclusive habit, growing only in clumps quite separate from other plants, a *Phytelephas* grove forms an outstanding feature in the landscape. The tree is found near the sea-coast in Darien, and reaches an altitude of more than 3000 feet in New Granada, but grows most abundantly on the banks of the river Magdalena, in Columbia. A damp soil seems to be necessary for its culture.

Botanists differ as to the position of the ivory palm in the vegetable kingdom. By several it has been classed with the palms, by others with the screw pines, while later authorities accord it a place midway between these two orders. The male and female flowers grow on separate trees. Male plants have higher, more erect, and more robust trunks; but in both sexes the inflorescence consists of flowers without a perianth arranged on a fleshy spadix. The fruit is formed of six or seven drupes clustered together in a mass as large as a man's head. As each drupe contains from six to nine seeds, and a tree usually bears from six to eight heads, this gives a total of from 200 to 300 nuts as the produce of each tree. The drupes are covered outside with hard woody protuberances. In its very young state the seed contains a clear insipid fluid, which travellers drink. As it advances in growth, the fluid becomes sweet and milky, and at this stage bears and hogs eat the nuts greedily. (By the way, hogs are particularly fond of nuts. A friend in Ireland has two walnut trees in a park some hundreds of yards from his farm. When the nuts ripen and drop to the ground, it is a sight to see the pigs scampering across the park as soon as the gate is opened. It will be remembered that in Germany pigs wander at large in the forest in autumn, subsisting on the fallen beech-mast.) In course of time the endosperm gradually hardens until it acquires a consistency almost as dense as ivory. A mature seed measures about 2 inches in length by $1\frac{1}{2}$ inch in breadth, and is roughly triangular

in shape, or rather like the quarter of a sphere. It is protected by a dark-brown testa, very dense and hard, measuring 1-30th of an inch in thickness or thereby, and broadening out to half an inch at the hilum, where it is perforated by mucilage pores. There is an almond-shaped cavity near the centre of each nut which detracts from its commercial value, but serves an important purpose in the life-history of the plant. When the embryo, which is small and situated near the hilum, begins to germinate, the cotyledon finds room for growth inside the cavity; it absorbs the endosperm for its first nourishment, and while this absorption of stored-up albumen is going on, the radicle and plumule find their way through a fracture in the testa, and begin the struggle for existence. The extreme hardness of the seed frequently causes an observer to remark that germination cannot be possible; but it has to be borne in mind that in their native soil dispersion must take place while the albumen is in a comparatively pulpy condition, and soaking in water has a softening effect even on very old fruit.

Microscopic examination of the endosperm shows that it is built up of polygonal cells radially arranged, having lignified walls and radiating pores, with a sucker-like expansion next the cell-wall but no intercellular spaces. Their structure is best seen when the section is mounted dry. If a seed be cut in halves, and the flat surface well polished, one can easily see with the naked eye a series of circular markings, which somewhat resemble dentine, and so justify its popular name of vegetable ivory. These circles seem to indicate that the endosperm is built up of concentric spheres; but microscopic preparations show, as already stated, that the cells are laid down radially, and the rings are probably due to the thickening of the transverse cell-walls.

The testa is deserving of careful examination, as it exhibits various forms of well-developed sclerenchyma. It will be remembered that Mr Coats read a paper last session, entitled "On Sclerenchymatous Cells," and I would refer members to that communication for an account of their structure and functions; but it may be repeated here that these cells are never directly concerned in the living processes of plant-life,—they form a purely mechanical tissue. The relative positions

of the various layers of tissue in the testa will be best understood by referring to the accompanying illustration (fig. 1). Prominent among these tissues is the layer of columnar cells. This form shows polygonal cells, with much lignified walls, numerous radiating pores, and the central canal occupied by small hexagonal cones (fig. 2). I have not been able to find a description of these curious cones in any work on structural botany. They fit into an expansion of the canal at the outer end of the columnar cell, and if the testa is macerated in strong potash, the cones drop out easily on the application of pressure. By grinding a very thin section of the testa a vertical view is obtained, and this shows the radiating pores and polygonal cell-walls (fig. 3). Preparations from the hilum show strongly developed scleroid. When the endosperm solidifies it contracts a little, and becomes detached from the testa. The rupture takes place in the middle of the fibrous layer, and a complete coat of the latter adheres to the endosperm. A network of veins may readily be observed traversing this tissue. It consists either of fibro-vascular bundles, or of the grooves formerly occupied by them. In the latter case, the fibro-vascular bundles have adhered to the testa.

Seeds of *Phytelephas macrocarpa* are imported in large quantities by London merchants under the name of "Corrozo nuts," a Central American name, and numbers of them are forwarded to the button-makers of Birmingham. The ingenious mechanics of that busy town convert the nuts into buttons, trinkets, drawer-knobs, umbrella-handles, dominoes, chess-men, and other articles where a hard white material, susceptible of taking on a high polish, can be used to advantage. They were first imported to this country in 1826. The present market price varies from £15 to £25 per ton, according to quality. Another palm-nut, from *Attalea funifera*, is known among turners as "Coquilla shell," and used by them for similar purposes; but the colour is light mottled-brown instead of white.

A recent number of the 'English Mechanic' contains an article describing a process now being carried on in Paris for the production of artificial ivory. It is obtained by mixing phosphate of lime, carbonate of lime, magnesia, alumina,

MICROSCOPIC STRUCTURE OF VEGETABLE IVORY.

(*Phytelephas macrocarpa.*)

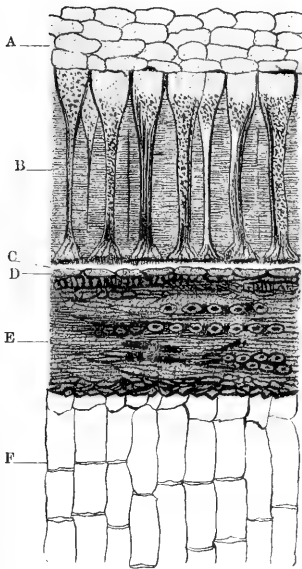


FIG. 1.



FIG. 2.

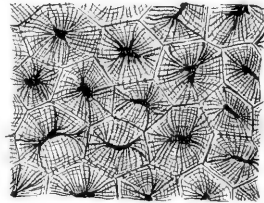


FIG. 3.

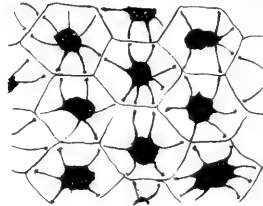


FIG. 4.

FIG. 1.—Radial section of testa and endosperm. $\times 120$.

A. Outside layer of seed coat composed of thin-walled parenchyma.

B. Columnar sclerenchymatous cells.

C. Thin layer of yellow tissue, apparently homogeneous.

D. Thin layer of kidney-shaped indurated cells.

E. Broad band of fibrous layers much warped and intercrossed.

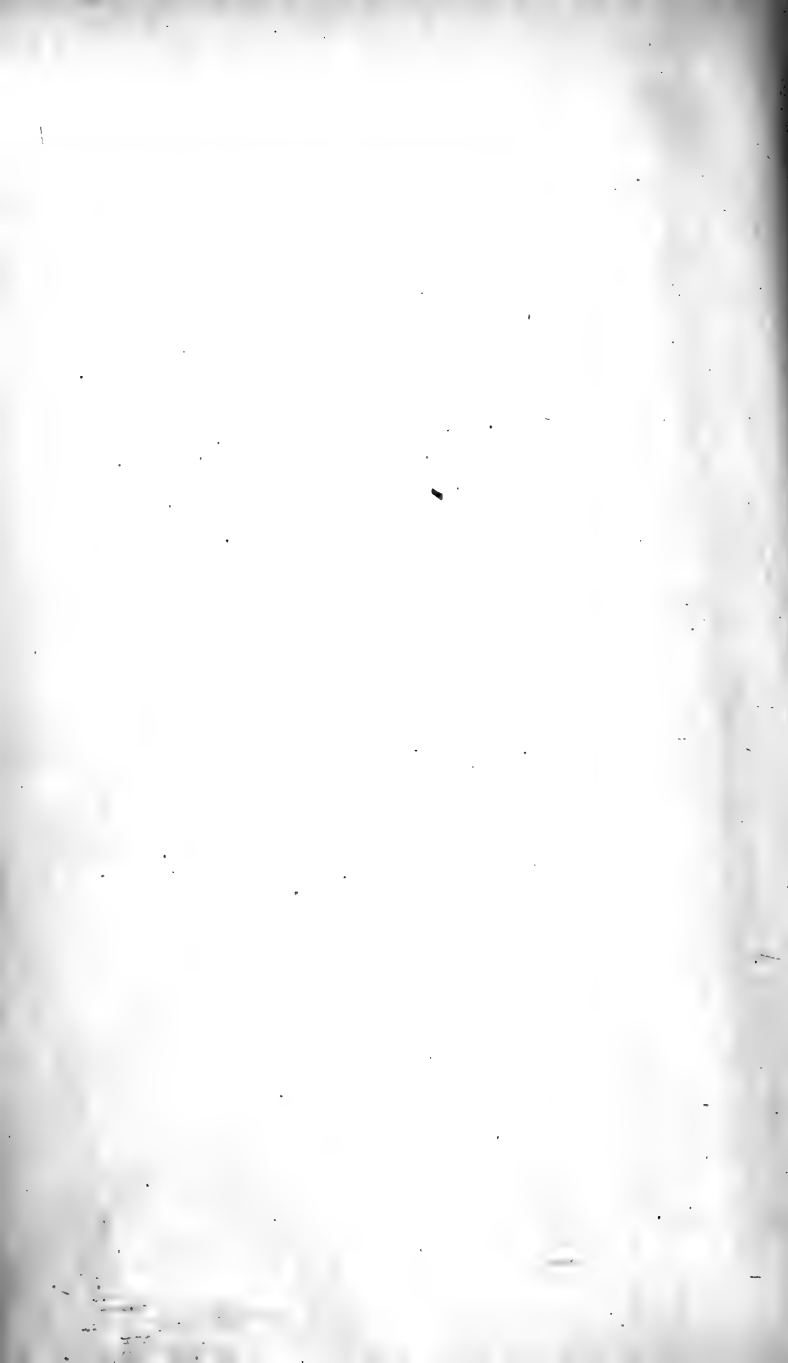
(Rupture between testa and endosperm occurs in middle of E.)

F. Endosperm.

FIG. 2.—Hexagonal cones from columnar cells. (Fig. 1 B.) $\times 160$.

FIG. 3.—Transverse section of columnar cells. (Fig. 1 B.) $\times 160$.

FIG. 4.—Tangential section of endosperm. (Fig. 1 F.) $\times 160$.



gelatin, and albumen in definite proportions. The mixture is dried and finely ground, then placed in a heated mould and subjected to a pressure of two tons to the square inch. This product is said to be an excellent substitute for ivory; and if it proves suitable for billiard-balls, combs, brush backs, bell-pull handles, and articles of ornament, it will command a ready sale, and very soon bring a fortune to the manufacturer.

XI.—*HOW I ROBBED THE EAGLE'S NEST,
AND WHY.*

BY MR TOM SPEEDY.

(*Read April 22, 1891.*)

IN the spring of 1890, while spending a few days with a friend in Ross-shire, I learnt that a pair of eagles had their eyrie in a rock in the centre of the deer-forest. As a number of lambs had disappeared from a neighbouring farm the previous year, and an eagle had been seen in the act of carrying one off, the farmer vowed vengeance against these robbers of his flock. After a series of complaints, it was reluctantly agreed to destroy the eagles. Being consulted in the matter, I suggested that, as it is only when the birds have to provide food for their progeny that they carry off lambs, if we could manage to rob the nest the parents might be spared. The keeper feared this was impossible, as the eyrie was in an inaccessible rock; but borrowing a cart-rope from the farmer, and taking with us a gun and cartridges, we wended our way towards the place. A couple of hours' walking took us to the bottom of the rock, which we carefully scrutinised with the telescope. We discovered that a birch-tree grew out about twenty-five or thirty feet above the eyrie, which we thought it possible to reach. We accordingly started to go a long way round on this mission, and with very considerable difficulty reached the birch-tree, my companion carrying the gun and rope, and I a stout walking-stick. On arriving at the tree,

we sat down to consider our position. Where we sat was a heathery steep sloping bank, eight or ten feet wide, and from the centre of it grew the birch-tree already referred to, which we found to be strong and deeply rooted. Far above us was the steep, rugged, almost perpendicular mountain of rock, intermingled here and there with patches of heather and other hardy shrubs, which caused us to wonder how we ever managed to descend to where we sat. Immediately below us was the birch-tree, and a few feet beyond that was the edge of the precipice, which went sheer down sixty or seventy feet, in the centre of which was the eyrie. At the bottom of this perpendicular part the ground was steep and rocky, similar to that above us already described. Up to this time we had made no arrangements which of us was to go over; but as my companion weighed over fourteen stone, and I under twelve, there was no difficulty in deciding. We threw over some stones, and with giant wings the eagle flew out from the rock. The gun was loaded and put safely down where it could be easily picked up. I then tied the rope carefully round my waist and prepared to descend. Donald put the rope round the tree with the view of relieving him of the strain of my entire weight. I did not look over before starting, or I certainly never would have made the descent. Crawling feet foremost, I at once got out of sight of my companion, and looking down, my experience was anything but pleasant. I have already stated that the precipice was only sixty or seventy feet to the bottom, but the ground below was so steep and rocky for many hundreds of yards far away down into the valley, that it was difficult to know where the precipice ended and the "climbable" ground began. My weight drew the rope up under my armpits, and somehow or other my beard got entangled in the knot of the cord, my head being held tight in an awkward position, which was extremely painful, and prevented me from crying up to give instructions. Not knowing that anything was wrong, Donald lowered away till I got a place to rest my foot. Directly he felt relieved of the strain, he cried over, "Are you at the nest?" For some time I was unable to speak, but getting my beard clear of the rope, I informed him that it was seven or eight feet lower. I could see the sticks

on the outer edge of the nest, but a projecting rock was between me and the centre of it. "Lower away!" I cried, and again, like Mohammed's coffin, I was suspended between heaven and earth.

In a few seconds I got my feet on another ledge, and had little difficulty in getting along to a platform eight or ten feet wide. On the centre of it was a great number of sticks, some of them of large dimensions, being fully six feet long, and as thick as a man's wrist. As some of them were Scots fir, they must have been carried a long distance. Among the sticks was entwined the antler of a stag which had five points. The lining of the nest was composed of heather, grass, and wool, in the centre of which, closely cuddled together, were two little downy eaglets, evidently only very recently hatched. "You will go with me to Liberton, my little friends," I mentally exclaimed; but getting my eyes on the parent birds coming in aerial circles towards the eyrie, I cried up to Donald to be ready with the gun. I also took the precaution of seizing one of the largest sticks and the antler of the stag, and put myself in an attitude of defence. I have never believed in eagles attacking man, but, to tell the truth, I had no desire to risk an encounter in such a position, on the edge of a dizzy precipice. One of the birds came so near that Donald fired a shot at it, which had the effect of making them keep a respectable distance off. Seeing the eagles had no intention of coming nearer, I explored the ledge, which went backwards a considerable distance, and being overhung, formed a sort of cavern. At the back of it I discovered from the excrements that one of the birds had been in the habit of roosting there, while the other was engaged in the process of incubation. A few yards off I saw what evidently was the larder of previous years, as the bleached remains of lambs, fawns, hares, rabbits, grouse, blackgame, ducks, &c., lay around in profusion, while a grouse plucked and partly devoured lay nearer the nest, evidently intended as the rusks of eagle babyhood.

Putting an eaglet in each coat-pocket, I cried to Donald to "haul me up." I felt the rope tighten and pull upwards, but it would not have lifted half my weight. "I cannot move you!" he cried down, "and I am pulling with all my might."

Here was a predicament! What was to be done? The reason, however, of his inability to draw me up was obvious. Above was the overhanging rock, and all the way to where the keeper sat the rope was subjected to severe friction, so that to lift my weight was simply impossible. "I will have to go to the farm for assistance," Donald cried down. "All right," I replied; "be as quick as you can,"—and I was now fated to be left for three hours at least in the eagle's eyrie. I took the eaglets from my pockets, put them again into the nest, and sat down in the farthest corner of the cavern. I thought that as I was partly out of sight, the eagles might come to their young without observing me, and especially as they had seen the keeper leave the place. This, however, they did not do, being evidently aware that I was concealed in the eyrie.

As may be supposed, the hours seemed like days; and as it became very cold, my imprisonment in such uncongenial quarters was anything but pleasant. At last Donald and two shepherds appeared, and when they came close enough for me to shout to them, I expressed my intention of going down to the bottom instead of ascending to the top. It appeared that no more rope was obtainable, and worsted was the only thing that could be got, so they brought several balls in their pockets. The two shepherds remained below, while Donald went away round in order to regain the summit. It took him half an hour to get round, when he lowered a small stone to me tied to double worsted. This I let down in order to see if the rope was long enough to reach the bottom. Discovering it was only thirty feet, I cried to let go the rope at the top, which I pulled down, and let one end drop to the bottom. I now set about securing the other end of it in the eyrie, which was no easy task. Tying it round a huge piece of rock and using two balls of worsted—which I drew up from below—to warp it securely, in order to prevent it from slipping, I prepared to descend.

To go down a rope thirty feet is a simple matter to those accustomed to it, but having ruptured the muscles of my shoulder in Norway eighteen months before, I had not regained the proper use of it, which consequently made it much more difficult. I threw over the stag's antler, pocketed

the two eaglets, and commenced to descend. Simple as it may look, I had great difficulty in getting down. My hands were rubbed and bleeding; my clothes were torn; my limbs were bruised and cut, and I could feel the blood trickling down; and I was several times roughly jolted against the rock. I however got down, but my poor little eaglets were crushed to death, which I very much regretted. I however brought them home, and they are now to be seen stuffed in the Museum of Science and Art. Donald having come round, we had some refreshment, which they thoughtfully brought with them. The rope was left hanging on the face of the rock, and there, I venture to affirm, it is hanging still.

XII.—ON A PECULIAR MODE OF FISHING IN THE ESTUARY OF THE THAMES.

BY MR A. B. HERBERT.

(Read April 22, 1891.)

MY attention has recently been directed to a peculiar and very primitive mode of fishing which is still practised at Southend and other places in the estuary of the Thames, and this may perhaps be interesting to some of our members. It is what we might expect to find among savage tribes, and not in use among the most civilised of nations in the nineteenth century. It has probably been adopted in the locality named from a very remote period. It is at once simple and ingenious, and, I am informed, also very effective. You will see from what I exhibit that it consists of a long line, to which are attached at intervals thinner lines of two strands about six inches long, having at their ends, instead of hooks, thorns of the blackthorn (*Prunus spinosa*). A piece of the twig about the same length as the thorn is left at its base, where the line is fixed in a very simple manner by a loop. The long lines with baited thorns are pegged down in the mud

at low water. The farmers allow the fishermen to cut these thorns from the hedges, and women are employed to bait them at the rate of one halfpenny per hundred, and they earn about sevenpence a-day. The baits used are pieces of thick sand-worms; and the fish taken are flounders, plaice, whiting, codlings, and many other species. You will see that the bait can be swallowed with either the point of the thorn or the other end foremost; but the traction being at the base of the thorn, the moment a strain is put on the line the wood becomes fixed across the gullet of the fish, and the penetrating thorn keeps it immovably in place. The fishermen maintain that the thorns are quite as efficient as hooks, and cost them nothing beyond the trouble of cutting.

A somewhat similar form of gorge-hook is still used in France for taking eels and other kinds of fish. It consists of a needle sharpened at both ends, with the line fixed in the middle. A worm is spitted on the needle, a little of the line being covered by the bait. Going back to remote dates, in the lacustrine dwellings in the Swiss lakes, among many implements discovered, are fish-gorges made of bronze wire called "bricoles." Going back to a still earlier date, we have the stone fish-gorge, found in the valley of the Somme in France, in a peat-bed twenty-two feet below the surface. The age of this peat-bed has been variously estimated,—M. Boucher de Perthes says 30,000 years. The late Sir Charles Lyell and Sir John Lubbock, without too strict an adherence to date, believed that this peat-bed represented in its formation "that vast lapse of time which began with the commencement of the neolithic period." Later authorities deem it not older than 7000 years B.C. In the centre a groove has been cut, the ends of the stone rising slightly from the middle. It must have been tied to a line, and this stone gorge was covered with a bait: the fish swallowed it, and the gorge coming crosswise in the gullet, the fish was captured. There can be little doubt that this is the oldest form of fish-gorge ever discovered.

XIII.—A "COLONIAL" HERBARIUM SPECIMEN.

BY JOHN H. WILSON, D.Sc., F.R.S.E.

(Read April 22, 1891.)

To many people a herbarium specimen is the symbol of soullessness: it pertains to the osteology of botany. Recently a German author spoke of such specimens as "Mumien des Herbars." I hope, however, to show that the epithet is misapplied,—that one may vitalise the "mummies" of the herbarium, and find material for stimulating research and far-reaching reflection.

The specimen now to be described measures only an inch and a half in height, and about the same across, and was recently added to the Herbarium at the Royal Botanic Garden from a private collection. The locality it was gathered in is not given, but for the purposes of this paper it may well be considered British. It bears evidence of some antiquity; indeed it may safely be set down as fifty years since it assumed the handy flat form characteristic of herbarium specimens in general. Age is a minor matter with these, further altering their form and texture very little indeed.

It will be remembered that Robert Dick had pleasure in thinking of the preservation of one specimen for a much longer period than fifty years, thereby perpetuating to a corresponding degree the memory of his friend, Charles W. Peach, long a respected member of this Society:—

"Oh, gin ye were an alpine plant
That grew upon the mountains high,
An' I a-wanderin' found the plant
The little mossy burnie by!

How I wad joy, if ye did 'scape
The wintry winds and storms severe,—
I'd pu' and put ye in my cap,
An' dry ye, for a thousand year!"

Our specimen will be found to present a more complicated economy than the poetic naturalist's alpine plant. It is

labelled "Isthmia," and is thus intended to be classified with diatoms, — but a very casual inspection discloses the fact that it illustrates more than one organised form. The first glance conveys the impression that it is meant to go with the sea-weeds, seeing that what is actually fixed to the paper, and is conspicuously the seat of the "colony," is one of the red algæ, *Delesseria alata*. First let us look at this most prominent element of our specimen. In all probability the *Delesseria* grew on some larger sea-weed, from which it was forcibly removed by a storm, or by the hand of the sure-footed prying collector. Its position on another sea-weed does not imply parasitism, even although its tissues are intimately in conjunction with those of the obliging host. Commensalism, of which this is an example, is very common among marine algæ, and very striking in many cases it is. Our *Delesseria* is one of the great family of the red sea-weeds, so named on account of their colour, which is due to the presence of a substance called phycoërythrine. The group includes those with shades of colour varying from rose to violet. The red colour-stuff can be dissolved out by cold fresh water, in which it will appear carmine-red in transmitted light, and yellow or green in reflected light. It must be borne in mind that chlorophyll is also present in the plant, but that it is so mixed with and concealed by the red material as to be invisible till the latter is removed. Our species branches copiously in a dichotomous and interruptedly pinnate fashion to form a bilateral thallus. Thickened mesial and oblique lines look like midribs and nerves, but of course these are not to be thought analogous to the structures so termed in an ordinary leaf, seeing that in our sea-weed there are no vascular tissues such as go to form the strengthening elements of higher plants. Two methods of propagation exist in *Delesseria*. One is by tetraspores, which are developed in sporangia occurring imbedded irregularly in the thallus along the midrib of the end segments or terminations of the pinnæ, and on special small "leaflets." The tetraspores are not endowed with means of locomotion, and are dependent on currents for their distribution. The other method is by carpospores, which develop in special receptacles — cystocarps — as a consequence of fertilisation by spermatia. The cysto-

carps, mostly single, occur attached to the midribs of the terminal segments, and on wart-like swellings of the "leaflets." The carpospores, like the asexual tetraspores, are not endowed with motion.

Attached to the Delesseria at two points one can see small specimens of *Ulva*—representatives of the great division of the green sea-weeds, such as have the chlorophyll unmixed with red material. *Ulva* is a green strap-like sea-weed, tapering at the base, where it is attached by a small disc to its support. Propagation takes place by various methods. One is by swarmspores—green round or oval bodies provided with cilia, by which they are propelled through the water. Two of them meet and fuse, the result being a body capable of growing up into a new thallus. Another method is by zoospores, which appear in specially modified cells of the thallus. Lastly, certain cells resembling *Protococcus* or *Palmella* are set free by degeneration of the tissues, and these either grow directly into the normal thallus, or they develop zoospores which produce the thallus. Minute examples of two other red sea-weeds were discovered—viz., *Plocamium* and *Polysiphonia*—into the life-history of which we need not enter.

We now come to look at the organism for whose sake the specimen had been kept. The individual examples of *Isthmia* are, like other diatoms, very minute. It is possible to detect them with the naked eye as mere shiny specks. Collectively they form greenish tufts at the extremities of the branches of the *Delesseria*. They attach themselves to this and to each other by an exudation of mucus (protoplasm), which preserves tenacity enough to enable the observer to lift them about in bunches. Their outline and method of attachment are quite characteristic, and familiar to microscopists. As is well known to most naturalists, the framework of the diatom is of silicic acid (flint), and it is very surprising to see how beautifully geometric that structure is, and how faithfully a specific pattern is followed. One is apt to forget, when viewing the delicate markings of prepared diatoms under a high power, that these are the outcome of vital influences at work in the protoplasm of the plant, and not in any sense carvings,—a notion which asserts itself very naturally. The mode of propagation is peculiarly interesting. In construction the

flinty skeleton of the diatom—the frustule—reminds one of the condition of two joints of a closed telescope, the margins or lateral walls of one half completely overlapping those of the other. Under the vital action of the protoplasm the inner half slips out of the embrace of the outer, and both acquire a new wall at their unprotected face. The inflected edge of the new walls are embraced by and telescope with the existing margins of the respective halves. It thus follows that the individuals of succeeding generations derived from the series of inner halves become smaller and smaller. A stage is reached, however, when the fate of being lost in infinity of subdivision is averted. The contents of valves at their minimum emerge, and either themselves grow into larger proportions, or enter into conjugal fellowship with others of a like nature to form large cells known as auxospores. These secrete a silicious framework of the maximum size, and inaugurate a new cycle. Diatoms are mostly buff-coloured, by reason of the presence of a substance termed diatomine, which hides the chlorophyll. They are generally endowed with somewhat limited locomotion, which is understood to be effected by the protrusion of protoplasmic processes, recalling pseudopodia, along certain definite lines. Besides the comparatively large diatom *Isthmia*, there are at least four others in company with it. A minute elliptical species in great numbers, lying like scales on many parts of the specimen, is *Cocconeis*. The others, including *Grammatophora*, are in closely jointed or loosely linked chains or rows.

So much for the flora of our colony: let us look now at its fauna, taking the lowest forms first. At many points there will be found microscopic spiral white shells, simulating those of shell-fish. They belong to foraminifera—organisms internally little better to all appearance than specks of jelly. From the mouth of the calcareous shell there protruded, when the inmate was in life, long, delicate, occasionally anastomosing strands of protoplasm (sarcode) covering the shell, and feeling about, amœba-like, in quest of food. They also acted as feet, enabling the shell-bearer to move about. The mode of reproduction is not well understood. Foraminifera, small as they are, have played an extremely important part in the upbuilding of the earth's crust. They form large masses of

rock—not only such rocks as the microscope reveals to be composed of them, but also such as have become changed, so as no longer to show their forms. Large tracts of the bottom of the Atlantic, at or about 2400 fathoms, are covered with the spherical tests of the now familiar form, *Globigerina*, the deposit being termed *Globigerina* ooze.

Here and there on our specimen the microscope also detects groups of transparent threads with the vestiges of terminal cups. These are the remains of the once extremely sensitive and active infusorian, *Vorticella*. Infusoria include many forms so closely akin in form and function to certain minute algæ and fungi, that it is a matter of extreme difficulty to distinguish where the boundary-line between the plants and animals should be fixed. *Vorticella*, the bell-animalcule, is distinct enough. Elevated on a delicate stalk, which is capable of extremely rapid spiral contraction, is a bell-shaped head, having a crown of cilia which vibrate in such a manner as to convey the idea of continuous rotary motion. At one side of the crown there is a mouth, into which food is swept by the vortices caused by the coronal cilia. A ciliated passage leads inwards and terminates blindly. The food is engulfed by the gelatinous body-substance, and then digested. A nucleus and a vacuole can be made out, the latter showing pulsating contraction and expansion. Multiplication takes place by simple fission of the bell, or by conjugation between individuals unequal in size, followed by division.

Hitherto we have dealt with animal forms too minute to be seen by the naked eye; now we have to deal with a relatively huge structure, forming, indeed, the most prominent object on the sheet. It is a sponge known as *Grantia compressa*, hanging from the *Delesseria* as a white, leathery, flattened sack, half an inch in length. Mr Lindsay has so recently described this species in his most interesting paper on the sponges, that it is unnecessary to dwell on its structure. Our ideas of sponge structure are generally taken from the contemplation of the household article, and most people have therefore a difficulty in believing that a sponge may be found to be virtually composed of sharp, three-rayed, calcareous spicules. Such, however, is really the condition of *Grantia*. In the living state of the sponge, as was pointed

out in the paper just referred to, currents are set up by the lashing of cilia passing out from cells which have been regarded as individually bearing a very close affinity with certain infusoria. Living sponges in a vessel soon deprive the water of its oxygen—a desideratum supplied in a reciprocal way by growing algæ. The reproduction of the sponge is accomplished by "eggs" or gemmules, and by fertilised ova which segment and become free-swimming larvæ.

The naked eye can easily discern a few shining beaded threads adhering to the alga. They are the chitinous scaffolding of two zoophytes, *Obelia* and *Sertularia*. In *Obelia* there are beautiful transparent cups on ringed stalks, which branch from a common stem. The cups in the fresh state contain a flower-like organism which can protrude itself, and spread out a whorl of waving tentacles to capture food. The mouth is situated in the centre of the whorl, and it communicates with a ciliated canal which runs through the stem, and connects all the zooids (polypites) in a common nutritive system. In certain of the cups there are developed medusa-like buds, which have a nervous system and organs of sense and reproduction. The buds break away and swim freely in the sea, and give rise ultimately to new stationary colonies. The other hydroid zoophyte present is *Sertularia*, in which the cups are sessile, and arranged on opposite sides of the stalk. In reproduction the generative buds do not break away and become free as in the *Obelia*.

The last items in our "colonial" census are also known as zoophytes, and, like those already described, have often found their way into herbaria as sea-weeds. Covering the rounded stem of the *Delesseria* is an elegantly reticulated white meshwork, the protective skeleton of a Polyzoan known as *Membranipora*. The spaces of the meshwork are the cells which separate zooids inhabited. These did not communicate with each other like the zooids of the hydroid zoophytes. They are much higher in organisation; indeed it surprises one at first sight to find them classed higher in the scale than the shell-fish, and almost at the top of the invertebrate series. The reason becomes apparent when the microscope reveals the fact that they have organs betokening high development. Each normal zooid has an alimentary canal and a nervous system.

Heart and blood-vessels are absent, respiration being effected by means of finely ciliated tentacles, borne either on a circular or crescentic apparatus—the lophophore. The ciliary action serves to drive food particles into the mouth, which is placed in the centre of the lophophore, and there are special muscles for pulling this organ within the protective cell. In some of the group certain zooids become wonderfully metamorphosed, so as to resemble the beaks of birds, which grasp small worms and the like, and hold them till they decompose, and their remains are swept into the mouths of the zooids. In others, the metamorphosis results in the formation of long, very active whips, which are understood to serve a similar purpose with the beaks. The reproductive elements are developed internally, and when mature pass into the body-cavity, where fertilisation takes place. The larva, having undergone segmentation, passes out in a ciliated condition, to live for a time a free and roving life. By-and-by it settles down, buds, and forms the network described. A small portion of another species was found on the alga. In this the cells were oval, hyaline, and connected together like a chain.

We have thus seen that, instead of having one plant on the sheet, as is ordinarily the case, we have had ten representatives of the plant kingdom, and, besides, seven of the animal kingdom. The former are members of two great families, the latter members of five. Think of the history and daily doings of that colony: seventeen species struggling for existence in less than two cubic inches of sea! Reciprocity is at work, the plant members agreeing to exchange the necessaries of life with the animal members. Think, too, of the rising generation setting out to occupy new regions. All are moving—a few by currents, the most by apparatus of their own. What a stir there must have been sometimes around this quiescent Delesseria—floating tetraspores, carpospores, auxospores, gemmules, and frustules, mingling with the dashing swarmspores, zoospores, free vorticellæ, sponge-larvæ, medusa-buds, and young polyzoans, the commotion being increased by the currents caused by the sponges, bell-animalcules, and zoophytes! And, after all, these form only a fraction of the crowd that would sometimes be there, as all know who have tried to identify the organisms got by dipping

a jar into the summer sea. Let us, therefore, for the sake of its record, regard our mummified herbarium specimen with some interest. It is not the fault of the specimen, but our own, if we are not benefited by the contemplation of it. We are not touched by a great poem if we do not understand the language it is written in, nor are we bettered by the possession of such objects as this we have handled if we do not know to some extent their life-history. And most will agree that a day at the sea studying its living inhabitants is better than a thousand in the mausoleum where only their remains and their names are preserved.

XIV.—*BEAR AND WOLF CHILDREN.*

BY MR SYMINGTON GRIEVE.

(*April 22, 1891.*)

MR SYMINGTON GRIEVE brought before the members of the Society the following question: "Are Human Beings ever reared by Bears, Wolves, or other Wild Animals?" Referring in the first place to the various half-mythical stories recorded in history of children having been reared by bears or wolves, Mr Grieve went on to speak of the widely spread belief in India regarding "wolf-children," and adduced the testimony of Sir William Sleeman and others on the subject. Mr Grieve next mentioned that he had himself seen a living example of a reputed "wolf-child," while travelling in India in November 1888. The history of this individual, now grown to manhood, seemed to be well authenticated. He was then living at St John's Orphanage for Famine Children at Sikandra, near Agra. Mr Grieve had taken much interest in this case, making inquiries on the spot as to the various circumstances connected with it. He was then led to study the whole subject somewhat particularly, and now brought it before the members of the Society, in order to elicit their opinion regarding it, as well as to gain further information upon it. Mr Grieve mentioned incidentally that Sir William

Hunter evidently believed in the existence of "wolf-children," and quoted a passage from that author's 'Indian Empire' (p. 518) in proof of the assertion. Mr Grieve also stated that, from inquiries he had made when in Agra, he had no doubt the story of a wolf-boy captured near Gwalior about August 1888 was quite true, as the poor child was taken to the hospital, and died a few weeks after admission.

In the discussion which followed several members took part, the general feeling of the meeting evidently being, that while the rearing of human beings by the lower animals might not be held to be impossible, yet fuller and more trustworthy evidence was required before it could be regarded as an indisputable fact.

[Since Mr Grieve introduced the above subject at the April meeting of the Society, his attention has been drawn to a valuable paper on "Wild Men and Wolf Children," which appeared in 'Chambers's Journal' for June 25, 1887, and which he desires to notice here as being well worth perusal.]

XV.—LIST OF PLANTS GATHERED AT EXCURSIONS, 1890.

BY MR ANDREW MOFFAT, SECRETARY.

THE Excursions of the Society for 1890 were singularly unfortunate in respect of weather and the small attendance of members and friends. There were, however, two notable exceptions—the Excursion to Inverkeithing and the North Ferry Hills, and that to West Linton, both of which were favoured with fine weather, a very good attendance, and an exceedingly rich gathering of plants. The railway station at North Queensferry not having been yet opened for traffic, the party had to go on to Inverkeithing, and then find its way back to the Ferry Hills. Owing to this, many good plants growing in the immediate vicinity of North Queensferry were missed; but this was compensated for by the time afforded to botanise in the neighbourhood of Inverkeithing Bay.

In the following list most of the more common plants are omitted. In a few cases plants here named have been already mentioned in former lists as growing in the same localities.¹ Plants marked thus (*) were gathered either in the marsh or among the *débris* to the south of Inverkeithing Bay; those marked thus (†), on that portion of the Ferry Hills nearest Inverkeithing, and looking eastward towards the Firth; and those marked thus (‡), on the moor by the side of the road, midway between West Linton and Dolphinton.

- | | |
|--|--|
| * <i>Ranunculus sceleratus</i> L. | * <i>Lepigonum marinum</i> Wahl. |
| <i>R. Flammula</i> , var. <i>reptans</i> L. ² | *† <i>Sedum villosum</i> L. |
| <i>R. hederaceus</i> L. ³ | † <i>Scandix Pecten-veneris</i> L. |
| † <i>Arabis hirsuta</i> R. Br. | <i>Sambucus Ebulus</i> L. ⁵ |
| * <i>Cochlearia officinalis</i> L. | † <i>Sherardia arvensis</i> L. |
| * <i>Cakile maritima</i> Scop. | † <i>Valeriana dioica</i> L. |
| † <i>Reseda Luteola</i> L. | * <i>Aster Tripolium</i> L. |
| † <i>Viola lutea</i> Huds. | † <i>Antennaria dioica</i> Gäert. |
| † <i>Polygala vulgaris</i> L. | † <i>Scrophularia nodosa</i> L. |
| * <i>Sagina maritima</i> Don. | † <i>Pedicularis sylvatica</i> L. |
| * <i>Arenaria peploides</i> L. | † <i>Veronica officinalis</i> L. |
| † <i>A. serpyllifolia</i> L. | † <i>Pinguicula vulgaris</i> L. |
| † <i>Hypericum perforatum</i> L. | † <i>Primula farinosa</i> L. |
| † <i>Geranium dissectum</i> L. | * <i>Glaux maritima</i> L. |
| * <i>Trifolium striatum</i> L. | * <i>Armeria maritima</i> L. |
| * <i>T. procumbens</i> L. | * <i>Plantago maritima</i> L. |
| † <i>Lotus major</i> Scop. | * <i>Suaeda maritima</i> Dum. |
| <i>Vicia sylvatica</i> L. ⁴ | * <i>Salicornia herbacea</i> L. |
| ‡ <i>Lathyrus macrorhizus</i> Wimm. | † <i>Orchis latifolia</i> L. |
| † <i>Spiræa Filipendula</i> L. | * <i>Allium Schœnoprasum</i> L. |
| † <i>Agrimonia Eupatoria</i> L. | * <i>Triglochin maritimum</i> L. |
| † <i>Alchemilla arvensis</i> L. | * <i>Eleocharis palustris</i> Br. |
| ‡ <i>Potentilla Comarum</i> Nestl. | * <i>Carex stellulata</i> Good. |
| † <i>Rosa spinosissima</i> L. | * <i>C. glauca</i> Scop. |
| * <i>Montia fontana</i> L. | ‡ <i>Botrychium Lunaria</i> Sw. |

¹ For former lists, see vol. i. pp. 254, 298; vol. ii. p. 79.

² Shores of Loch Leven. Mentioned by Lightfoot (1792) as growing in the same locality in his time. Said only to be found here and at Windermere.

³ Ditches near West Linton.

⁴ Abundant on the banks of the Lyne, near West Linton.

⁵ Found well established on the railway embankment west of Inverkeithing bay. Before the construction of the railway it was growing in a hedgerow occupying as near as possible the same site.

ANNUAL BUSINESS MEETING.

THE Annual Business Meeting of the Society was held in 20 George Street on the evening of Wednesday, 28th October 1891,—Dr William Watson, President, in the Chair. The Secretary reported that 15 general meetings of the Society had been held during the past Session, 6 of which had been indoor and 9 field meetings. The following are the dates and localities of these meetings—viz. :

INDOOR MEETINGS: 1890—26th November, 24th December; 1891—28th January, 25th February, 25th March, and 22d April. FIELD MEETINGS: 1891—9th May, Polton and Roslin; 16th May, North Berwick; 23d May, Newbattle; 30th May, Kinghorn and Seafield Tower; 6th June, Haddington; 13th June, Culross; 20th June, West Linton; 4th July, Gosford and Aberlady; 18th July, Duddingston.

[In addition to these outdoor meetings, on the 25th of July the Council and a number of the members met at a garden-party, on the invitation of Charles Jenner, Esq., at Easter Duddingston Lodge, where luncheon and tea were provided for the company, and the afternoon was pleasantly spent in examining the floral treasures of this famous garden.]

The Treasurer reported that the income for the past Session, including balance from last account and donations to the Publication Fund, amounted to £49, 13s. 3½d., and the expenditure to £48, 4s. 9½d., leaving a balance in the Treasurer's hands of £1, 8s. 6d. It was explained, however, that while these figures represented the actual receipts and disbursements, there was still due the sum of £11, 12s. on the printing account. A small committee was appointed to take steps to wipe off, as soon as possible, this adverse balance.

It was reported that the membership of the Society for the past Session was 167, as against 186 for the previous Session,—24 members having withdrawn and 5 members been added to the list during the year, showing a decrease of 19. A discussion took place as to the best means of bringing the income and expenditure of the Society more into accord, in view of the diminution of the membership that has been reported annually by the Secretary for the past few years. It was

finally decided that, rather than curtail any of the operations of the Society, the members should endeavour to make the benefits to be derived from the Society more widely known, in order to secure if possible, during the next Session, a large increase to the membership.

The election of Office-Bearers was the next business, when, after the various vacancies had been filled up, the complete list stood as follows:—

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Mr T. B. Sprague, the newly elected President, then took the Chair, and briefly thanked the members for the honour done him in calling him to this honourable position in the Society.

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- Sprague, T. B., M.A., F.R.S.E., 29 Buckingham Terrace.
- Sprague, Mrs T. B., 29 Buckingham Terrace.
- Steele, Adam B., 10 Comely Bank.
- Steele, Miss, 33 Upper Gray Street.
- Stevenson, Miss, 2 Albert Place.
- Stewart, Miss, 7 Gt. Stuart Street.
- Stewart, Robert, S.S.C., 7 East Claremont Street.
- 140 Stewart, William D., 62 Princes Street.
- Stiell, William, 9 Royal Circus.
- Sutherland, John, 21 Brougham St.
- Tait, John Scott, C.A., 8 Claremont Terrace.
- Tait, John W., 68 Montgomery St.
- Taylor, William, M.D., 12 Melville Street.
- Terras, James, B.Sc., 40 Findhorn Place.

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| <p>Thomson, Thomas, 11 Dundonald Street.</p> <p>Tod, Andrew, Elmpark, Ettrick Rd.</p> <p>Turnbull, George, 16 Thistle Street.</p> <p>150 Usher, Andrew, Blackford House.</p> <p>Walcot, John, 50 Northumberland Street.</p> <p>Walker, David, 61 Great King St.</p> <p>Wallace, Prof. Robert, University, Edinburgh.</p> <p>Wallace, William, St Boswells.</p> <p>Walton, Frederick, 40 Frederick St.</p> <p>Watson, Dr William, Lockharton, Slateford.</p> | <p>Watson, Mrs, Lockharton, Slateford.</p> <p>White, Miss, 7 Lutton Place.</p> <p>Wilson, George A., 46 Queensferry Street.</p> <p>160 Wilson, James T., Restalrig House.</p> <p>Wilson, J. H., D.Sc., F.R.S.E., Royal Botanic Garden.</p> <p>Wilson, Miss Katie, 2 Archibald Pl.</p> <p>Wood, T. A. D., F.S.A. Scot., Viewforth, Brunstane Road, Joppa.</p> <p>Woodhead, Dr G. Sims, London.</p> <p>Wright, Thomas, 6 Greenside Place.</p> <p>Yorkston, James, 3 Grange Road.</p> <p>167 Young, David E., 131 Mayfield Rd.</p> |
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