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A Century of Botany in Canterbury*

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Abstract

BOTANICAL investigations began in Canterbury with collections at Akaroa by D'Urville's expedition (1840) and on Banks Peninsula by Raoul (1840-43). The first British collectors were from the surveying vessels *Acheron* (Lyll, 1849-50) and *Pandora* (Jolliffe, 1854), or were visitors such as Bolton (1850). The British collected for J. D. Hooker as did the first resident botanists, Travers, Sinclair and Von Haast. Prominent in the later nineteenth century were Enys, Potts, the Armstrongs (father and son), and the bryophyte specialists Wright, Beckett and Brown. Collectors from the north were Cheeseman and T. Kirk, and from overseas came Berggren (1874) and Diels (1902). Leonard Cockayne came to Canterbury in 1885, began publishing in 1898 and did some of his most important work in the vegetation of New Zealand before he left the province in 1914. Important workers during and after the Cockayne period were Allan, Brockie, Foweraker, Holloway, Laing, Martin, Talbot and Wall. Most of their work was in systematics or ecology but Hilgendorf and Frankel fostered cytology and genetics. A marked expansion of organisations and facilities began in the 1950's and heralds a new period in Canterbury botany.

THE history of botanical exploration in Canterbury began on 8 April 1840, when a French corvette, the *Astrolabe*, anchored in Akaroa Harbour. This vessel, and its escort the *Zélée*, which arrived next day, were under the command of Captain J. S. C. Dumont D'Urville (1790-1842) who had previously visited New Zealand in 1824 on the *Coquille* and in 1827 on the *Astrolabe*. The expedition was heading north to Russell from Otago Harbour, after having spent ten days at the Auckland Islands. Although only a brief visit to Akaroa was planned, to take on water and fresh provisions, departure was delayed until 17 April by bad weather (D'Urville, 1841-46) and during this time a few plants were collected. Montagne (1845) records 15 species of seaweeds, two lichens and one moss, collected either by D'Urville or Hombron at Akaroa, and most of these records were later included in J. D. Hooker's *Flora Novae-Zelandiae* (1852-55). But the members of the French expedition were not energetic collectors, as is seen by the paucity of their gatherings at this and other localities, and the many novel plants growing on the hills surrounding their beautiful anchorage remained unobserved for a little while longer.

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A few months later, on 17 August, the *Comte de Paris* arrived at Akaroa with the settlers of the Nanto-Bordelaise company. The surgeon on the escorting warship *l'Aube* was E. F. A. Raoul (1815–52) who remained based at Akaroa until 11 January 1843, being attached to *l'Aube* until 26 January 1842 and on its recall, transferring to *l'Allier*. Between voyages to Russell and to Sydney Raoul made an extensive collection of plants on Banks Peninsula. He published a preliminary account of his new species in the *Annales des Sciences Naturelles* in 1844, and this was followed in 1846 by his beautifully produced “*Choix de Plantes de la Nouvelle Zélande*” which gives detailed descriptions of 44 species including those in his earlier paper and some mentioned for the first time. Thirty-three of the species are magnificently illustrated.

The majority of Raoul's species are still accepted, and Akaroa or Banks Peninsula are thus the type localities for several well known native plants. It is fitting that two of these species, which are probably now confined to the Peninsula, were named after Frenchmen. *Hebe lavaudiana* commemorates Captain Lavaud of *l'Aube*, and *Celmisia mackaui* is named after Admiral Baron de Mackau, the minister responsible for the French Navy and colonies at that time. Raoul's other recognised taxa from Akaroa are: *Adiantum fulvum* Raoul, *Arthropodium candidum* Raoul, *Chionochloa rigida* (Raoul) Zotov, *Clematis foetida* Raoul, *Coprosma robusta* Raoul, *Corokia cotoneaster* Raoul, *Discaria toumatou* Raoul, *Elaeocarpus hookerianus* Raoul, *Griselinia littoralis* Raoul, *Gunnera monoica* Raoul, *Helichrysum glomeratum* (Raoul) Benth. et Hook. f., *Hoheria angustifolia* Raoul, *Lophomyrtus obcordata* (Raoul) Burret, *Microlaena avenacea* (Raoul) Hook. f., *Notodanthonia unarede* (Raoul) Zotov, *Olearia avicenniaefolia* (Raoul) Hook. f., *Parsonia capsularis* (Forst. f.) R.Br. var. *rosea* (Raoul) Ckn., *Pittosporum obcordatum* Raoul, *Potamogeton ochreatus* Raoul, *Potentilla anserinoides* Raoul, *Pseudowintera colorata* (Raoul) Dandy, *Senecio lagopus* Raoul, *Senecio sciadophilus* Raoul, *Uncinia leptostachya* Raoul, and *Uncinia rupestris* Raoul. The genus *Raoulia* was also described by Hooker from specimens in this collection.

In addition to flowering plants and ferns the records in the *Flora Novae-Zelandiae* show that Raoul also collected mosses, liverworts, seaweeds, fungi and lichens at Akaroa.

EARLY RESIDENTS AND VISITING BOTANISTS

The first British botanist in Canterbury was Dr David Lyall (1817–95), who had been co-botanist with J. D. Hooker in the antarctic voyage of the *Erebus* and *Terror* and who returned to New Zealand as surgeon on *H.M.S. Acheron*, which surveyed parts of the coast between 1847 and 1851. The *Acheron* arrived at Akaroa from Wellington on about 21 February 1849, and was in Canterbury waters until 9 April. After a short visit to Dunedin the vessel returned to Akaroa and left for Wellington on 28 April.

Three main excursions were made by *Acheron* parties.

1. Mr Strange, one of the naturalists, explored to the westward from 4 to 10 March 1849, and climbed on to Mount Torlesse. He has left a graphic description of extensive landslides on the mountain, which he considered caused by the same earthquake which had recently damaged Wellington. Strange added: “To my disappointment, I found that the specimens I was in search of were not procurable at this point of my journey, although could I have proceeded twenty miles further to the westward, I doubt not that I should have found them.” “The only new things I got today were two species of *lepidoptera*, three species of *helix*, and a fern.” (Strange, 1850).

2. Immediately on his return, Strange joined a party including Captain Stokes and W. J. W. Hamilton (surveyor for the New Zealand Company, attached to the *Acheron*) which left on 11 March to explore the country to the north and reached the summit of Mount Grey on 23 March (Hamilton, 1850).

3. In April 1849 W. J. W. Hamilton explored the Waiau, and it is of some interest to determine whether Lyall accompanied him on this journey. The following information is available to us.

(a) In his report to Stokes, Hamilton (1850) referred to his "two visits inland (alone and with yourself)". As we know that Stokes accompanied Hamilton to Mount Grey, this statement could imply that Hamilton went alone to the Waiau; or that he was only accompanied by the usual porters and guides.

(b) McClymont (1959) states, however, that an officer of the *Acheron* accompanied Hamilton; and Maling (1958) identifies this officer as Lyall, referring to a journal of Captain Stokes in the Hocken Library.

(c) The relevant passage in the Stokes journal refers to the return from the Mount Grey journey and then continues: "In a day or two after, Mr Hamilton again set out on an exploring expedition accompanied by our naturalist the indefatigable Dr Lyall". Whether "indefatigable" implies that Lyall had just returned from Mount Grey I do not know, but it appears certain that Lyall set out with Hamilton for the Waiau, a journey which began on 4 April (McClymont, 1959).

(d) There is, however, one further point to be considered. The Stokes journal notes later: "We sailed from Otago to take up Dr Lyall left behind to make collections as before mentioned in the country between Port Cooper and Akaroa." As the only previous entry is that quoted above, it would seem that Lyall first went north, and then on his return journey crossed Banks Peninsula to rejoin the *Acheron* at Akaroa.

The *Acheron* arrived back at Lyttelton on 29 November 1850, and Torlesse, who does not mention meeting Lyall on the earlier visit, noted that he went botanising with Lyall at Riccarton on 30 November (Maling, 1958). Lyall's collections in Canterbury were sent to Hooker, and are mentioned in both the *Flora Novae-Zelandiae* and the *Handbook of the New Zealand Flora* (1864-67). From Port Cooper (Lyttelton) Hooker mentions eight species of flowering plants, two of mosses, two liverworts and eight seaweeds; and from Akaroa one flowering plant, one fern, and ten species of seaweed. There are 14 records from "Banks Peninsula" (12 seaweeds) and seven records from "Canterbury" or "Canterbury Plains".

Charles Obin Torlesse (1825-66), the young assistant-surveyor of the Canterbury Association, arrived at Lyttelton on 15 December 1848. He took an intelligent interest in the plants and soils, as his maps and many entries in his diary show; and when his old school-fellow Edward Ward arrived on the *Charlotte Jane* in 1850, Torlesse was able to point out to him the plants useful for dyeing or tanning, and those of medicinal value (Ward, 1951). Torlesse collected seeds, flowers, mosses and lichens, but only, it seems, to send to his parents (Maling, 1958, p. 97). He could well have been responsible for the following advertisement in the *Lyttelton Times* on 29 November and 6 December 1851. "A meeting will be held at the Land Office, Christchurch, on Saturday the 13th of December next, at noon, for the purpose of taking the necessary steps for the establishment of a Botanical Society, at which the attendance of all persons disposed to forward the object in view, is particularly requested."

I know of no further record of a Botanical Society, but this meeting may have led to the formation of the Christchurch Horticultural Society which held its first exhibition in Hagley Park on 16 December 1852, the second anniversary of the

Canterbury settlement. The *Lyttelton Times* reported on 25 December: "The Native Grasses, 25 varieties, shown by Mr W. Wilson, and tastefully arranged in a box, excited much attention, as also those exhibited by Messrs Torlesse and H. Ward, as dried specimens in blotting paper."

Torlesse records the arrival at Lyttelton on 13 December 1850, of *H.M.S. Fly* returning Sir George Grey from the Enderby Settlement on the Auckland Islands. Also on board was Colonel R. E. Bolton, who commanded the Royal Engineers in New Zealand and was a collector for J. D. Hooker. (This was apparently Bolton's second visit to the Auckland Islands as McLaren (1948) states that the *Fly* with Bolton aboard anchored in Ross Harbour on 11 February 1850.) *Convolvulus erubescens* is recorded in the *Handbook of the New Zealand Flora* as collected by Bolton at Port Cooper.

Another early collector in Canterbury was John Jolliffe (1822–87), surgeon on the *Pandora* (Captain Drury) which continued the *Acheron's* survey from 1851 to 1856. The typescript of Jolliffe's diary held at the Turnbull Library records that the *Pandora* was at Lyttelton from 8–20 December 1854, and at Akaroa on 20 December, from whence the vessel went to Port Chalmers. An entry for 14 December states: "Jones and myself walked to the top of the highest mountain in Banks Peninsula": and on 20 December Jolliffe recorded of Akaroa and Mr Robinson's garden: "The houses are all well built, scattered about and surrounded by gardens abounding in fruit trees, vegetables and flowers. The roses in great abundance and of most luxurious growth. One garden we walked through was exceedingly pretty. Some of the native trees and flowering shrubs had been left that added much to the beauty of the spot, particularly the Ti palms which are now in full bloom, their fine feathery blossoms perfuming the air most delicately."

A few of Jolliffe's earlier collections of liverworts from Hokianga and Auckland are mentioned in the *Flora Novae-Zelandiae* while in the *Handbook* there are four mosses from Banks Peninsula, as well as gatherings from Whangarei, Waiheke Island, Coromandel, Mercury Bay, Bay of Plenty, Mount Carmel and Wellington.

TRAVERS, SINCLAIR AND VON HAAST

By 1861 the first resident botanists were at work in Canterbury. They were William Thomas Locke Travers (1819–1903), Andrew Sinclair (1796–1861) and Julius von Haast (1822–1887). All were in close correspondence with J. D. Hooker at Kew, and all sent important collections to enrich the *Handbook of the New Zealand Flora* which Hooker was then preparing.

W. T. L. Travers, a lawyer and politician, made several noteworthy collections for Hooker in the mountains south of Nelson. He later lived in Christchurch from 1860 to 1869, where he continued his collecting as several records in the *Handbook* show. He was a foundation member of the Philosophical Institute, and has left us an essay comparing features of the flora of Nelson and Marlborough with that of Canterbury (Travers, 1869). His son Henry collected at the Chatham Islands in 1863 and in 1871.

But the most venerable Hookerian collector in New Zealand, other than Colenso was surely Dr Andrew Sinclair. It is sufficient to note here, that while Colonial Secretary in New Zealand he had sent valuable collections to Hooker, and that the dedication of the *Flora Novae-Zelandiae* reads "To the Rev. William Colenso, M.A., Andrew Sinclair, M.D., R.N., and David Lyall, M.D., R.N., this work, which owes so much to their indefatigable exertions, is dedicated by their very sincere friend, J. D. Hooker." Following a brief retirement in England, Sinclair had returned to New Zealand in 1858 to continue his work, this time in the south. After collecting

in Nelson he came to Canterbury where he joined Haast's first expedition, which explored the headwaters of the Rangitata and its tributaries. While returning from their camp at the junction of the Clyde and Lawrence Rivers to Samuel Butler's station at Mesopotamia Sinclair was drowned while crossing the Rangitata River. He was 65. Haast (1879) wrote, "Near the banks of the river just where it emerges from the Alps, with their perpetual snow-fields glistening in the sun, amidst Veronicas and Senecios, and covered with *Celmisias* and *Gentians*, there lies his lonely grave."

The records of the annual meeting of the Philosophical Institute of Canterbury held in December, 1920, state: "In February a deputation of the Council waited on the Hon. W. Nosworthy in reference to the preservation of Butler's house and Sinclair's grave, situated on his property at Mesopotamia. Though he could not see his way to transfer these two sites to the Institute, Mr Nosworthy undertook to mark the site of Sinclair's grave and personally to guarantee the preservation of Butler's house." Sinclair's resting place may be seen to this day, and bears the inscription: "In Memory of Andrew Sinclair, M.D., Late Secretary to the General Governor of New Zealand under the administration of Sir George Grey. He was drowned crossing the Rangitata on 1 April 1861." (The *Lyttelton Times* for 3 April 1861, gives 25 March as the date of Sinclair's death; but from Haast's account (1879) it is clear that the correct date was 26 March).

The vast mountain area of the central South Island still remained relatively unexplored botanically, and it was Julius von Haast, the Provincial Geologist, who made known its treasures to Hooker and to science. On all his explorations into the mountains from 1861 onwards he found time while studying the geological formations, to collect plants. And they were often collected in "horse-loads". With amazing energy he sorted and dried them in the field. It is said that on Mount Torlesse alone he collected over 200 flowering plants of which over 30 were new to science (H. von Haast, 1948). Hooker (1867) wrote of him: "The great opportunities enjoyed by the distinguished geologist and explorer, Julius Haast, Esq., F.L.S., Government Geologist of Canterbury, have been used to the best advantage in the furtherance of botanical science, he having contributed more new species to the Flora of the islands than any collector since Mr Colenso. I am indebted to him also for a series of maps, notes, and observations, especially respecting the ranges of the mountain plants, including the most alpine species hitherto discovered, which have been of great service. It is difficult to imagine how, with so many and such arduous duties as surveyor and geologist, Mr Haast can have personally effected so much for botany as he has done, and I anticipate that his method of making complete collections on each mountain and on each line of march, will eventually do much to develop the extremely curious subject of the variations of New Zealand plants. Mr Haast has further called my attention to the labours of his assistant Mr William Young, who has made several interesting discoveries, more particularly amongst the Grasses and Sedges of the alpine regions."

William Young was a young surveyor who accompanied Haast on his exploration of the Haast Pass and whose name is commemorated in *Raoulia youngii*, *Trisetum youngii*, *Agropyron youngii* and *Deyeuxia youngii*.

SOME CANTERBURY BOTANISTS

With a Handbook of the New Zealand Flora to guide them, and a Philosophical Institute, founded in 1862, as a forum, Canterbury naturalists gradually began to sever the link with the mother country. Von Haast set about forming a herbarium for his proposed museum. The nucleus of it was a collection which he had brought with him to Christchurch, presumably of specimens gathered during his exploration of south-west Nelson. Material from his Canterbury explorations expanded the

collection. In 1862 he received a herbarium from the Rev. Canon J. Butler, father of Samuel Butler, in exchange for a collection of New Zealand plants (H. von Haast, 1948) and while he was in the field the work went on nearer home. Haast wrote (1868) "I may be here allowed to state, that for more than four years Mr Armstrong, and his son Mr J. B. Armstrong, have assisted me in collecting our indigenous vegetation, for the herbarium of our Museum, and for making exchange; and both have also given me great help in arranging the botanical collections belonging to the province. In fact, whilst I was collecting and investigating the alpine and sub-alpine Flora of New Zealand, my two botanical assistants did the same work in the neighbourhood of Christchurch, and contributed several complete sets of plants to the Museum, which, however, like the great bulk of our botanical collections, have hitherto been inaccessible to the public, for want of space to exhibit them in."

The Armstrongs had come to Canterbury in 1862 (Barnett, 1963) and played an important part in the development of Canterbury and New Zealand botany. The father, John Francis Armstrong (1820–1902) was appointed Government Gardener in succession to Mr Barker in 1867 and was assisted by his son Joseph Beattie Armstrong (1850–1926) who was in charge of nursery work (Herriot, 1919). Both resigned from the gardens in 1889.

We are indebted to the Armstrongs for the conversion of a sandy waste into a thriving botanic garden, and for bringing into cultivation a large assortment of native plants which they collected on their botanical excursions. On one of these J. F. Armstrong accompanied von Haast to the headwaters of the Waimakariri.

TABLE I.—Some Classifications of Canterbury Vegetation.

von Haast (1870)	J. B. Armstrong (1879)	L. Cockayne (1900b)
1. The Littoral Zone.	1. The Littoral District.	1. The Lowland Region (9 Formations).
2. The Lowland or Pine Zone.	2. The Banks Peninsula District.	2. The Lower Mountain Region (9 Formations).
3. The Mountain or Beech Zone.	3. The Lowland or Middle District.	3. The Subalpine Region (7 Formations).
4. The Subalpine or Dracophyllum Zone.	4. The Alpine District:	4. The Alpine Region (3 Formations).
5. The Alpine or Raoulia Zone.	(a) The Zone of Beeches.	
	(b) The Zone of Shrubby Compositae and Scrophulariaceae.	
	(c) The Zone of Herbaceous Plants.	
	(d) The Zone of Perpetual Snow.	

In 1870 J. F. Armstrong published a valuable paper "On the Vegetation of the Neighbourhood of Christchurch, including Riccarton, Dry Bush, etc.," and this was prefaced by a classification by von Haast of the vegetation zones of the Province of Canterbury, which then included Westland (Table I). The practised eye of the geologist used to classifying country into broad divisions could not fail to be impressed by the vegetation changes from east to west—more obvious here than elsewhere in New Zealand.

In 1872 J. F. Armstrong published the first list of the naturalised plants of Canterbury. In the same year a report appeared dealing with native and introduced grasses, prepared by a committee of the Philosophical Institute of Canterbury and to this J. F. Armstrong contributed a list of naturalised grasses growing in Canter-

bury and with his son "Notes on Grasses Indigenous to the Province of Canterbury" (1872). One of the Committee's activities was to import seeds of grasses, and a collection from Vienna was reared by Armstrong. Other plants were also reared, and by 1881 it was estimated that 694,972 young trees had been distributed by the Christchurch Gardens to public bodies throughout New Zealand (Herriot, 1919).

J. B. Armstrong commenced independent publication in 1880 with a valuable paper entitled "A Short Sketch of the Flora of the Province of Canterbury, with Catalogue of Species", which includes a classification of Canterbury vegetation (Table I). This paper gives an extensive list of flowering plants and ferns, but also includes 214 mosses, 106 liverworts, four Characeae, 95 lichens, 91 fungi, 107 algae as well as additions to the earlier list of naturalised plants! This list is indeed puzzling because it is hard to credit the Armstrongs with such a wide and authoritative knowledge of such groups as mosses, lichens, algae and liverworts. J. B. Armstrong wrote "The catalogue attached to this paper I have made as complete as possible. The whole of the species enumerated have been collected by my father and myself and the identification may be relied upon as correct." However, only the flowering plants and ferns have locality notes. The explanation is obtained from the following comment in one of Laing's first seaweed papers (1886). "In the Transactions of the New Zealand Institute for 1879 there appeared a list of the seaweeds of Canterbury, but as it was evidently only a compilation from Hooker, I will not refer to it further."

Both Armstrongs described new taxa, but in this the son was much more active than the father. He defined the genus *Corallospartium* and during his notable investigations on the native veronicas he first defined the species now known as *Hebe amplexicaulis*, *H. armstrongii*, *H. canterburiensis*, *H. decumbens* and *H. rakaiensis*. On his death in 1926, J. B. Armstrong "bequeathed his herbarium and library to the Botanic Gardens. For want of suitable accommodation at the time the herbarium was housed in the Canterbury Museum where it remains to this day" (Barnett, 1963).

J. B. Armstrong's wide botanical knowledge, his philosophical turn of mind, his acute powers of observation, his energy, and the felicity and quiet authority with which he writes of the plants he loved, place him amongst our foremost botanists of the nineteenth century. J. B. Armstrong's grave is at Linwood, and his father is buried in Barbadoes Street Cemetery.

Living at Governors Bay at this time was Thomas Henry Potts (1824-1888) described as "an alert vivacious peppery little man" (H. von Haast, 1948). He was a keen naturalist, particularly interested in birds, and an enthusiastic cultivator of native plants. His main claim to our notice is the series of articles which he wrote mainly for the *New Zealand Country Journal* (published by the Canterbury A. and P. Association, between 1877 and 1899) and which he made into a book entitled "Out in the Open" (1882). It includes two long articles on New Zealand ferns.

Potts employed a professional gardener, Mr William Gray, and together they wrote a paper on the cultivation of some species of native trees and shrubs (1871) which contains scattered information on plants of Banks Peninsula. Gray had earlier accompanied J. F. Armstrong on an exploration of the Upper Rangitata Valley in 1869. He had a small property in Governor's Bay at which he ran the Ohinetahi Post Office. Gray died on 30 May 1910, aged 84, and is buried in the Anglican Churchyard, Governor's Bay.

At the Castle Hill Station from 1864 to 1891 lived John Davis Gilbert Enys (1837-1912) who discovered several new species in the surrounding Craigieburn and Torlesse Ranges. Castle Hill must have welcomed many lowland botanists in

those days. Sven Berggren of the University of Lund visited there in February, 1874 (Berggren, 1898). T. F. Cheeseman from Auckland collected thereabouts with Enys in January, 1880 (Cheeseman, 1882); and Thomas Kirk was there in 1876, and in January, 1891 (Kirk, 1895)*. It is therefore appropriate that four of the peaks in the nearby Craigieburn Range are named after botanists—Cheeseman, Cockayne, Enys and Wall.

Thomas Kirk, the author of *The Forest Flora of New Zealand* (1889) and the unfinished *Students' Flora of New Zealand* (1899) had a short association with Canterbury when he was a lecturer in Natural Science at Lincoln College in 1881 and again in 1884 (Blair, 1956). His son, Thomas William Kirk, arranged the herbarium of the Canterbury Museum. H. von Haast (1948) records: "In 1878, Haast, having been authorised to employ Mr T. W. Kirk to arrange the botanical collection for a fee of 50 guineas, which did not include fastening and poisoning, arranged with Kirk to do this work also, and to accept a set of duplicate fossils as remuneration".

Lower plants were not neglected by the Canterbury botanists of this period. Mr Thomas George Wright, a keen collector of mosses and lichens, lived at what was then 172 Gloucester Street, Linwood. He was a friend of Mr T. W. N. Beckett, an accomplished bryologist, whose following short biography has been supplied by his grandson, Mr Thomas Naylor Beckett of 336 Ilam Road, Fendalton.

"Thomas Wrench Naylor Beckett was born at Liverpool 24th July 1839, the eldest son of William Henry Beckett, a wine merchant. Educated at the Royal Institutional School, Liverpool, he emigrated to Ceylon in the 1860's and became a coffee planter. He returned to England in 1869 to marry Sarah Tolson Clint of Rock Ferry, Cheshire, spending his honeymoon at Kew and going back to Ceylon in 1870.

"About 1879 some kind of pest destroyed the coffee plantations and these plantations then changed over to tea, but the changeover caused him, and many others, to lose their money and sometimes their property.

"With four children, he came out to New Zealand in 1883 per the P. and O. vessel *Thames* via Melbourne, transhipping on the *U.S.S. Waihora* to Lyttelton.

"On his arrival, he purchased ten acres named "Elbedde" on the corner of Clyde and Ilam Roads (then named Penhelig and Webbs Roads) where he became an orchardist.

"Throughout his life he was interested in lichens and mosses and, as early as April, 1865, he was elected a member of the Linnean Society, Burlington House, London. He travelled mainly through Canterbury, West Coast and Nelson districts for his collections, and corresponded with many overseas colleagues, with whom he exchanged many of his specimens for those of other countries. He was also an early member of the Philosophical Institute of Canterbury.

Tall, upright in stature, with a long auburn beard and blue eyes, he was a ready mixer, be it a West Coast roadman or the Bishop. A stalwart of St Barnabas's Anglican Church, Fendalton, being Vicar's Warden for 18 years, he died 5 December 1906, aged 68, and was buried at the Papanui Church Cemetery."

When Beckett settled down in Canterbury he wrote to various New Zealand botanists in about 1887 to ask for information on the state of bryology in the Colony and offering to exchange mosses. The replies from W. Colenso in Napier,

* Hamlin (1965) lists several more visits to Canterbury.

H. Hill in Gisborne, W. T. L. Travers in Wellington, T. F. Cheeseman in Auckland, G. M. Thomson and W. Bell in Dunedin, Joshua Rutland of Pelorus Valley, and T. H. Potts and T. G. Wright in Christchurch may all be seen in the extremely valuable Beckett correspondence which, with his collections, has recently been presented to the Canterbury Museum. Beckett was elected a member of the Philosophical Institute of Canterbury in July, 1887, and read there seven papers on New Zealand Mosses, between 1892 and 1898.

T. G. Wright concluded his first letter to Beckett on 14 June 1887 by remarking: "There is but one other person that I know in Christchurch who takes any interest in bryology—and he is an old shoemaker—who I really think knows more about them than anyone else in New Zealand unless it be Colenso. I will, with your consent, take an opportunity shortly of introducing you to him, when you will find, if you will listen to him, he will 'talk moss' for hours". This old shoemaker was Robert Brown. Cockayne's recollections of him (1927) are no doubt well known. He was born in southern Scotland about 1824, lived in Glasgow, studied a little under Professor Henedy at the Andersonian University and studied the flora of the Highlands. He came to New Zealand in 1876, and settled in Merivale from whence he travelled widely in the South Island searching for his beloved mosses. I could add here that Brown lived in Andover Street on the site of the present numbers 48 and 50. Miss Osborne who lives at No. 50 recalls that Brown's old house was pulled down about 1926 and that he had glasshouses in his garden. Cockayne notes that: "For the technical part of his work Brown was provided only with an old-fashioned microscope, a camera lucida of his own making, an ancient moss flora of Great Britain, a few specimens of European mosses, and the Handbook of the New Zealand Flora; of contemporary literature he had none. Picture this old man of over seventy working day by day, making camera lucida drawings hour by hour and at night his table illuminated by a badly trimmed kerosene lamp".

But Cockayne also wrote of Brown in the *Lyttelton Times* on 19 December 1906 soon after his old friend's death, and the following extracts help us fill in the canvas a little more.

"First of all, I must say, he was far and away the most ardent naturalist I have ever met. Fatigue, hardships of many kinds, want of food and sleep—these things were as nothing to him. Spare of body and apparently weak, at the age of seventy and upwards he could put most young men to shame. He was wont to walk thirty or even forty miles in one day, carrying a heavy burden, and heeded little whether his bed at night was beneath a roof or the friendly shelter of the mountain beech tree . . . It is only a little more than a year ago, and when over eighty years of age, he walked, botanising all the way, from Kaikoura to Blenheim. . . . But to many in Christchurch the erect figure, every movement showing the energy of a young man, despite that he was far beyond the span allotted by the Psalmist, and the rugged, intellectual face, crowned by a wealth of snow-white hair, were well known and will be long remembered. . . . At the Philosophical Institute of Canterbury, no member was more in evidence than Robert Brown. Naturally the most modest of men, should a statement be made opposed to his beliefs, he was wont to express his opinions most freely no matter who was his adversary, for in matters of science he recognised no master, and only believed in direct observations made on the organisms themselves."

This freedom of expression is obvious in many of the papers which Brown presented to the Philosophical Institute of Canterbury, to which body he was elected on 7 July 1887, at the same meeting as Beckett. Before his election he had made two small communications through Professor Hutton, the first describing a new Composite and the second a new *Acaena* both of which turned out to be introduced weeds. After his election we hear nothing of him until 1893, when

the following trumpet blast is heard in the overture to his first moss paper. "I am with reluctance approaching this subject prematurely, much remaining yet to do, but from circumstances which have recently transpired I am forced to do so in order to protect my own rights; for, acting on the suggestion of the late Sir Julius von Haast, I presented nearly all my specimens and camera-lucida drawings to the Christchurch Museum, where they remain for anyone to describe who may think fit to rob me of my hard-earned rights" (Brown, 1893). No wonder Mr Wright wrote to Mr Beckett concerning a proposed "Cryptogamic Club"—"Would it be quite safe" and he underlined the sentence "Would it be quite safe to get all the Cryptogamists together in one room?"

In all, Brown wrote 22 papers on Mosses between 1892 and 1904; but even if he had published nothing, we would be in his debt for the stimulus which he gave to Cockayne, embodied in the treasured words—"Trust not authority; pay no heed to the books, but go to the plants themselves".

LEONARD COCKAYNE (1855–1934)

On 5 June 1895, two new members were elected to the Philosophical Institute of Canterbury. The first was Mr W. W. Smith, an amateur zoologist, who was to publish a valuable paper in 1904 on plants naturalised in the county of Ashburton, and later to become curator of parks in New Plymouth. The second new member, nominated by R. M. Laing, was a Mr L. Cockayne. This gentleman took only a minor part in the proceedings for some time. After ten months he brought along a female *Katipo* with nests and young which he had collected on the sands at New Brighton, and told the meeting something about the spider (*Proc.* 18/4/96); and after a further eighteen months he read his first scientific paper. Yet fifteen years after this he had achieved a world reputation as a botanist and was elected a Fellow of the Royal Society of London. Cockayne's most active and creative period was spent in Canterbury, but he had lived in the province for ten years before he was elected to the Institute at the age of 41, with half his life behind him. What had he been doing in this time?

Cockayne's preliminary entries in the first edition of "Who's Who in New Zealand" (1908) are as follows:

"Cockayne, Dr Leonard; born Thorpe House, Sheffield, 1854*: youngest son of William Cockayne, merchant; married Maria Maud Blakeley, of Harcourt, Vic. Educated privately and public schools; Owens College (now Manchester University); emigrated Australia 1879; engaged in teaching; arrived N.Z. 1881; on staff Tokomairiro District High School 1881–85; farming near Christchurch; —."

The farm near Christchurch was at Styx and here on 27 October 1885 Cockayne had purchased 15 acres 6 perches (Lands and Survey Department records). Next year he bought another seven acres to round off the block and here he lived until 1892. He was naturally interested in horticulture, and about 1887 is said to have read G. M. Thomson's "Ferns of New Zealand" which aroused his interest in native plants (Anon. 1919). Through these two interests he struck up a friendship with Robert Brown and they made many excursions together. Brown's *Andreaea cockaynei* (1893) was "named in honour of Mr L. Cockayne, my botanical companion in many rough journeys among the mountains". In 1889 they were at Walkers Pass together (Cockayne, 1899b, p. 420) and in December, 1896, he "proceeded in company with Mr R. Brown to Mount Torlesse" (Cockayne, 1898, p. 437).

* Given as 7 April 1855, by Anon. (probably Cockayne, 1919).

Cockayne also made an excursion with Donald Petrie in January, 1893, from Westland over Arthur's Pass to Canterbury (Hamlin, 1958) and recalls of Petrie (Cockayne, 1926) that: "During one long summer's day on Kelly's Hill, Westland, I well remember he looked neither to right nor left, but steadily gazed at the carpet of plants hour by hour pausing only to collect those which were new to him or which he wished to examine; and this was my daily experience during a rather extensive excursion he and I made about 31 years ago".

In all these outings Cockayne's main interest in the native plants was that of a horticulturist. He was searching for horticultural subjects and information of commercial value. This interest predominated for a long time as is shown by his early addresses and first scientific paper. His first talk to the Philosophical Institute was on "The Improvement of Wild Flowers by Artificial Selection" and was illustrated by a very large number of exhibits of cut and pot plants (*Proc.* 4/11/96). In 1897 he gave a lecture in the Art Gallery on "The Daffodil" and in 1898 lectured the Institute on "The Cultivation of New Zealand Alpine Plants". At several meetings he exhibited specimens of exotic garden plants. In 1898 in his first scientific paper he suggested that rhizomes of *Ranunculus lyallii* collected in September "would be in perfect condition for yielding large masses of bloom. Such dormant rhizomes landed in England in December should flower as well as in their native land, and as the demand for such a unique spring flower would be very great a new industry would be established in this country". Cockayne's interest in horticulture remained with him all his life (Bailey, 1938) but from about 1892 the centre of gravity of his work began to change. In that year his growing collection of native and other plants "got so large that he decided to remove to a small property of 4½ acres near New Brighton and devote his life to horticulture and New Zealand botany" (Anon. 1919).

Cockayne (1900b, p. 98) wrote of his New Brighton property, "Also I reside and have an experimental garden in the coastal region situated partially on the older sand dunes", and he refers to it as the "Tarata Garden". The Tarata stamp reproduced in Fig. 3 is on the title page of his copy of Goebel's "Outlines of Classification and Special Morphology of Plants" (1887), now in the Botany Division library. The location of the property was traced through Lands and Survey Department records (where it was registered under M. M. Cockayne) and found to be the present 26 Bexley Road, North Brighton. Cockayne's house still stands and the property is still undivided (Fig. 2).



FIG. 3.—Leonard Cockayne's "Tarata" stamp.

In 1892 Sir John Lubbock's two volumes *On Seeds and Seedlings* were published and this undoubtedly prompted Cockayne to make observations on the large number of native plants which were germinating in his glasshouses. His observations are summarised in four papers from 1899 to 1901. But his descriptions of the seedling stages were only part of the story which he told. For each species he added valuable observations on the adult plant and speculations as to how the seedling characteristics are correlated with the natural environment. Cockayne's original copies of Lubbock are in the Botany Division library, together with a second uncut set, a gift to Cockayne from the author.

The seedling work reached its climax with the visit to New Zealand in November-December, 1898, of Professor Karl von Goebel of the University of Munich. As F. O. Bower (1927) later wrote, it was Goebel who "More than any other writer of the time saved plant morphology from itself, by diverting its higher pursuit from formal and scholastic channels, and leading its adherents by preference towards middle lines of thought".

Writing as an old man in the year before he died Cockayne's enthusiasm for this visit of von Goebel is still fresh and his memories vivid. Goebel stayed with Cockayne at New Brighton, saw his seedlings and made a trip with him to Westland, staying at the old Castle Hill Hotel, and camping at the head of the Otira gorge on the way. Cockayne recalled, "In a moist gully at the base of Mount Alexander in Westland crowned with liverworts of every size and shape (many being giants of the family) von Goebel's delight rose to its highest pitch. 'Here' he cried 'were it possible for me, I would build a cottage and spend the rest of my life studying the bryophytes of this gully'". "At the head of the Otira gorge, where we camped for some days, he collected the giant moss *Polytrichum dendroides*, saying he wished to carry out a little experiment as to the power of its vessels to conduct water to leaves. In the small room to the right of the old biological laboratory at Canterbury College the experiment was carried out. Professor Dendy was asked for various stains, none of which he possessed, so the experimenter said: 'We will use ink', and ink he did use. Seated on a low stool, smoking a huge cigar, a small towel on his knees, with a razor in the right hand, he carried all out in the twinkling of an eye." And Cockayne wrote: "To me von Goebel's visit was the greatest scientific stimulus to my botanical career, such as it has been. Never before had I understood what a truly great man was, and to be in the company of such in the field day by day is education of the highest order" (Cockayne, 1933).

A further influence on Leonard Cockayne was a paper by Ludwig Diels of Berlin which appeared in 1896. At that time Diels had not visited this country, but later, in February and March, 1902, after his expedition to Western Australia, he toured New Zealand and saw both Canterbury and Westland (Diels, 1905). In his "Vegetations-Biologie von Neu-Seeland" (1896) he described the types of vegetation here, and attempted to relate the leaf structure of selected species to the environments which they occupied. He also discussed the origin of the flora. Diels used herbarium material and living plants at the Berlin Botanic Gardens, and obtained information from Cheeseman, Kirk and particularly Cockayne. Cockayne (1900b, p. 96) has put on record his part in this pioneer paper: "Part of the data concerning the plants of the montane, subalpine, and alpine region was, in response to a request from Dr A. Engler, furnished by me. Now, since some of my statements may not have been altogether correct, I may be allowed for my own credit's sake to explain that I distinctly stated in a letter to Mr Diels that I could not guarantee their scientific accuracy, since they were written from memory for the most part, and not from observations taken note-book in hand from the plants in their habitats. Nor had I any idea of the scope of the proposed work, or I might have been more cautious still. Be that as it may, the work appeared, and, when the conditions under which it was written are considered, it is indeed a work of no small merit. That it should contain errors goes without saying; the only marvel is that it does not contain many more. At any rate, it marks a distinct epoch in New Zealand botany, and now it remains for local botanists to supersede it with something more full and more accurate. To fulfil this want in some small measure will be attempted in this present work". In fact the greater part of the rest of his life was devoted to this purpose.

In the following paragraphs I have attempted to build up an itinerary, albeit incomplete, of Cockayne's field work during the notable Canterbury period, and to mention other events of importance during this time. A glance at the list of papers

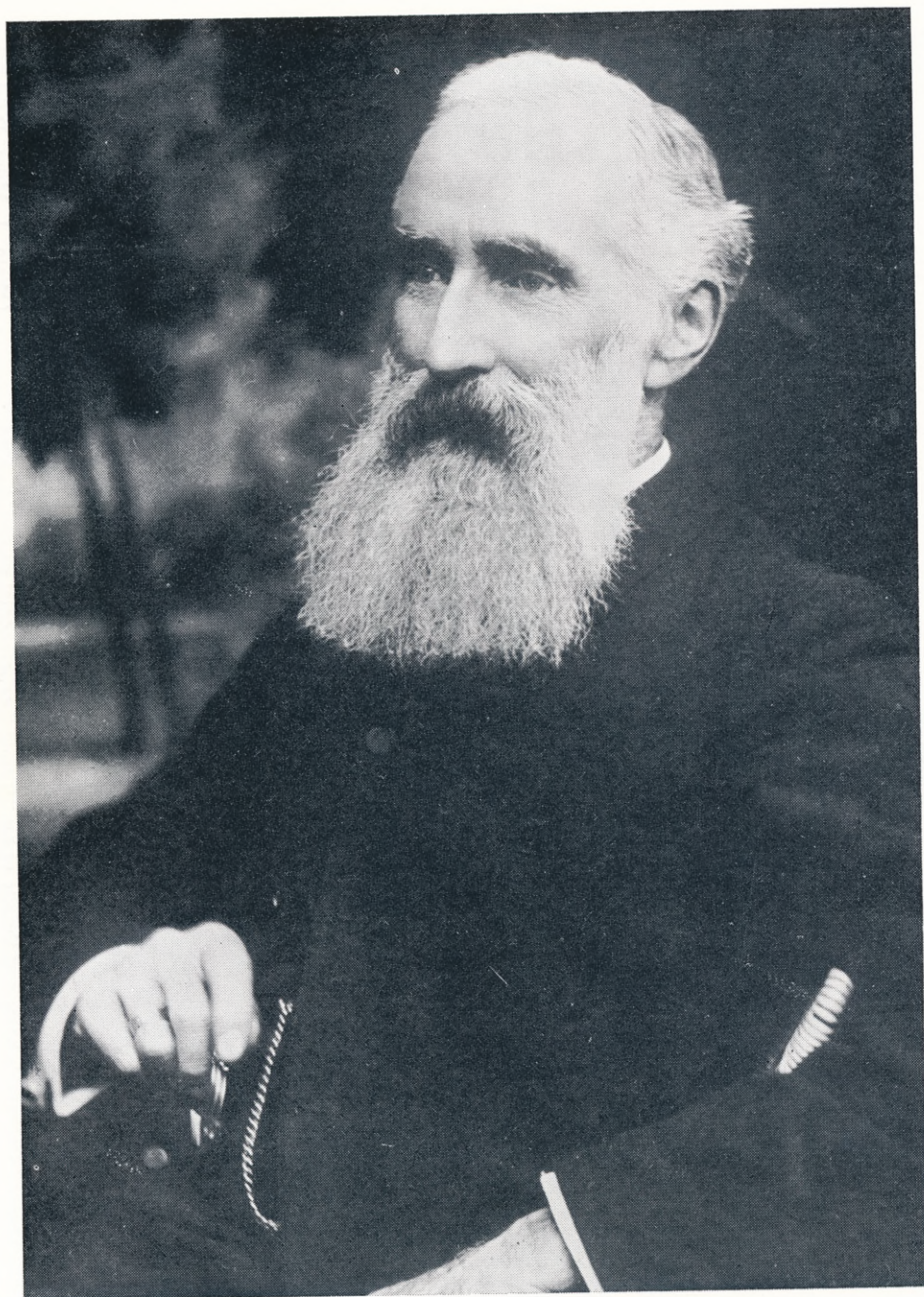


FIG. 1.—Thomas Wrench Naylor Beckett (1839–1906). (By courtesy of Mr T. N. Beckett, Christchurch.)

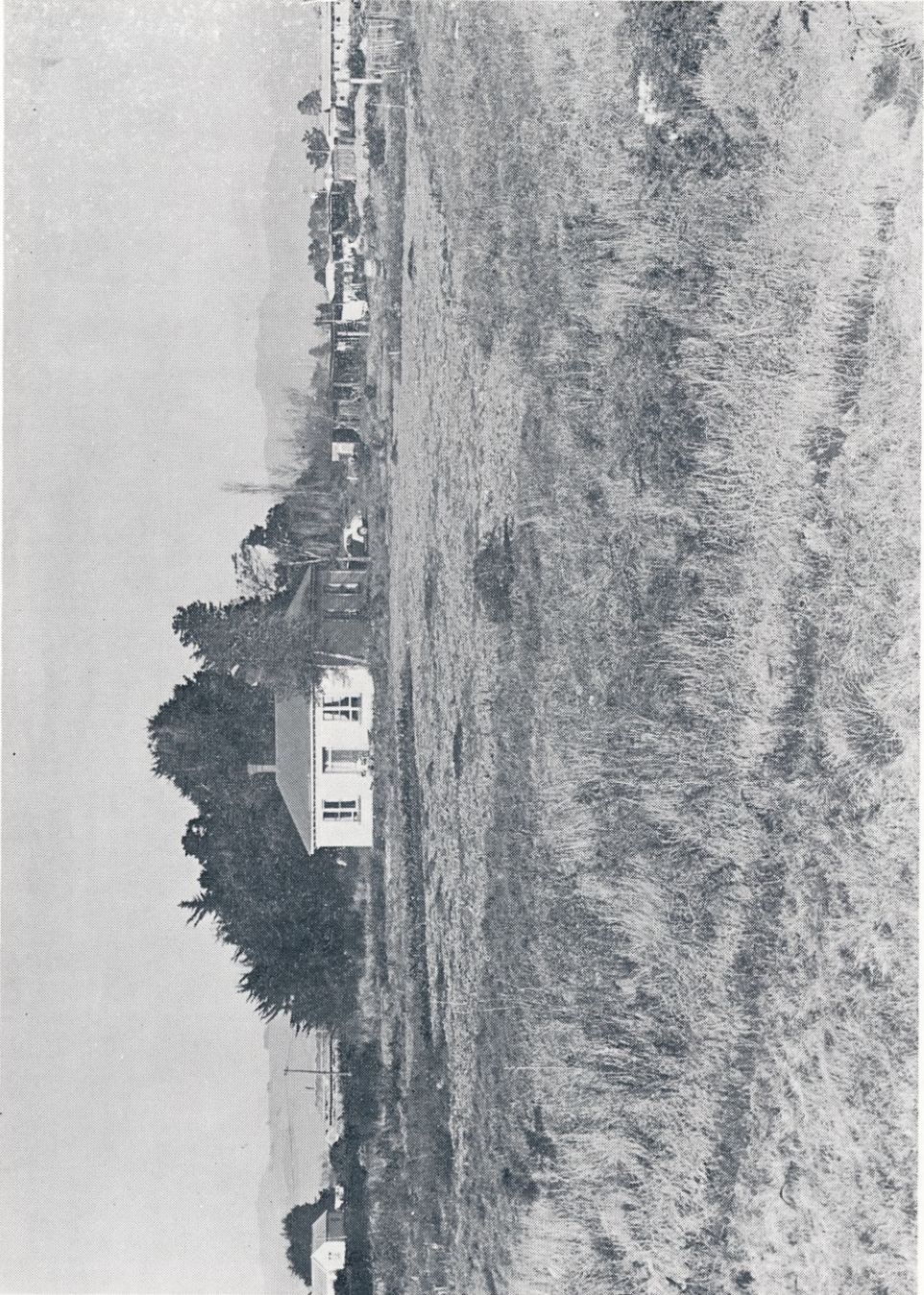


FIG. 2.—Leonard Cockayne's home and the site of his "Tarata" experimental garden, in 1962.

(Photo, J. Miles, D.S.I.R.)

from which this information has been gathered will give some idea of Cockayne's immense energy in the field, and his application at the desk, while he busied himself almost single-handed in describing the vegetation of this country. A very good preliminary assessment of Cockayne's contributions to botanical thought was given by Laing (1936).

1897: A botanical excursion to Otago Lakes in February (Cockayne, 1898, p. 441).

1897–98: Six weeks camping at Arthur's Pass from December to January (Cockayne, 1899c, p. 399; 1900b, p. 131).

1898: With von Goebel in December to Castle Hill and the head of the Oira Gorge, both for some days (Cockayne, 1933) and on to Westland for two weeks (Cockayne, 1900b, p. 133).

1901: Six weeks at the Chatham Islands in January and February (Cockayne, 1902, p. 245).

1902: Cockayne (1906d, p. 361) wrote: "My own acquaintance with the Kairouras commenced in 1902, when in February of that year I partially ascended Mount Fyffe twice, and once crossed over its summit, following the long spur from the River Kowhai and descending by another spur leading directly from the summit to the plain near the north end of the mountain. A year or two later Mr Brown and myself camped for some days near the River Conway, which we followed up to its source and to the Palmer Saddle".

1903: On the *Hinemoa* in February to Dusky Sound (Cockayne, 1910, p. 16) and Open Bay Islands (Cockayne, 1905a, p. 369). Left Lyttelton on the *Hinemoa* in the middle of June for Stewart, Auckland, Campbell and Antipodes Islands (Cockayne, 1904, p. 229). In October Cockayne was at the Thirteen Mile Bush at the source of the Selwyn River (Cockayne, 1905b, p. 368).

In 1903 Cockayne received an Honorary Ph.D. degree from von Goebel's university, the University of Munich, and pointed out in *Who's Who in New Zealand* that Lord Kelvin was then the "only other Englishman enjoying this distinction".

Some time during this year Dr Cockayne left his New Brighton property and gave the contents of his garden to the Christchurch Beautifying Association which used many of the plants on the banks of the Avon (Anon. 1919).

1904: Early in this year an invitation was received from Professor Engler "to contribute to the comprehensive *Vegetation der Erde* a volume written in English dealing with the plant-geography of New Zealand" (Cockayne, 1921). Dr Cockayne's name is not mentioned in the reports of the 1904 meetings of the Canterbury Philosophical Institute until, at the Annual Meeting on 30 November the Council regretted "that owing to his removal to Wellington it has lost the services of Dr Cockayne". He lived at Island Bay (Cockayne, 1906a, p. 342).

1905: Cockayne sailed on the *Hinemoa's* northern trip, landing on East Cape Island (Cockayne, 1907, p. 321) and on 28 February for two and a-half hours on the Poor Knights Island (Cockayne, 1906b, pp. 351, 352). On 5 March he collected near the Rangaunu estuary north of Kaitaia (Cockayne, 1917, p. 59). On 5 April he was elected a member of the Wellington Philosophical Institute. Later in the year he returned to Christchurch and on 5 July purchased the property which is now 51 Olliviers Road, Linwood (Lands and Survey Department records). By 6 September he was back at the Canterbury Institute meetings and in October was again on Mount Fyffe (Seaward Kaikoura Range) this time with Mr H. J. Matthews of Dunedin, the Chief Government Forester (Cockayne, 1906d, p. 362).

In November the Longwood Range was visited with J. Crosby-Smith and H. P. Young (Cockayne, 1907c, p. 361).

1906: In January, Cockayne made a three-days' trip to Mount Holdsworth (Tararua Mountains) with his son A. H. Cockayne, B. C. Aston and Professor T. H. Easterfield (Aston, 1910, p. 13).

The annual report of the Canterbury Philosophical Institute dated 5 December 1906 states "The Council has been in communication during the past year with the Government and with the other branches of the New Zealand Institute with regard to the pressing need of a complete botanical survey of New Zealand at an early date on the modern ecological lines adopted in similar surveys now being conducted in Europe and North America; the Council strongly urged the appointment of a Government Botanist to carry on this important work. The Council regrets to report that the Government does not propose to take any steps in the matter at present".

On 11 December 1907 we read however: "The Council in last year's report drew attention to the advisability of the appointment of a Government botanist, and it is pleased now to state that, while such a post has not yet been created, arrangements have been made between the Government and Dr Cockayne which are very satisfactory from a scientific point of view, and which enable that gentleman to continue and extend the work which he has so long and so successfully carried on at his own expense".

Under this arrangement Cockayne produced his fine series of reports on sand-dunes and various National Parks and Reserves. These surveys began, in fact, in early October, 1906, when fourteen days were devoted to a botanical survey of Kapiti Island (Cockayne, 1907b, p. 2).

1907: In January and February Cockayne studied the vegetation of Stewart Island in company with R. M. Laing, F. G. Gibbs and J. Crosby-Smith (Cockayne, 1909a, p. 5). The purpose of this visit was to obtain information "for my volume of 'Die Vegetation der Erde'". Two months in this year were also spent on a botanical survey of the Waipoua Kauri Forest (Cockayne, 1908a, p. 2). And from 14-30 November he was a member of the Subantarctic Islands Expedition organised by the Philosophical Institute of Canterbury, spending one day at the Snares and 13 days at the Auckland Islands.

1908: From 11 January to 19 March Cockayne was engaged upon a botanical survey of the Tongariro National Park (1908b, p. 5), and in September and October he completed his field work on Stewart Island (Cockayne, 1909a, p. 6).

1908-09: Beginning in mid-November Cockayne surveyed the dunes of western Wellington Province and parts of Taranaki until 8 February, and until 18 February dunes in the South Island at Normanby (South Canterbury), Waikouaiti, and coastal tree-planting at Karitane (Cockayne, 1909a, p. 3; 1911a, p. 3).

1909-10: For a few weeks in this summer, Cockayne accompanied by Mr R. Speight, surveyed the vegetation in the vicinity of Lake Heron and the Ashburton Gorge (Speight, Cockayne and Laing, 1911, p. 343).

1910: In December the dunes of Western Auckland, Ocean Beach (Dunedin) and Southland as far east as Waikawa were examined. Earlier in the year Cockayne had studied the Otago dunes to the south of Dunedin and those near Westport (Cockayne, 1911a, p. 3). In this year too, the first edition of "New Zealand Plants and their Story", appeared.

1911-12: In December and January to Marlborough (particularly the Awatere) and Nelson, with C. E. Foweraker (Cockayne, 1913).

1912: In March to the Clinton Valley and the summit of McKinnon's Pass with J. Crosby-Smith (Cockayne, 1913, p. 251).

1913: The preliminary work for "The Vegetation of New Zealand" was completed in June and the task of writing the book commenced (Cockayne, 1921). On 2 July Cockayne delivered his Presidential Address to the Philosophical Institute on "A Suggestion for Future Research in Canterbury" (*Proc.* 1913). A special committee set up to consider his recommendations reported as follows to the Council (Minutes of 21 August):

"(1) That it is desirable that the main work of the members of the Philosophical Institute of Canterbury should be devoted to the Natural History of Canterbury, with the object of producing a work thereon.

"(2) That this work should embrace the following subjects and that the persons whose names are mentioned against each subject should be requested to arrange and be responsible for the work of his subject: 1, Geology and Physiography, Mr R. Speight; 2, Botany, Dr L. Cockayne (assisted by Mr C. E. Foweraker); 3, Vertebrate Zoology, Mr Edgar R. Waite; 4, Invertebrate Zoology, Dr C. Chilton; 5, Entomology, Dr F. W. Hilgendorf; 6, Meteorology, Dr C. Coleridge Farr; 7, Soil Survey, Mr A. M. Wright." (Mr Wright was chemist to the New Zealand Refrigerating Company at Islington, and President of the Philosophical Institute of Canterbury in 1921).

However, on 3 December the Council recorded that it "has had before it the suggestion for future research in Canterbury, outlined by Dr L. Cockayne in his ex-presidential address, and, while recognising that the Institute should undertake definite work of the character outlined, it was decided, after full consideration, that in the meantime the Council could not commit the Institute to any definite scheme" (*Proc.* 1913). But the proposal was never completely forgotten and in 1927 the Philosophical Institute published its *Natural History of Canterbury* along the lines suggested by Cockayne fourteen years before. To this work R. M. Laing contributed a brief history of botanical research and described the botany of the foothills and of Banks Peninsula; the vegetation and flora of the plains was described by Cockayne, the alpine and sub-alpine flora was discussed by Wall, and H. H. Allan outlined earlier investigations on lichens, mosses and ferns.

1914: The text of the first edition of the *Vegetation of New Zealand* was completed by the end of March (Cockayne, 1921) and in April Dr Cockayne left Christchurch to live in Wellington (Anon., 1919). But his connection with this province was never completely severed. In May, 1930, at the age of 76 he revisited Arthur's Pass, and with J. W. Calder of Lincoln College studied the changes in vegetation in the 34 years since his descriptions of 1897-98 (Cockayne and Calder, 1932).

1900-1950

Influenced by the work of Diels, Warming and Schimper, and with the encouragement of Cockayne, several investigations were made at Canterbury College in the early 1900's of the morphology and anatomy of native plants in relation to habitat. Leafless plants and their assimilatory tissue were studied by Miss A. C. Finlayson (1903); Miss B. D. Cross (1910) studied the life forms and leaf-anatomy of halophytes from the Heathcote estuary, New Brighton and Timaru, and included transplant experiments in her investigations; Miss E. J. Pegg (1914) studied the life forms and leaf anatomy of New Brighton sand dune plants; Miss L. A. Suckling (1914) reported on the leaf anatomy of some trees and shrubs of the Port Hills; and Mr J. W. Bird (1916) investigated the life forms and leaf anatomy of the lianes in Riccarton Bush, an area also studied by Cockayne (1906c) and Wall (1923).

Miss E. M. Herriott began her botanical work with a description of the leaf structure of some plants from the subantarctic islands of New Zealand, using material brought back by Cockayne in 1903. She wrote: "The material on which I have been able to work has been growing ready to my hand. Dr Cockayne during his visit to the islands, succeeded in making a very valuable collection of living plants, and this he has very kindly presented to the biological laboratory of Canterbury College for its rockery. The rockery was built last year, under Dr Cockayne's supervision, for the cultivation of alpine plants. It is situated on the south side of the laboratory, and is thereby protected to a considerable extent from the sun" (Herriott, 1905). Miss Herriott assisted with botanical teaching at Canterbury College until the 1930's.

Another Canterbury woman who did much to further an interest in native plants and scenery was the author and social worker Miss Blanche Edith Baughan (1870–1958). Her name was commemorated in *Ranunculus baughanii*, a novel buttercup which she collected on the Milford Track and which Petrie described in 1913. It was probably on this same trip that at Cockayne's request, Miss Baughan collected from the Copland Pass area 74 species described as "of importance, since it is the first record of the flora of any part of alpine Westland south of the Franz Josef Glacier and its vicinity" (Cockayne, 1913, p. 251). In 1914, with Cockayne and Speight she described the Summit Road, and her illustrated booklet on Arthur's Pass and the Otira Gorge appeared in 1925.

Cockayne's departure inevitably lessened the tempo of work in Canterbury, but there were still many enthusiasts left and their names have an honoured place in New Zealand botany. The most prominent were R. M. Laing, J. E. Holloway, H. H. Allan, Arnold Wall, W. Martin, C. E. Foweraker and F. W. Hilgendorf.

Robert Malcolm Laing (1865–1941) was elected a member of the Philosophical Institute of Canterbury on 3 May 1883, and in the same year, at the age of 18 gave his first paper about some thermal springs at Lyttelton. Two years later he spoke on the classification of the Algae, and on the Fucoideae of Banks Peninsula. These papers heralded a life-time's interest in the marine Algae upon which subject Mr Laing wrote some 20 papers. But he also developed his interest in terrestrial plants no doubt under Cockayne's guidance. His major excursions were to Stewart Island with Cockayne in 1907, with the Campbell Island party of the Subantarctic expedition in 1907, to the Mount Arrowsmith region in 1909–10, to the Spenser Mountains in 1910–11 and to Norfolk Island for six weeks in early 1912. He wrote papers on most of these explorations. He also explored Banks Peninsula and wrote on its vegetation (Laing, 1914, 1919, 1922, 1924, 1927). From his cottage at Arthur's Pass he studied the vegetation there and with W. R. B. Oliver (Director of the Dominion Museum) published an account of the vegetation of the Upper Bealey River Basin in 1928. His *Plants of New Zealand* with Miss E. W. Blackwell, first published in 1906 has had a great influence in the training of New Zealand botanists.

One of Laing's colleagues on the staff of the Boys' High School was Mr H. W. Gourlay who taught there from 1919 to 1959. Gourlay aided Laing in his studies of the algal genus *Gigartina* and of the small-leaved species of the New Zealand Pittosporums (1935), and with observations at Arthur's Pass.

The Rev. J. E. Holloway (1881–1945) was vicar at Oxford from 1912 to 1916 and vicar at Leeston in 1922–23 (Allan, 1946). Between 1914 and 1916 he presented three papers to the Canterbury Philosophical Institute on the life histories and methods of reproduction of the genus *Lycopodium*. Material of the prothalli of *Lycopodium fastigiatum* was discovered near Mount Oxford. Help with imbedding and sectioning was given by C. E. Foweraker in the biological laboratories of

Canterbury College (Holloway, 1916) and apparently too, a part of the even more famous work on the prothallus of *Tmesipteris* was done in these laboratories (Holloway, 1918).

Arnold Wall was Professor of English Language and Literature at Canterbury University College from 1898 to 1931. He was elected to the Institute on 5 April 1899, and his first address on 3 May was, as we would expect, entitled "The Life-history of Words". In 1901 he spoke on "Evolution in Literary Types". We do not hear of him again until 1918 when he published a very modern paper for those times. Professor Wall took two very closely related daisies on Banks Peninsula, *Senecio saxifragoides* and *S. lagopus*, and studied the details of their morphology and distribution to see if in fact two units really existed. He concluded that they were "only two varieties of the same plant". Wall seemed to appreciate before most other New Zealanders the kinds of problems involved in speciation. In 1920 he brought evolutionary ideas to his study of *Ranunculus paucifolius*; and in a very thoughtful paper in 1926 set out to study a problem which he defined as follows. "The student of the flora of New Zealand in its wild state is confronted with very many problems arising out of the distribution of particular species. A certain plant, for example, will be found only in a very restricted area with no nearly related forms in its vicinity; or another will be found most nearly related only to one which grows many hundreds of miles away, both being quite rare; or yet another will be found commonly growing in two or more different localities at a great distance from one another, yet entirely absent in the intervening spaces. An attempt is here made to offer provisional explanations of some of these apparent anomalies".

Professor Wall walked over much of the Peninsula and he combined his discoveries there with those of Laing (1924) and with Speight (1930). In 1922, he published his botany of Christchurch and his wide explorations as a mountaineer led to many records of distribution and to his Flora of Mount Cook in 1925. Several articles on his botanical excursions were contributed to the Press, and he did valuable work in caring for the herbarium at the Museum.

Mr William Martin began his botanical career in Canterbury when appointed in 1912 as instructor in Agriculture to the South Canterbury Education Board. He made numerous visits to Akaroa and took up the study of the ferns there. His discoveries, some of them additions to the work of Laing and Wall, were published in 1920, in the Pteridophytes of Banks Peninsula (Eastern Portion). During his Canterbury period he studied *Celmisias* and this was of use in his later valuable work on the genus. Martin was Secretary of the Philosophical Institute of Canterbury for two years and Secretary of the First Science Congress here in Christchurch in 1919 of which Cockayne was President. Mr Martin left Christchurch in 1920 when he was appointed a lecturer at the Dunedin Training College. In 1916 and 1920 he had collected mosses at Arthur's Pass, and in 1942 began collecting there again, publishing an account of the Moss Flora of Arthur's Pass National Park in 1946.

Dr H. H. Allan (1882–1957) taught at Waitaki Boys' High School and Ashburton High School and between 1917 and 1921 carried out an examination of the vegetation of Mount Peel, describing the forests, shrub lands, grasslands and other herbaceous communities and spending some 30 weeks in the field there (Allan, 1926).

It is also appropriate to mention here the pioneer proposal for a soil survey of New Zealand, made by L. J. Wild (1917) while lecturer in chemistry at Canterbury Agricultural College.

Mr C. E. Foweraker (1886–1964) began his botanical work as a young teacher, and early accompanied Laing to the Spenser Mountains in 1910–11, and Cockayne to the Awatere in December and January, 1911–12. In 1915 he was appointed to

the staff of the Biology Department, Canterbury College. Foweraker's M.A. thesis dealt with the mat and cushion plants of the Cass River Bed (1917), and the work was carried out at the Canterbury College Mountain Biological Station which had been conceived by Cockayne, implemented by Chilton and was opened in March, 1914. Foweraker also combined with Cockayne to describe the principal plant associations in the vicinity of the station (1916). Studies were also made of the montane tussock grassland (A. H. Cockayne, 1916) and the rosette plants (Betts, 1920).

After war service and a year at Downing College, Cambridge, Foweraker returned as lecturer in botany in 1920. He became lecturer-in-charge of the forestry department, Canterbury College, on its inception in 1924, and was Director of the short-lived School of Forestry between 1930 and 1934. Until his retirement in 1951 he was in charge of botanical teaching and research and a steady stream of M.Sc. theses was produced in the department. Those referable to the Cass region were: "Plant succession on shingle fans" by D. M. Oldridge (1922); "Pimeleas of the Cass Valley" by B. I. Parlane (1925); "Montane tussock grassland" by N. A. Malcolm (1925); "The periodicity of the Phytoplankton in Lake Sarah" by E. A. Flint (1935); "The Ecology of *Celmisia spectabilis*" by F. R. Nurse (1940); "The growth and anatomy of terminal shoots in *Hymenanthera alpina*" by B. C. Arnold (1947); and "The scree plants of Mount Bailey" by F. J. F. Fisher (1947).

With the death or retirement of the older workers and the unsettlement of the Second World War, botanical activities outside the University gradually decreased during the thirties and forties in Canterbury. However, continuity in field work was maintained by W. B. Brockie and H. Talbot.

Brockie served his gardening apprenticeship at the Haining Estate, Selkirk, Scotland. He came to Dunedin in 1921, arrived in Christchurch in 1928, and was employed in the Gardens from 1929 to 1947. He was in charge of the native section in 1930, and later propagator and foreman of glasshouses, but returned to general outside activities principally to develop the New Zealand native section, a project in which the Director, Mr J. A. McPherson, had a keen interest. Brockie laid out the Cockayne Memorial Garden, which was officially opened by Professor Carl Skottsberg in 1939. Brockie collected from 1930 onwards in many areas from Mount Torlesse to the Spenser Mountains and Seaward Kaikouras and also in the Garvie Mountains, Central Otago, South Canterbury, Westland and Nelson. In 1947 he wrote an account of the vegetation of the Maruia River and Ada Pass. In this and most of his later trips Brockie was accompanied by H. Talbot, who taught at the Springfield School from 1937 to 1956 and was particularly interested in the botany of the Torlesse region.

W. R. B. Oliver continued his collecting in Canterbury while Director of the Canterbury Museum in 1947-48, and V. D. Zotov, of Botany Division, D.S.I.R., then in Wellington, studied the Canterbury grasslands in 1937-38.

The studies mentioned so far have usually been concerned with native plants and native vegetation. But F. W. Hilgendorf (1874-1942) of Lincoln College, took up the study of the new flora and vegetation which was developing as a result of the activities of man. We are indebted to him for the first popular book on New Zealand weeds (1926) and for a most important contribution on the vegetation of New Zealand, his *Grasslands of the South Island of New Zealand—An Ecological Survey* (1935). This is the only published attempt that I know of to put the vegetation-types of the whole South Island on a map in any detail. And an important feature is that Hilgendorf made no distinction between native and introduced plants. He recorded the situation as it was. He has put down on a map—to serve "as a record of the present condition, from which future changes and their causes may be traced"—the end results of processes which he aptly describes as follows:

“In the case of New Zealand, however, there has been a recent and violent change in the environment of most of the plant associations. From the middle of last century there has been a most vigorous attack upon the native indigenous vegetation following the settlement of the land by a highly civilised agricultural population. The white man came with his axe, his fire-stick, and his plough. A description of the country by its plant covering must therefore be linked up with an explanation of man's action in producing it, whether he has left it untouched, or has undertaken a struggle with Nature: and in the latter case whether he has beaten Nature and established the plants he desired, or whether Nature has beaten him and covered the land with plants he did not wish for and whose growth he cannot at present control”.

Just as Canterbury had led New Zealand in the development of ecological studies so also scientists in the province took the lead in developing the relatively new science of cytology and genetics. In 1910 Hilgendorf was asked by his Director, Professor R. E. Alexander, to try and improve the local wheat varieties. This he did with great success and in the course of his work his natural interest in number led him to campaign for the use of proper statistical methods in field trials and led him to an appreciation of Mendel's laws. He recorded “I think that I was also the first New Zealand protagonist for the Mendelian theory of inheritance,” and also “perhaps the best compliment I ever received for a lecture was from Dr Chilton. Beforehand he had said to me: ‘Well, I teach Mendelism and I examine upon it but I don't understand it’; and after the address he said: ‘Well, Mendelism isn't so difficult after all’” (Blair, 1956).

Early in 1929 O. H. Frankel came to New Zealand to join the staff of the newly formed Wheat Research Institute under Hilgendorf. Frankel had worked under Erwin Baur in Germany; for the Empire Marketing Board in Palestine; and at Cambridge University. He was given a laboratory in an old brick building which had earlier been the college power-house, and began to study the chromosomes of the native Hebes probably at the suggestion of Dr Cockayne or Dr Allan. In 1932 Frankel was joined at Lincoln by J. B. Hair who expanded Frankel's work on Hebes as his M.Sc. thesis, and they published jointly on this subject (1937). J. W. Calder also worked for a time with this group and in 1937 published a study of the chromosomes of native *Danthonias*. In Frankel's later cytological work he turned particularly to wheat, but Dr Hair has maintained his interest in the native plants to the present day at Botany Division.

THE OLD AND THE NEW

During its first one hundred years the province of Canterbury supported a small but lively community of professional and amateur botanists, whose work often placed them in the vanguard of the science in New Zealand. As already stated this was particularly so in plant ecology, in cytology, and in genetics. But there still remained many gaps in our knowledge of provincial botany. After one hundred years we possessed good check-lists of the flowering plants and ferns of Banks Peninsula due to the work of Laing, Wall and Martin; and certain other smaller areas, such as Riccarton Bush, had been intensively botanised. But the only attempt to treat the province as a whole remained the early work of the Armstrongs; and it was also their collection which formed the nucleus of the relatively small provincial herbarium. For adventive plants the most up-to-date list was that for Ashburton County by Smith (1904) and for vegetation we had only the very generalised map by Hilgendorf (1935). On the other hand the native plant section of the Christchurch Botanic Garden was developing well. Thus it can be seen, that as the second century of botany in Canterbury gets under way, much still remains to be

observed and catalogued from the field. A worthwhile aim would be the production of a "Flora of Canterbury" containing more detailed local information than can be given in a "Flora of New Zealand".

A future historian would probably consider the 1950's as the beginning of a new period in Canterbury botany, and there would be several reasons for this. First, the amalgamation in 1950 of the Agronomy Division with the wheat breeding section of the Wheat Research Institute to form the Crop Research Division of the D.S.I.R.; second, the creation of a chair of Botany at Canterbury College in 1954 and the appointment of W. R. Philipson to this position; third, the transfer of the Botany Division of D.S.I.R. from Wellington to Christchurch in 1954; fourth, the location of the Forest and Range Experimental Station of the Forest Service at Rangiora under J. T. Holloway; and last, the formation of the Tussock Grasslands and Mountain Lands Institute in 1960, located at Lincoln College with L. W. McCaskill as first director. To discuss this period is not my present concern. I will only point out that there is now in Canterbury one of the biggest concentrations in New Zealand of organisations interested in some aspect or another of plant research, and that the future for botany here seems bright indeed.

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LITERATURE CITED

- ALLAN, H. H., 1926. The Vegetation of Mount Peel, Canterbury, New Zealand. Part 1. The Forests and Shrublands. *Trans. N.Z. Inst.* 56: 37-51. Part 2. The Grasslands and other Herbaceous Communities. *Trans. N.Z. Inst.* 57: 73-89.
- 1927. Lichens, Mosses and Ferns of Canterbury in Natural History of Canterbury, 160-66.
- 1946. John Ernest Holloway (1881-1945). *Trans. roy. Soc. N.Z.* 76: xlv-vi.
- ANON., 1919. Biographical Notice. Leonard Cockayne, Ph.D., F.R.S., President of the New Zealand Institute. *N.Z. Journ. Sci. Tech.* 2: 231-34.
- ARMSTRONG, J. B., 1880. A Short Sketch of the Flora of the Province of Canterbury, with Catalogue of Species. *Trans. N.Z. Inst.* 12: 325-53.
- ARMSTRONG, J. F., 1870. On the Vegetation of the neighbourhood of Christchurch, including Riccarton, Dry Bush, etc. *Trans. N.Z. Inst.* 2: 118-28.
- 1872. On the Naturalised Plants of the Province of Canterbury. *Trans. N.Z. Inst.* 4: 284-91.
- ARMSTRONG, J. F., AND ARMSTRONG, J. B., 1872. Notes on Grasses Indigenous to the Province of Canterbury. *Trans. N.Z. Inst.* 4: 301-4.
- ASTON, B. C., 1910. Botanical Notes made on a Journey across the Tararua. *Trans. N.Z. Inst.* 42: 13-25.
- BAILEY, L. H., 1938. Leonard Cockayne, Horticulturist. *Journ. N.Z. Inst. Hort.* 8: 1-8.

- BARNETT, M. J., 1963. *The Men who made the Gardens in A Garden Century, 1863–1963*. Pegasus Press, Christchurch.
- BAUGHAN, B., COCKAYNE, L., AND SPEIGHT, R., 1914. *The Summit Road: Its Scenery, Botany and Geology*. Christchurch.
- BAUGHAN, B. E., 1925. *Arthur's Pass and the Otira Gorge*. Whitcombe and Tombs Ltd.
- BERGGREN, S., 1898. *On New Zealand Hepaticae*. E. Malmström, Lund.
- BETTS, M. W., 1920. Notes from the Canterbury College Mountain Biological Station, Cass. No. 7—The Rosette Plants. *Trans. N.Z. Inst.* 52: 253–75.
- BIRD, J. W., 1916. Observations on the Lianes of the Ancient Forest of the Canterbury Plains of New Zealand. *Trans. N.Z. Inst.* 48: 315–53.
- BLAIR, I. D., 1956. *Life and Work at the Canterbury Agricultural College*. Caxton Press, Christchurch.
- BOWER, F. O., 1927. Organography of Plants. *Nature*, 119: 931–32.
- BROCKIE, W. B., 1946. Notes on the Indigenous Vegetation at the head of the Maruia River and Ada Pass with lists of Species. *Trans. roy. Soc. N.Z.* 76: 255–61.
- BROWN, R., 1893. Notes on the New Zealand species of the genus *Andreaea*, together with Descriptions of some New Species. *Trans. N.Z. Inst.* 25: 276–85.
- CALDER, J. W., 1937. A Cytological Study of some New Zealand Species and Varieties of *Danthonia*. *J. Linn. Soc. (Bot.)* 51: 1–9.
- CHEESEMAN, T. F., 1882. On some Additions to the Flora of New Zealand. *Trans. N.Z. Inst.* 14: 299–301.
- COCKAYNE, A. H., 1916. Notes from the Canterbury College Mountain Biological Station. No. 3—Some Economic Considerations concerning Montane Tussock Grassland. *Trans. N.Z. Inst.* 48: 154–165.
- COCKAYNE, L., 1898. On the Freezing of New Zealand Alpine Plants: Notes of an Experiment conducted in the Freezing-Chamber, Lyttelton. *Trans. N.Z. Inst.* 30: 435–42.
- 1899a. An Enquiry into the Seedling Forms of New Zealand Phanerogams and their Development. Part 1. *Trans. N.Z. Inst.* 31: 354–61.
- 1899b. An Enquiry into the Seedling Forms of New Zealand Phanerogams and their Development. Part 2. *Trans. N.Z. Inst.* 31: 361–98.
- 1899c. On the Burning and Reproduction of Sub-alpine Scrub and its Associated Plants; with special reference to Arthur's Pass District. *Trans. N.Z. Inst.* 31: 398–419.
- 1899d. Descriptions of New Species of *Astelia*, *Veronica* and *Celmisia*. *Trans. N.Z. Inst.* 31: 419–424.
- 1900a. An Enquiry into the Seedling Forms of New Zealand Phanerogams and their Development. Part 3. *Trans. N.Z. Inst.* 32: 83–94.
- 1900b. A Sketch of the Plant Geography of the Waimakariri River Basin, considered chiefly from an Oecological point of view. *Trans. N.Z. Inst.* 32: 95–136.
- 1900c. A Glimpse into the Alps of Canterbury in Canterbury Old and New, 1850–1900. A Souvenir of the Jubilee. Whitcombe and Tombs.
- 1901. An Enquiry into the Seedling Forms of New Zealand Phanerogams and their Development. Part 4. *Trans. N.Z. Inst.* 33: 265–98.
- 1902. A short account of the Plant-covering of Chatham Island. *Trans. N.Z. Inst.* 34: 243–324.
- 1904. A Botanical Excursion during Midwinter to the Southern Islands of New Zealand. *Trans. N.Z. Inst.* 36: 225–333.
- 1905a. Notes on the Vegetation of the Open Bay Islands. *Trans. N.Z. Inst.* 37: 368–77.
- 1905b. On the Defoliation of *Gaya lyallii*. *Trans. N.Z. Inst.* 37: 368.
- 1906a. On a Specific Case of Leaf-variation in *Coprosma baueri*, Endl. (Rubiaceae). *Trans. N.Z. Inst.* 38: 341–45.
- 1906b. Notes on a Brief Botanical Visit to the Poor Knights Islands. *Trans. N.Z. Inst.* 38: 351–360.

- COCKAYNE, L., 1906c. Riccarton Bush. List of the Flowering Plants and Ferns with introductory note, etc. Lyttelton Times Co.
- 1906d. Notes on the Subalpine Scrub of Mount Fyffe, Seaward Kaikouras. *Trans. N.Z. Inst.* 38: 361-74.
- 1906e. Robert Brown, Botanist. *Lyttelton Times*, 19 December.
- 1907a. Some Observations on the Coastal Vegetation of the South Island of New Zealand. Part 1: General Remarks on the Coastal Plant Covering. *Trans. N.Z. Inst.* 39: 312-59.
- 1907b. Report on a Botanical Survey of Kapiti Island. Wellington.
- 1907c. Some Hitherto-unrecorded Plant-habitats. (II). *Trans. N.Z. Inst.* 39: 361-78.
- 1908a. Report on a Botanical Survey of the Waipoua Kauri Forest. Wellington.
- 1908b. Report on a Botanical Survey of the Tongariro National Park. Wellington.
- 1909a. Report on a Botanical Survey of Stewart Island. Wellington.
- 1909b. Report on the Sand Dunes of New Zealand. Wellington.
- 1909c. The Ecological Botany of the Subantarctic Islands of New Zealand, in *The Subantarctic Islands of New Zealand* 1: 183-235.
- 1910. *New Zealand Plants and their Story* (First Edition). Wellington.
- 1911a. Report on the Dune-areas of New Zealand, their Geology, Botany and Reclamation. Wellington.
- 1911b. On the Peopling by Plants of the Subalpine River Bed of the Rakaia (Southern Alps of New Zealand). *Trans. and Proc. Bot. Soc. Edinburgh*, 29: 104-25.
- 1913. Some Hitherto-unrecorded Plant-habitats (VIII). *Trans. N.Z. Inst.* 45: 251-63.
- 1917. Notes on New Zealand Floristic Botany, including Descriptions of New Species, etc. (No. 2). *Trans. N.Z. Inst.* 49: 56-65.
- 1921. *The Vegetation of New Zealand* (First Edition). Leipzig and New York.
- 1926. Donald Petrie, 1846-1925. *Trans. N.Z. Inst.* 56: vii-ix.
- 1927. Robert Brown, in *Natural History of Canterbury*. Christchurch.
- 1927. The Vegetation and Flora of the Canterbury Plain, in *Natural History of Canterbury*, 115-144.
- 1933. Karl Ritter von Goebel, 1855-1932. *Trans. N.Z. Inst.* 63: 389-91.
- COCKAYNE, L., AND FOWERAKER, C. E., 1916. Notes from the Canterbury College Mountain Biological Station: No. 4, The Principal Plant Associations in the Immediate Vicinity of the Station. *Trans. N.Z. Inst.* 48: 166-86.
- COCKAYNE, L., AND CALDER, J. W., 1932. The present vegetation of Arthur's Pass (New Zealand) as compared with that of Thirty-four Years Ago. *Journ. Ecol.* 20: 270-83.
- CROSS, B. D., 1910. Observations on some New Zealand Halophytes. *Trans. N.Z. Inst.* 42: 545-74.
- DENDY, A., 1900. Plants and Animals of Canterbury, in *Canterbury Old and New, 1850-1900. A Souvenir of the Jubilee*. Whitcombe and Tombs.
- DIELS, L., 1896. Vegetations-Biologie von Neu-Seeland. *Engler's Bot. Jahrb.* 22: 201-300.
- 1905. Über die Vegetationsverhältnisse Neu-Seelands. *Engler's Bot. Jahrb.* 34: *Beiblatt* 79: 64-.
- D'URVILLE, J. S. C., DUMONT, 1842-46. *Voyage on Pôle Sud et dans l'Océanie sur les corvettes l'Astrolabe et la Zélée*. Paris.
- FINLAYSON, A. C., 1903. The Stem-structure of some Leafless Plants of New Zealand, with Especial Reference to their Assimilatory Tissue. *Trans. N.Z. Inst.*, 35: 360-372.
- FOWERAKER, C. E., 1917. Notes from the Canterbury College Mountain Biological Station No. 5. The Mat-Plants, Cushion-Plants, and allied forms of the Cass River Bed. *Trans. N.Z. Inst.* 49: 1-45.
- FRANKEL, O. H., AND HAIR, J. B., 1937. Studies on the Cytology, Genetics and Taxonomy of New Zealand *Hebe* and *Veronica*. Part 1. *N.Z. J. Sci. Tech.* 18: 669-87.
- HAAST, H. V. VON, 1948. *The Life and Times of Sir Julius von Haast*. Wellington.

- HAAST, JULIUS VON, 1870. Introductory Remarks on the Distribution of Plants in the Province of Canterbury. *Trans. N.Z. Inst.* 2: 118-19.
- 1879. Geology of the Provinces of Canterbury and Westland, New Zealand. Christchurch.
- HAMILTON, W. J. W., 1850. Report on explorations in North Canterbury. *Great Britain Parliamentary Papers*, 153-5.
- HAMLIN, B. G., 1958. Itinerary of Donald Petrie's Botanical Expeditions, with a Bibliography of Petrie's Botanical Papers. *Rec. Dom. Mus.* 3: 89-98.
- 1965. Itinerary of Thomas Kirk's Botanical Expeditions. *Rec. Dom. Mus.* 5: 93-100.
- HERRIOTT, E. M., 1905. On the Leaf-structure of some Plants from the Southern Islands of New Zealand. *Trans. N.Z. Inst.* 38: 377-422.
- 1919. A History of Hagley Park, Christchurch, with Special Reference to its Botany. *Trans. N.Z. Inst.* 51: 427-447.
- HILGENDORF, F. W., 1935. The Grasslands of the South Island of New Zealand. An Ecological Survey. *D.S.I.R. Bull.* No. 47.
- HOLLOWAY, J. E., 1916. Studies in the New Zealand Species of the Genus *Lycopodium*: Part 1. *Trans. N.Z. Inst.* 48: 253-303.
- 1918. The Prothallus and Young Plant of *Tmesipteris*. *Trans. N.Z. Inst.* 50: 1-44.
- HOOKE, J. D., 1853-55. *Flora Novae-Zelandiae*. London.
- 1867. *Handbook of the New Zealand Flora*. London.
- KIRK, T., 1895. Descriptions of New or Remarkable Plants from the Upper Waimakariri. *Trans. N.Z. Inst.* 27: 349-53.
- LAING, R. M., 1886. Observations on the Fucoideae of Banks Peninsula. *Trans. N.Z. Inst.* 18: 303-11.
- 1914. On a Subalpine element in the Flora of Banks Peninsula. *Trans. N.Z. Inst.* 46: 56-59.
- 1919. The Vegetation of Banks Peninsula with a list of Species (Flowering Plants and Ferns). *Trans. N.Z. Inst.* 51: 355-408.
- 1922. The Flora of Banks Peninsula. *New Zealand Nature Notes*: 41.
- 1927. The History of Botanical Research in Canterbury; The Botany of the Canterbury Foothills; The Botany of Banks Peninsula in Natural History of Canterbury, 97-114. Christchurch.
- 1936. Leonard Cockayne, 1855-1934. *Trans. roy. Soc. N.Z.* 65: 457-67.
- LAING, R. M., AND BLACKWELL, E. W., 1906. *Plants of New Zealand*. First Edition. Whitcombe and Tombs.
- LAING, R. M., AND GOURLAY, H. W., 1934. Vegetation of the Bealey River Basin. Supplement to list of Species (1929) with Notes. *Trans. roy. Soc. N.Z.* 64: 1-10.
- 1935. The Small-leaved Species of the Genus *Pittosporum* occurring in New Zealand, with descriptions of New Forms. *Trans. roy. Soc. N.Z.* 65: 44-62.
- LAING, R. M., AND OLIVER, W. R. B., 1929. Vegetation of the Upper Bealey River Basin, with a list of the Species. *Trans. N.Z. Inst.* 59: 715-30.
- LAING, R. M., AND WALL, A., 1924. The Vegetation of Banks Peninsula: Supplement 1. *Trans. N.Z. Inst.* 55: 438-44.
- MALING, P. B. (Ed.), 1958. *The Torlesse Papers*. The Pegasus Press, Christchurch.
- MARTIN, W., 1920. Pteridophytes of Banks Peninsula (Eastern Portion). *Trans. N.Z. Inst.* 52: 315-22.
- 1946. The Moss Flora of Arthur Pass National Park. *Trans. roy. Soc. N.Z.* 76: 37-57.
- McLAREN, FERGUS B., 1948. *The Auckland Islands*. Wellington.
- McClymont, W. G., 1959. *The Exploration of New Zealand*. Second Edition. London.
- MONTAGNE, C., 1845. *Voyage au Pôle Sud etc. Botanique*. 1. *Plantes Cellulaires*. Paris.

- PEGG, E. J., 1914. An Ecological Study of some New Zealand Sand-dune Plants. *Trans. N.Z. Inst.* 46: 56–59.
- POTTS, T. H., AND GRAY, W., 1871. On the Cultivation of some Species of Native Trees and Shrubs. *Trans. N.Z. Inst.* 3: 181–202.
- POTTS, T. H., 1882. Out in the Open: A Budget of Scraps of Natural History gathered in New Zealand. Christchurch.
- RAOUL, E. F. A., 1844. Choix de Plantes de la Nouvelle-Zélande. *Ann. Sci. Nat. Ser.* 3, 2.
 ——— 1846. Choix de Plantes de la Nouvelle-Zélande. Paris.
- SMITH, W. W., 1904. Plants Naturalised in the County of Ashburton. *Trans. N.Z. Inst.* 36: 203–225.
- SPEIGHT, R., COCKAYNE, L., AND LAING, R. M., 1911. The Mount Arrowsmith District: A Study in Physiography and Plant Ecology. *Trans. N.Z. Inst.* 43: 315–378.
- STRANGE, MR, 1850. The Canterbury Plains. Canterbury Papers, No. 3, p. 77.
- SUCKLING, L. A., 1914. The Leaf-anatomy of some trees and shrubs growing on the Port Hills, Christchurch. *Trans. N.Z. Inst.* 46: 178–188.
- TRAVERS, W. T. L., 1869. Remarks on a Comparison of the General Features of the Flora of the Provinces of Nelson and Marlborough with that of Canterbury. *Trans. N.Z. Inst.* 1: Essays, 17–21.
- WALL, A., 1918. On the Distribution of *Senecio saxifragoides* Hook. f. and its Relation to *Senecio lagopus* Raoul. *Trans. N.Z. Inst.* 50: 198–.
- 1920. *Ranunculus paucifolius* T. Kirk: Its Distribution and Ecology, and the Bearing of these upon certain Geological and Phylogenetic problems. *Trans. N.Z. Inst.* 52: 90–105.
- 1922. The Botany of Christchurch. Revised edition, 1953.
- 1923. The Riccarton Bush. Lyttelton Times Co.
- 1925. The Flora of Mount Cook. Christchurch.
- 1926. Some problems of Distribution of Indigenous Plants in New Zealand. *Trans. N.Z. Inst.* 57: 94–105.
- 1926. Alpine and Sub-alpine Flora, in Natural History of Canterbury. 145–59. Christchurch.
- 1930. Appendix on the Plant-covering of the Spit, in R. Speight, The Lake Ellesmere Spit. *Trans. N.Z. Inst.* 61: 147–69.
- 1935. Notes on the Armstrong Herbarium. *Rec. Canterbury Mus.*, 4, 97–114.
- WARD, EDWARD, 1951. The Journal of Edward Ward. The Pegasus Press, Christchurch.
- WILD, L. J., 1917. On the Proposal for a Soil Survey of New Zealand. *Trans. N.Z. Inst.* 49: 476–490.
- ZOTOV, V. D., 1938. Survey of the Tussock-grasslands of the South Island, New Zealand. Preliminary Report. *N.Z. Journ. Sci. Tech.* 20: 212–244.

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