A drawing was also shown of the rare and beautiful Argentine (*Scopelus*), that was captured in Milford Sound, by the author, which, under former classifications, would have formed a fourth Salmonoid fish, but the genus has been separated from this family in recent works.

THIRD MEETING. *July* 10, 1870.

Hon. Mr. Mantell, F.G.S., President, in the chair.

The Chairman announced that this meeting had been specially convened, to discuss the very important question of the best method of preparing the Native Flax. He was glad to see that several of the Commissioners appointed last year to enquire into this subject were present; but before asking them to favour the meeting with the results of their investigations, he would call on Dr. Hector to describe his latest experiments.

Dr. Hector opened the discussion by giving a minute account of the structure and physiology of *Phormium tenax*, Irish flax, Manilla, and other varieties of fibre, their difference of texture and relative strengths, and to assist in giving a better illustration, made use of diagram drawings from microscopic examinations. The Irish flax plant has a woody texture, chiefly in the centre, the useful fibre being released from an intermediate layer between the hard woody centre and the outer cuticle; and the only difficulty in the production of this fibre is in the process of separating it from the core and the epidermis. The fibre of the New Zealand flax, unlike that of the Irish variety, is not contained in the stem, but in leaves which spring direct from the root and grow for years before a flowering stock is sent up. These leaves are protected by a peculiar hard outward covering that enables them to resist the effects of water, and beneath which lies the soft and succulent tissue containing the fibre. The strength of the various fibres appears to depend in a great measure upon the amount of lateral adhesion of their ultimate fibrillæ, which prevents them drawing away from each other; and the chief object therefore to be sought for, is some process by which to separate the bundles of minute fibres, and at the same time free them from the cellular matter within which they are embedded, without breaking or injuring the fibre in any way. Drawings were referred to, made from samples of New Zealand flax dressed by several different processes, both by mill and by hand, showing the frayed ends of the ruptured fibres, and indicating very clearly the effect on the fibre of the peculiar

dressing to which it had been subjected. The samples had all been broken under water, so as to avoid any influence the air might exercise. The result was that the fibres were distinguishable into two classes — those that frayed out, and those that broke square across. The frayed samples were of flax that had been prepared by chemical means or retting, which implies chemical change, but exhibited the same kind of lengthy filaments at the point of break as that shown in the Irish flax, which suggested the idea of having been drawn out of a centre. The best machine-dressed samples, from Auckland, had more the appearance of having been cut. A sample of Manilla, subjected to the same test, also showed the same abruptly broken fibre as the former. A sample prepared by Booth's process—which professes to be but a mechanical adaptation of the Maori process, and in which india-rubber tables are supposed to possess the flexible elasticity of the Maori's knee—was a closer approach to the frayed appearance of the hand-prepared. A sample of Journeaux's modified retting process also showed the frayed character. The general deduction, however, he thought might be drawn from the experiments which have been made is, that those fibres which break abruptly will stand a heavy direct strain, while the others, having more flexibility, will be found better adapted for weaving and spinning into rope. Attention was called to a sample of Maori dressed flax broken by a strain of 300 lbs., which presented a bottle-brush-like end; and also to a sample of Manilla broken by a weight of 179 lbs., which broke off like a stick, or rather like whalebone. Allowing for the increased strength given to the Maori flax by the lateral adhesion of the fibre through the presence of gum, he thought that the strength of the ultimate fibre of each might be the same. Machine dressed flax, however, and Manilla, must be classed together. Particular attention was called to the fact that flax, according to the process of dressing employed, is capable of being made available for articles of greater value than mere ropes and gunny-bags. At present, the commissioners have been chiefly engaged in preliminary investigation with a view to testing, by a regular series of experiments, flax prepared by the different mills. In describing a means by which a variety of textile fibres had been tested, each sample having been laid up in the same way as nearly as possible, Dr. Hector said that while Manilla hemp broke with a strain of 188lbs., and Europe rope 135lbs., the New Zealand flax (Maori dressed) only parted at a strain of 300lbs; a sample of Journeaux's process yielded at a pressure of 238 lbs.; several other samples kept close to the Manilla, and in one instance—that of Demarque's—

the strain stood was rather over 200 lbs; the remainder marking from 150 lbs. to 180 lbs. However, he thought such data should not be regarded as absolutely correct, but rather as indicating general results. As an illustration, a sample of flax was tested by means of a spring balance, to which was attached a clip that grasped a twisted hank of flax (a South Island sample); the other end was stretched downwards by a screw so arranged as to mark the weight on the dial of the spring balance. The sample broke after marking a strain of 225 lbs. Extracts from the results of similar experiments in England were read which put silk at 34, New Zealand flax at 23, English hemp at 16, English flax at 11, showing New Zealand flax to be a stronger vegetable fibre than any other in the market. Dr. Hector said he was once of the opinion that the best way to treat flax was by pressure or hammering, but he had, since reading Mr. Nottidge's paper on the subject, come to the opinion that the better way would be to divide the fibre by mechanical means without any pressing action, so that when subsequently subjected to a solvent, the water might find its way between every fibre, exactly as retting Irish flax. He believed this had been already done on a small scale, but the process was worthy more attention than it had received from manufacturers.

Mr. Macffarlane, M.H.R., Chairman of the Flax Commission, said it was once matter for enquiry whether flax would grow from seed; but after a great number of experiments it had been ascertained that it would do so, and more readily than was generally expected. The natives themselves never grew it from seed, as they had always a sufficient supply of roots to transplant; besides, it gave them the advantage of a couple of years' growth or more. After experimenting with various kinds of machines in Auckland, they had settled pretty generally on the modifications of the fluted roller principle. After passing through the machine the plant was washed and bleached, which took from fourteen to sixteen days, according to the weather, and afterwards put through the scutcher, when it was considered fit to pack for market. To show the advantage of the washing process—which was best done in such water as that of a mill dam, as running water was found not to answer so well—he mentioned that on taking out the flax after a few seconds' immersion, a large patch of blood-coloured matter clouded the water. The process was completed after three immersions. If the flax were sent out without being cleansed in that manner it bore a yellowish appearance; and great quantities of it had from this cause become unfit for certain purposes afterwards. When they, in the North, found that flax-dressers in the South were

resorting to chemicals, they also altered their process somewhat; though they still adhered to machines, they afterwards used the retting or fermentation process, and by that means were now producing an article as soft and as free from gum as any to be shown; and he thought they were coming round to the idea that the true process lay in a combination of the two different modes. The commissioners had tested a sample produced by Dr. Florence, of Canterbury, which had been put twice through the stripping machine, and then in the solvent, the exact nature of which was the secret of the inventor; and had tested another sample which had been three times through the machine; but much stress was not placed on these experiments. The commissioners were still engaged in experimenting, and the result of course would be made public. A bag was shown, the property of Mr. Kebbell, that had been made fourteen years ago, and that had been in constant use all that time; and to all appearance it was equal to another fourteen years of the same usage. There was no doubt that New Zealand flax was well adapted for far higher purposes than it now served, and by giving the necessary attention and perseverance to the matter, we should yet command the London market, where at present a combination existed against us. But that combination we could break down by sending a good article, and in sufficient quantity, which would ultimately drive some of the other fibres out of the market.

Mr. Travers, M.H.R., in the course of some remarks, said that one of the earliest and best samples of flax he had seen in the colony, was prepared by a Mr. M'Glashan; the process was, in its main features, the same as was suggested by himself in a paper read by him before the Philosophical Society of Canterbury. That process was one of the simplest, and produced a fibre for ordinary manufacturing purposes better than that by any other process now in use. It was safer, freer from gum, did not so soon become harsh to the touch, and lasted longer. One feature of the process was that from the time when the fibre was first cut it was never allowed to become in any degree dry. It was not bruised or beaten, but simply, after having been boiled with an alkali derived from the ashes of the wood which boiled it, subjected to the compression of grooved rollers. The outer cuticle being then broken up, was washed away in a running stream. As Dr. Hector had demonstrated that the gum was soluble in water, that, therefore, seemed to him the best way which, by the quiet and simple action of running water, got rid of the extraneous matter. He had examined a great many machines, Auckland and others, and he thought them wasteful, clumsy, and expensive, when compared with the process of Mr. M'Glashan. Mr. Travers here read an extract

from a book by Mr. Dixon, stating that the Society of Arts in England, had actually offered a reward of fifty guineas for the best machine for the preparation of New Zealand flax; and also that from a sample of 50 lbs. tested at home, 17 lbs. of long fibre were produced and 6 lbs. of an inferior sort, but 23 lbs. in all of valuable fibre. No description, however, of the kind of flax experimented upon was given, but he supposed it to be dry leaf. Because New Zealand flax was connected with gummy matter, to get rid of which was our main desire, it must not be supposed that other fibres had no gummy substance; all were affected more or less in that way. Mr. Travers then related an anecdote of flax dressing. The first Napoleon, anxious to counterbalance the decided lead England had taken in the cotton manufacture, sought to encourage the manufacture of flax, and offered a reward of two million francs for the best process. This reward stimulated the ingenuity of a M. Girard, who produced a machine; but after doing so he could find no one in France with sufficient enterprize to put his plans in motion; however, he was at length lucky enough in finding what he wanted in the town of Leeds. He (Mr. Travers) had heard of an exploding process with carbonic acid gas being tried, but it had not been very successful. The people of New Zealand should not be anxious so much to produce a large quantity of fibre, as to produce a quality that would be suitable for the finer textile fabrics, and that could only be done by removing the gum in the leaf before the fibre was sent home to Europe. New Zealand flax, he thought, had no advantage over Irish flax; and that, if we were forced to cultivate, the latter would perhaps be found preferable, as it was not an exhausting crop—at least not more than crops of any kind usually were. It yielded, it was true, a long fibre, if that was of any particular value, and it was perennial. New Zealand flax must be cut at its proper season to obtain it in its greatest strength. In flax manufacture he thought the returns might be made much larger if attention were turned to that portion of the leaf which yielded the best fibre; weight of material should not be looked to so much as excellence of quality. And to show the enormous importance of the flax trade in England, returns proved that the imports of flax from foreign countries, in 1853, amounted to 94,000 tons, which at an average price of £110 per ton, showed that for that year the large sum of £10,000,000 had been paid to foreign producers for a single article.

Mr. Charles Graham, M.H.R., explained the *modus operandi* of the Booth machine, which he said consisted of a double set of rollers, formed of yielding segments resembling the key board of a piano. By that

means allowance was made for the irregular thickness of the leaf, each part of which was subjected to an equal pressure while being scraped, the first set scraping one side of the leaf, the other side being afterwards scraped by the second set of rollers.

Mr. J. C. Crawford said that as the general opinion seemed to point to the retting process as the proper one to be adopted, he might mention that all the necessary information regarding it would be found in "Ure's Dictionary of Arts, Manufactures, and Mines." As to the exhausting nature of the Europe flax, he thought the rotation at home was once in nine years—that is before the land was brought into a fine state of tilth; so that if we wished to grow Europe flax in New Zealand as they did in Ireland, we could only expect to put in a crop once in nine years. While at Manilla he remarked that all their fine textiles, such as cambrics and dresses, were made from the pineapple fibre, and at an enormous expense, and not from the ordinary fibre used for rope.

The Hon. Mr. Hall wished to know whether the attention of the Commissioners had been directed to the matter of paper manufacture.

Sir David Monro said he had been informed by a young friend of his who had got most authentic information on the matter from people in England, that the price of New Zealand fibre was so high as to preclude it entirely from that manufacture. He wished to know at what period of its existence the flax plant yielded its best fibre, as he thought the question one of equal importance with the separation of the fibre. He had frequently observed, as no doubt others had, that the strength of flax was not the same at all periods of the year, as in the early part of the summer, when it seemed to have less tenacity.

Mr. Macffarlane said the commission had directed their attention to that matter, and the result of their observations would be found in their report when laid before the House of Representatives. The plant, in its earliest stage, shot up one leaf at a time until there were six or eight. In about four or five years the plant reached maturity, when the outer leaves began gradually to decay; and one reason for the depreciation of our flax in the English market was, that much of those dead and dying leaves had been sent home amongst the first shipments. As to whether the plant could be cut down all the year round, he believed the Maoris never cut it at the period spoken of, but he was of the impression that as soon as any one began to cultivate the plant the leaves might be cut down as they ripened.

Mr. Graham said there was no point on which there was so much difference of opinion; but on one point all were unanimous, viz., that,

like the American aloe, as soon as the plant flowered it began to die, and therefore fibre derived after flowering time was inferior. As to the exact season when the fibre was at its best, he found that a much vexed point, and one that would take years to determine.

Mr. Smythies suggested the necessity of experimenting by selection and inoculation of the flower.

Mr. Travers mentioned a fact that came under his observation in Canterbury that might be worthy of attention. He had seen there what was called "half-stuff," of pulpy consistence, that could be produced very cheaply, and seemed to be well adapted for the purpose of paper-making.

Mr. Macffarlane said the article would only be admitted as a manufactured article.

The Chairman thought a good many seemed to forget that Sir Charles Clifford was one of the earliest flax manufacturers in the colony, and carried on business on the beach as Clifford and Partridge. As to the age of leaves, he had seen excellent fibre produced from leaves that were lying withered on the ground. The idea that the plant died after flowering time was no doubt very sentimental, but he did not believe in it for all that.

FOURTH MEETING. *July* 17, 1870.

Hon. Mr. Mantell, F.G.S., President, in the chair.

1. Dr. Hector read a paper for Mr. Duigan, which went to show that the earth of New Zealand is as good a conductor of electricity as that of any other country. The paper elicited some comment, some thinking the weather, and the nature of the soil in particular localities, influence electrical power in a great degree.

2. Mr. Potts read a paper "On the Great Auk, or Northern Penguin," (see *Transactions*,) and exhibited a drawing of an egg of that variety, which he possesses. Although the bird at one time abounded at the Orkneys, Auckland, and Farroe Islands, it is very rare now, if, indeed, it is not entirely extinct, a view which is shared by Professor Owen and other eminent naturalists. They base their belief chiefly on the fact, that notwithstanding the many expeditions that have been sent out during late years, no mention has been made of the Great Auk in any of their records. There are those, however, who still believe that the bird is not yet extinct, and think that it may have retired to the lonely and surf-lashed Skerries in the Northern Sea. So high a value is set upon these eggs, owing to their exceeding rarity, that one *virtuoso* gave £30 for a