The Field Naturalists' Club, initiated at one of the meetings of the Society, has been actively at work during the past season, and a report of its proceedings has been prepared by Mr. P. Thomson, the Honorary Secretary of the Club.

Election of Officers for Year Ending 30th June, 1873: *President*—His Honour Mr. Justice Chapman; *Vice-Presidents*—Rev. Dr. Stuart, J. T. Thomson, F.R.G.S.; *Council*—Professor Black, M.A., D.Sc., Professor Shand, M.A., Dr. Deck, T. M. Hocken, M.R.C.S.E., R. Gillies, H. Skey, P. Thomson; *Hon. Treasurer*—J. S. Webb; *Hon. Secretary*—D. Brent, M.A.

1. "On Barata Numerals," by J. T. Thomson, F.R.G.S. (See *Transactions*, p. 131.)

2. "On Local Variations of Atmospheric Pressure dependent on the Strength of Winds," by J. S. Webb. (See *Transactions*, p. 106.)

A collection of plants from Auckland, presented by Mr. T. Kirk, F.L.S., was laid on the table, also a collection of ferns made by Mr. P. Thomson during the past season.

Third Meeting. *18th August*, 1872.

His Honour Mr. Justice Chapman, President, in the chair.

The President gave the following

ADDRESS.

We meet this evening to inaugurate the fourth year of the Otago Institute. And first, I have to thank you for again electing me President. At the same time, you must permit me to suggest that this office should not be permitted to devolve, as of course, continuously on the same individual. The infusion of new blood is salutary to an institution like this. Many of our members are more masters of their time than I am, and on several occasions, when I have especially desired to attend the meetings of the Society, I have been prevented either by absence at the Court of Appeal or on circuit, or by my engagements here. There are also many members of scientific attainments, whose election to the office of President would tend to promote the success of the Society. I therefore hope that at the election of officers for the year 1873–74 your choice will fall upon some worthy successor.

The constitution of this Society, and of others of a similar character in close union with the New Zealand Institute, seems to me to be highly favourable to the promotion of science. Taking our own Society alone, it provides for the free interchange of the scientific knowledge and scientific thought possessed and capable of being communicated by each and all of the members. It also furnishes the wholesome stimulus of emulation and friendly competition. It has another advantage, apart from science—its primary object. It has a social usefulness. It brings together, in friendly social intercourse, men who from their private engagements and pursuits, or remoteness from each other, might never otherwise have an opportunity of meeting. The New Zealand Institute performs for the several societies united with it, that which each society does for its own members. It makes common property of the contributions of all. Whatever is useful in the deliberations and proceedings of one is thrown into the common stock, with a salutary power of rejection and selection. The four volumes of *Transactions* bear witness to this. No one society, howsoever able its members, or howsoever liberally supported, could have produced such a valuable body of scientific information as we find in the volumes to which I have alluded. Nor could all the societies, working independently, have done so. The mere pecuniary economy of the present arrangement is a source of efficiency which no amount of isolated energy could attain. All share in the liberality of the Legislature. The power of selection, too, to which I have alluded, which involves rejection, has imparted to the *Transactions* a character which has called forth commendation from the scientific bodies of other countries.

A few words upon the history of these institutions will, I trust, be deemed not out of place. The first attempt to establish a scientific body in New Zealand was the New Zealand Society in 1851. Its chief promoter was Sir George Grey. It had about seventy members, and I had the honour of being one of its vice-presidents. Among the members were several gentlemen of scientific attainments, and others not unversed in literature. I may mention the names of the late Mr. Swainson, the well-known naturalist; Mr. Walter Mantell, a geologist by descent; Dr. Sinclair, an accomplished botanist; Dr. Ralph, a skilful microscopist; and there were others. At that time, however, the whole colony contained only about 32,000 Europeans—scattered over the whole length and breadth of the two islands; and it cannot be matter for surprise that the society, though well intentioned, languished; and, I believe, after a few years died what must be deemed a natural death. But let us be grateful to it, as the precursor and germ, and perhaps even the suggester of the existing well-established Institute.

The New Zealand Institute owes its existence to the "New Zealand Institute Act, 1867." The geological survey of the country is very wisely one of the principal objects connected with the Institute, and the Governor is empowered to appoint a manager of such survey, and also assistants. Branch societies may be incorporated with the Institute, and when so incorporated each Society elects a member to vote for the elected governors. Practically this gives to each Society a voice and influence in the Institute. Although I cannot but lament the loss of Dr. Hector to this province, I think that those whom I am now addressing will rejoice that so able and accomplished a man has been secured as the animating spirit of the New Zealand Institute. Of his scientific attainments no one has any doubt; but it is not all who are aware how well fitted he is to direct the affairs of the Institute, by his genial nature, his equanimity, and his cheerful readiness to assist those who are in search of scientific knowledge. The *Transactions* bear witness to his firmness, discrimination, and skill as an editor.

The Wellington Philosophical Society, which from its locality has a closer connection with the Institute than more distant societies can have, numbers among its members several men of high scientific attainments, nor is any one of the societies destitute of members capable of making valuable contributions to the common stock of scientific ideas. Sir George Bowen, the Governor, has directly promoted the success of the Institute, and indirectly that of the affiliated Societies, by his zeal and especially by his encouraging addresses.

When the New Zealand Institute Act was passed in 1867 several local societies were in existence, doing yeoman service no doubt, but limited in their range of usefulness by the feebleness incidental to local effort. The New Zealand Institute imparted to them a new character; and the service was mutual, for without them the Institute itself would have been a mere incorporeal entity—but little better than a phantom. In June 1868—the year after the passing of the Act—the Wellington Philosophical Society and the Auckland Institute were incorporated with the New Zealand Institute, and in October of the same year the Philosophical Institute of Canterbury and the Westland Naturalists and Acclimatization Society followed. By this solid and compact union, the New Zealand Institute became what the French call *un fait accompli.* From my connection with the old Society of 1851, and from my previous intercourse with Dr. Hector, I naturally felt a strong interest in the new Society. Its constitution seemed to me to be sound—an opinion fully borne out by results; and as there was then no similar body near my own home, I at once joined the new Society. Our own Society did not long lag behind its predecessors. The Otago Institute dates from July, 1869, under the presidency of Mr. Justice Ward, and on my return from Europe in 1870 I found it in full vigour. In January, 1871, the Nelson Association for the promotion of Science and Industry was established, under the presidency of Sir David Monro. Both these Societies were at once incorporated with the Institute, so that at this time the New Zealand Institute may be characterized, not by perfect resemblance, but by analogy not very remote—as a quasi-University of Science, composed of five scientific colleges, with a general resemblance to each other, and yet with sufficient variety in their objects to impart vigour to the whole, and render profitable interchange of thought between them more practicable than it would be among isolated bodies all cast in the same rigid and unvarying mould.

Hitherto the attention of all these societies has been directed principally, but not quite exclusively, to what are called the natural or physical sciences. Of these, undoubtedly geology and her twin sister mineralogy are of the greatest importance to us. New Zealand is especially rich in mineral resources —gold, iron, and other metals, and coal. Unscientific enterprise may develope, and indeed has developed these resources to a considerable extent; but they are capable of being rendered available with immeasurably greater rapidity, if energy be directed by scientific knowledge. Now all science is susceptible of two distinct kinds of progress. First, there is the improvement and development of science itself—the increase of the sum total of scientific knowledge; and, secondly, the extension of the existing stock of scientific knowledge, be it great or small, among those who may reap practical benefit from it.

One of our poets has said—

> "A little knowledge is a dangerous thing,
> Drink deep or taste not —."

No doubt, full, accurate, and exhaustive knowledge is better than the poet's little knowledge, but practically a little knowledge is better than no knowledge at all; and although superficiality is to be avoided, yet the communication of even a little knowledge, if that little be sound in itself, is in the highest degree useful. The miner works with more certainty, and with less risk of failure, if armed with even a small amount of geological and mineralogical science, provided that the little which is imparted to him by the man of science be accurate. The farmer, too, without aiming at being a great chemist, is saved from many disappointments by even a "little knowledge" of that department of chemistry which treats of soils and the food of plants. Other industrial pursuits are capable of being similarly aided. I was therefore not sorry to see that the youngest of our Societies—that of Nelson—makes the promotion of industry one of its objects, coupling it with the promotion of science. If the *Transactions* be extensively read they cannot fail to promote the second mode of extending science, and the press throughout the country has a useful function to perform by extracting such portions of our *Transactions* as may be of practical utility to the miner, the farmer, and other developers of the natural resources of the country.

But the natural or physical sciences do not exhaust what is comprehended in the word science; and our field seems to me to be of much wider extent. There is a science in every department of human knowledge; even our manly English sports have their science; that is, their operations are referred to principles and reduced to rules. Niebuhr has taught us that there is a science of historical criticism. Look at our best modern histories as compared with the dry chronicles of the middle ages. The historian now dives into the springs of human action, he applies a rigid criticism even to the facts previously accepted as historical, and he arrives at conclusions with a degree of moral certainty unattainable in early times. The early history of the native race of New Zealand is not unworthy of the labours of the critical historian; their traditions are worthy of being collected and critically examined upon recognized principles which constitute the science of history. The language of the Maori proves beyond all doubt that he is a member of the widely-spread Polynesian family. His own tradition points to Hawaiki as the place whence he came, and Hawaiki is no more than a linguistic variety of the name Hawaii, and the two languages have no more differences than are capable of being accounted for by Grimm's law. Philology is now copiously applied to the testing of traditions. This Society has already contributed something to the common stock under this head, in the most interesting paper by Mr. J. T. Thomson, printed in the fourth volume just issued. But we in Otago are too remote from the great seats of the Maori population to be favourably situated even for the collection of facts. The northern societies, however, have the facts at their very doors, and I cannot help hoping that the attention of some members of those bodies will be directed to the subject before it becomes too late.

There is another subject, or rather class of subjects, quite within the province of this Society. I mean the science of language generally, and the science of each particular language, and especially of our own mother English. Much has been done of late years in Europe in these departments of science. Max Müller has produced two interesting volumes of lectures on the Science of Language, and he has, I think, succeeded in showing that there is such a science generally, without reference to particular languages except for purposes of illustration. Writers in the present century—Grimm in German ("Geschichte der Deutschen Sprache"), and Littré in France ("Histoire de la Langue Française"), Latham in England ("The English Language"), and Marsh in America ("Lectures on the Origin and History of the English Language"), have all treated their respective languages more or less scientifically. Until the present century there were very few dictionaries which were anything more than collections of words with fancied etymologies, which were often misleading and sometimes false. The dictionary of the French Academy, the Italian *Vocabolario della Crusca*, and even our own Johnson's dictionary, all fall short of the requirements of the present state of philological knowledge. The great German dictionary of Grimm, the French dictionary of the learned Littré, and the new English dictionary of Latham, are of a much higher character.

It is of course our own speech which is of the most importance to us; and with a few exceptions, at distant intervals, it is only recently that it has been philosophically investigated. This has been much aided by the recent revival of the study of Anglo-Saxon, which is really English in its oldest form. To take part in these investigations, with the hope of adding something to the common stock of knowledge, is certainly not inconsistent with the general scope and objects of these societies; and be it observed that the wider the field which we embrace the more do we place ourselves in communion with the scientific and learned bodies in Europe and America.

In England, France, and the United States, each science has its distinct society. Geological societies, geographical societies, botanical societies, antiquarian societies, philological societies, historical societies, and many others, are to be found in all the countries of Europe and America. We are far too young, and our population is too small and too much divided for such a division of scientific labour. The Institute is a happy expedient for securing all the advantages of association which our circumstances admit of, and this principle of union for scientific objects is not without example in England, where it is less needed than with us. The British Association for the Advancement of Science is of this catholic character, and there is a certain correspondence and connection (I am not sure whether I should be justified in calling it affiliation) observed between some of the metropolitan societies and provincial societies which pursue the same objects. The Royal Society of Antiquaries, for instance, has some such connection with various local antiquarian societies; so that the principle of our Institute is recognized as sound by those societies which have more experience than we have. What the French call *l'esprit d'association* is in fact one of the characteristic features of the present age.

I have alluded to the two kinds of progress of which science is susceptible; and let it never be forgotten that if in our humble beginning we should add but little, or even nothing, to the increase or improvement of science, extension and diffusion are within our reach. But may we not also hope to add something to the general stock? Let me say a few words to encourage hope, and stimulate exertion in that direction. Great and successful examples cannot fail to animate hope in those who are laudably ambitious of scientific attainments, and of making some contribution to the common fund.

One of the grandest discoveries of modern times—perhaps the most remarkable discovery of science ever achieved—was effected simultaneously by two mathematicians but little known at the time. I allude to the discovery of the planet Neptune. This planet was literally discovered before it was seen, by two scientific men acting entirely without concert. These men were known rather as skilful mathematicians than as astronomers. They were Leverrier, of Paris, and Adams, of Cambridge. The planet Uranus had been discovered by the elder Herschel in 1781. During the ensuing half century its orbit had been observed and calculated and recalculated over and over again. Its theoretical orbit is of course an ellipse, but its actual and observed orbit differs from its theoretical orbit, that is, its orbit as it ought to be is found to be disturbed or perturbed. These perturbations, as they are called, were accurately observed and recorded not only by Herschel himself but by hosts of astronomers in all parts of Europe. Now all except a fraction of these perturbations were capable of being accounted for and laid down with precision, as caused by the attraction of Saturn and Jupiter. The combined influence of the smaller planets—Mars, the Earth, Venus, and Mercury—was so small as to be left out of account; for, besides their immense distance from Uranus, the size of the Earth as compared with that of Jupiter is about that of a pea to a moderate-sized orange. But it was found that after giving due effect to the attraction of Jupiter and Saturn—which could be exactly estimated—there remained certain perturbations still unaccounted for; and it was conjectured that these might be due to some unknown planetary mass far beyond the orbit of Uranus. Leverrier and Adams, unknown to each other, imposed each upon himself the gigantic labour of determining the place of this unknown planetary mass, by inference from the known and accurately recorded perturbations. The converse process was familiar to mathematical astronomers, that is:—Given the mass and density of a planet, and its distance from the affected body, the perturbation could be found. But no one, I believe, before their time had had the courage to grapple with the problem:—Given the perturbation of the affected planet, what is the place of the unknown disturbing body? However, after labour which is almost incomprehensible to persons not in some degree familiar with such calculations, Adams and Leverrier both came to nearly the same conclusion at the same time, the difference between the two results being very trifling.

In September, 1846, Leverrier wrote to Dr. Galle, of Berlin, announcing the result at which he had arrived, giving him the heliocentric longitude of the supposed planet for the 23rd September, and requesting him to look for the disturbing body in or near the place pointed out. On the 23rd September Dr. Galle, assisted by M. Encke, discovered what then appeared to be a star of the eighth magnitude very near the place indicated; but either from its distance or from the insufficient power of the instruments it did not exhibit a defined disc, so as to enable the observers at once to determine its planetary character. There was, however, no star in that place in the most recent catalogue. Star or planet was a question which could not be solved at once, and Galle had to wait until the following night with what patience he could. Then, indeed, the newly discovered body had moved in its orbit, and its true planetary character was placed beyond doubt. Subsequent observations have proved that it is to this planet, since called Neptune, that the perturbations already mentioned must, according to the Newtonian law of gravity, be assigned. This narrative is calculated to stimulate the study of science. It shows what human perseverance governed by science can effect. Not that it is given to many men to discover a planet or a star; but science has numerous fields of inquiry which are open to the aspiring student, and in which every one may hope to discover something new and useful to his fellow men.

Scarcely inferior to this as a scientific discovery by the mere force of reasoning, and superior in practical results, is that which is described by Tyndall in one of his admirable lectures, namely, the discovery or rather invention of the barometer, which was arrived at by a process of scientific reasoning. It grew out of the common pump. About 1632 the Grand Duke of Tuscany was desirous of improving the public gardens of Florence, and in order to raise water to a considerable height he ordered some large pumps to be made. When they were set to work it was found that the water would not rise above 32 feet. What could be the cause of this? The hypothesis then current was, that nature abhorred a vacuum. Had her supposed abhorrence a limit? The problem was submitted to Galileo, but he was then in an ill humour in consequence of the persecutions of the Church for his heretical and unscriptural doctrine that the earth moves round the sun, and he answered sulkily that he supposed that nature only abhorred a vacuum up to 32 feet. The real meaning of his answer was that he was unable to solve the problem. But it was taken up by his pupil, Torricelli. He assumed that the water could not move up the exhausted cylinder of the pump without the application of some external force, and he conjectured that that force was the weight of the column of the atmosphere. Galileo had previously proved that air is not destitute of weight. Torricelli then reasoned thus: If the weight of the atmospheric column be the exact equivalent of the weight of 32 feet of water, then, inasmuch as mercury is about thirteen times as heavy as water, the column of air ought to support about 30 inches of mercury. This grand scientific conception being once generated the proof was easy. Torricelli took a glass tube about three feet long, closed—that is, hermetically sealed—at one end; into the open end he poured mercury until it was full, then closing the orifice with his finger or thumb he inverted the tube and plunged his hand into an open basin of mercury, upon the surface of which the external air could freely act; he then removed his hand, and you may judge of his delight when he found that the mercury fell to about 30 inches and there stopped.

This experiment was soon followed by another, which confirmed Torricelli's theory (if indeed it needed confirmation). The French philosopher, Blaise Pascal, reasoned thus: If Torricelli be right, if the water in the pump and the mercury in the tube be equally supported by the weight of the atmospheric column, then, as we decrease the height and weight of that column, by ascending a mountain, the mercury ought to fall. Accordingly, he ascended the Puy de Dôme, taking with him what we may now call a mercurial barometer, which he found to fall as he ascended, and rise again as he descended, with perfect regularity.

Now, although we cannot hope to match the grand discoveries which I have just described, let this Society and others connected with the New Zealand Institute comfort and animate themselves with the reflection that we enjoy as the scene of our operations a new country and a comparatively unexplored field; and not only may we add materially to the common stock of scientific knowledge, but we may exercise a much more useful function—we may each in our humble sphere of life aid in the extension and diffusion of scientific knowledge among those who by their practical skill are best able to turn it to profitable account.

Another word of encouragement to those who are actively engaged in the ordinary business of life. The highest attainments of science have not been confined to those who have devoted themselves exclusively to scientific pursuits. Merchants, bankers, clergymen, lawyers, musicians, medical men—actively engaged in their respective professions and callings—have rendered themselves eminent in science by study during their hours of leisure. Lord Bacon, a lawyer and Lord High Chancellor of England, is considered the founder of the inductive philosophy, the true method of "interrogating nature," to use his own expression. David Ricardo, author of the "Principles of Political Economy and Taxation," was an active and successful member of the Stock Exchange. Thomas Tooke, the author of the "History of Prices," and a scientific writer on currency, was a Russian merchant, and at a time, too, when merchants had a prejudice against the science. George Grote was a banker when he commenced his truly philosophical "History of Ancient Greece," and became an active member of Parliament during the progress of his work. John Stuart Mill, when he wrote his admirable "System of Logic, Ratiocinative, and Inductive," and his "Principles of Political Economy," was a laborious officer of the East India Company. It is only his recent works that can be considered as the fruit of "a learned leisure." His philosophical works are enough for a long life of thought, and yet between thirty and forty years of that life were occupied in a laborious and responsible office. The power-loom was invented by the Rev. Edmund Cartwright—a country clergyman. The great bell at the New Houses of Parliament was planned, and the casting thereof superintended, by a barrister and a clergyman—E. Becket Denison and the Rev. W. Taylor; and it is a curious coincidence that the first bell ever cast in England was cast by Turketel, a monk, Chancellor to the Saxon King, Edmund the Elder. Another barrister, Benjamin Rotch, was the inventor of the patent fid, now universally used in ships for securing topmasts; and to descend to smaller things, but still with a scientific element, another barrister, whose name I forget, was the inventor of a machine for making coffee—scientific in its principle, simple in its contrivance. The safety-valve of the steam-engine, or rather the mode of rendering it self-acting, is said to have been invented by an idle boy to save his own labour.

The great astronomer, Sir. W. Herschel, was by profession an organist. Music was the business of his life, astronomy his recreation, until in process of time they changed places. Grove, the author of one of the most profound and able works of modern science—an "Essay on the Correlation of Forces," a work which ranks side by side with the scientific writings of Tyndall and Huxley—was a practising barrister, then a Queen's Counsel, and is now one of the Judges of the Court of Common Pleas at Westminster. It will be obvious therefore that not one of the ordinary pursuits of active life is inconsistent with the prosecution of science. All such active pursuits afford some hours of leisure. There is a conventional "day's work" in all occupations, and when the mind once becomes habituated to healthy activity, inaction becomes unendurable and we naturally crave some new occupation for our hours of leisure. To all such craving spirits this Society offers comfort and help, co-operation and encouragement.

Mr. J. S. Webb said that the President's address was remarkably appropriate, in having brought into notice some things which it was necessary that some one with authority should mention. He knew that there were many gentlemen among them competent to take part in those meetings, who had all along kept back too much. This was owing, he thought, in the first place to the fact that they fancied something great was expected from them, forgetting that they appreciated any honest effort to impart knowledge and increase the common stock when they themselves were the recipients, and failing to deduce from that fact that their own efforts would be received with thankfulness, and that the smallest effort would have its value. In the second place, they forgot that the object of the Society should be to diffuse knowledge as well as to seek after the production of original matter. There were a great many whom he knew, both present and absent, who could put together the knowledge they possessed, and impart it in a manner which would be very pleasing to the members, and which they would be very thankful for. He himself proposed at their next meeting to set a good example by endeavouring not to impart anything original, but to gather together information, not to be found in text books, etc., respecting the recent progress of some branches of science. He hoped to find the experiment successful in drawing from his fellow members similar efforts.

Mr. Robert Gillies thought that if their meetings were to partake more of a conversational character, probably more interest would be taken in them. He felt very much interested in the remarks made by the President with reference to the science of language, and the enormous strides it had made since it was started. There could be very little doubt that it would in future greatly revolutionize their ideas with regard to many things in the world. With reference to this branch of science, he came across a statement which might not have come under the notice of members of the Society. They were all aware that the Indo-European languages had mostly two bases, which were termed the Turanian and Semitic. The Semitic languages had undergone a searching investigation, but hitherto all attempts to trace the foundation of the Turanian line had to a great extent failed. A short time ago he read a report of an address delivered by the Professor of Japanese in the Paris University. In that address the Professor stated that in the Japanese language were to be found the germs of the Turanian language, which had been so long sought for.

1. "On a fish of the genus *Bovicthys*, caught near Dunedin," by J. S. Webb.

(ABSTRACT.)

Bovicthys, sp.

Dorsal, 8—19; anal, 15.

Head three times in length, and four times diameter of eye; inter-orbital channel one-third of same; base of first dorsal less than half that of second; pectorals reaching to anal.

Upper surface light brown with olive blotches, and dull white patches on the sides; white beneath.

Stomach contained crustacea (*Phronima*).

Rocky pools, Lawyer Head.

Differs from *B. variegatus* chiefly in the number of fin rays.

FOURTH MEETING. 17*th September*, 1872.

The Rev. Dr. Stuart, Vice-President, in the chair.

New members.—James Wilkin, W. T. Glasgow, G. E. Barton, F. R. Chapman.

1. "On a Supposed Hybrid," by A. C. Purdie.

(ABSTRACT.)

The author said that the subject of his remarks was presented to the society by Mr. Jennings as a cross between a cat and an opossum, said to be bred by Mr. Jones, of Ballarat, Australia.