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ORDINARY MEETING.*

PROFESSOR EDWARD HULL, LL.D., F.R.S., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following paper was read :—

REMARKS ON THE PAST, PRESENT, AND FUTURE OF THE AUSTRALIAN FLORA. By the Rev. W. WOOLLS, Ph.D., F.L.S.

THE primeval history of Australian Botany is necessarily associated with the adventurous navigators, who, animated by the spirit of Vasco di Gama, traversed the Indian Ocean and reached the North-western shores of New Holland whereof Van Diemen's Land—subsequently called Tasmania, was then regarded as an integral portion. Such a mistake may seem strange to the present generation, but it held its ground until the year 1798, when Bass and Flinders discovered that Van Diemen's Land was separated from the mainland by at least a hundred miles of sea. Portuguese and Dutch navigators had already become acquainted with New Holland in their voyages to the East Indies, but as these voyages were undertaken in the interests of commerce and at a period when systematic botany was only in its infancy, they added but little to our knowledge of the Australian Flora. It was not until the days of DAMPIER, who in 1699 visited the Western Coast of Australia for the second time, that any specimens of Australian plants were collected and taken to Europe. To DAMPIER belongs the honour of having been

* January 21st, 1895.

the first to communicate any knowledge of such plants to the scientific world. His herbarium is still preserved at Oxford and contains forty specimens, eighteen of which are figured in his *Voyage* (vol. III., ed. 1709), though few of them with the exception of *Colutea Novæ Hollandiæ* (now *Clianthus Dampieri*), can be identified. The distinguished navigator COOK, was the next to render service to the cause of Australian botany, for although the original intention of his first expedition (1770) was to promote geographical and astronomical research, Mr. (afterwards Sir Joseph) BANKS had sufficient influence with the Government of the day to connect the voyage with the pursuit of natural history. For this purpose he determined to share the glory of the expedition and to furnish at his own expense the means of prosecuting his favourite study. He provided, therefore, the apparatus conducive to that object, and engaged Dr. Solander (a Swede by birth and a distinguished pupil of Linnæus) to accompany him, as well as two artists—one to delineate views and figures, and the other to paint subjects of natural history—with a secretary and four servants. "No pains," says Baron Cuvier, "were spared by the naturalist to enrich his collection or to gratify his curiosity. BANKS displayed an astonishing activity; fatigue did not depress him, nor did danger deter him. He was always in advance, and invariably referred to in time of difficulty." BANKS and SOLANDER collected specimens at Botany Bay, Endeavour River, and other parts of the Australian coast, and added 1,000 species to the few already known. On this subject, Sir Joseph's biographer remarks, "It was long hoped that BANKS and SOLANDER would give an account of their labours and of the immense collections made during the expedition. SOLANDER, having devoted ten years to his part of the undertaking, died in 1782." In addition to their common journal, their notes and all the designs made under their direction still exist in the Banksian Library, now in the British Museum. A series of engravings, which it was intended to increase to 2,000, had been commenced; but from some cause or other not very well explained, nothing was published under the auspices of the authors. Their labours, however, were not lost to the scientific world (botanists being permitted to consult the specimens which had been collected), and in the course of a few years they received due recognition from the greatest botanist of the age, ROBERT BROWN. Menzies, in Vancouver's expedition of 1791, and Labillardière

in that of D'Entrecasteaux in 1792, also contributed materially to the knowledge of the Australian Flora, as did Mr. JOHN WHITE, Surgeon-General, who arrived in the colony of New South Wales in 1788 with the "First Fleet," and resided there for seven years. He sent to Europe specimens which were described by Sir John Smith, and figured in the appendix to White's *Voyage to New South Wales*. It was in the beginning of the present century, however, that the expedition of FLINDERS (1801–1803) gave additional and permanent interest to the study of Australian botany, and introduced to European notice some of its most remarkable features. ROBERT BROWN, sometimes designated "The Prince of Botanists," and sometimes "The Father of Australian Botany," accompanied FLINDERS as naturalist and rendered imperishable service to the cause of science by his observations. He had been induced by BANKS to give up his commission as ensign and surgeon for the pursuit of botany, and the foresight of Sir J. Banks was fully realised in the singular ability of his illustrious *protégé*. After having visited the southern coasts of the continent, and examined the flora from Port Jackson to the Blue Mountains, he returned to Europe *spoliis Orientis onustus*, bringing with him some 4,000 species of plants, either wholly new to science or only imperfectly known, but destined to employ him for several years in determining their relative position in the system of classification which experience had taught him to adopt. In his celebrated *Prodromus Novæ Hollandiæ* (1810), he may be said to have laid the foundation of Australian botany on a sure basis, and to have initiated that mode of arranging orders and genera which, with some modification, all subsequent botanists have been content to follow. This great work was composed in the midst of Banks's collections, and so highly did Sir J. Banks value his services, that by his will (1820) he bequeathed to him an annuity of £200, together with the use and enjoyment during his life of his library, herbarium, manuscripts, drawings, &c. He also bequeathed to F. BAUER (the eminent artist and companion of Brown who had been in Banks's employment for thirty years) an annuity of £300 on condition of his continuing to delineate the flowers at Kew. Bauer's illustrations of Australian flowers have always been valued for their elegance and accuracy, and being made under the direction of Brown exhibited the organic peculiarities on which the great botanist based his system. Few men indeed

have gained a more honourable reputation in the paths of science than ROBERT BROWN, and his name will ever be associated with the Flora of Australia in the appropriate terms by which he designated many of its genera. Contemporaneously with this distinguished man, GEORGE CALEY was sent out to New South Wales by Sir Joseph Banks, and resided in the colony from 1800 to 1810. During that period he collected 400 species of plants, and advanced farther into the interior than any previous explorer, having penetrated as far as Caley's Repulse (near the present Numantia) some years before the Blue Mountains were crossed by WENTWORTH, BLAXLAND, and LAWSON. His correspondence with Banks is preserved in the *Brabourne Papers*. It is recorded of him that "his primary duties in New South Wales were the collecting of plants for his patron and seeds for the garden at Kew; but so greatly did he extend his field of action that the most splendid portion of the Museum of the Linnean Society consists of quadrupeds, birds, and reptiles, collected by his indefatigable energy." Brown named the genus *Caleya* after him "as a skilled and accurate botanist."

The surveys of Admiral KING in the intertropical and western coasts of Australia between 1818 and 1822 did much to promote the advancement of botanical knowledge. Moreover, and at the especial request of Sir Joseph Banks, ALLAN CUNNINGHAM accompanied the expeditions and made valuable collections of plants, especially on the North-west shores of Australia. His remarks on these plants appended to King's voyages reveal a multitude of new forms hitherto unknown to science. The interior of the colony having been opened up by the passage over the Blue Mountains in 1813, Cunningham was able to penetrate farther into the interior than any of his predecessors, and whilst OXLEY was tracing the Lachlan and Macquarie Rivers, he traversed 1,200 miles and collected 450 species of plants. But Cunningham was more than an accomplished botanist, and as an enterprising explorer must ever rank amongst those who have exerted themselves to extend the geographical knowledge of the continent. His discoveries in the northern parts of the colony, now part of Queensland, tended to facilitate communication with what was then called "the back country" and to prepare the way for profitable settlement. He was not, however, fortunate in his relations with the Colonial Government of the day, Governor MACQUARIE having failed

to render him that assistance which was necessary for the furtherance of his pursuits and the development of Australia's resources. Nor was he more fortunate in the valuable specimens forwarded to England, many of which were not utilised until the publication of the *Flora Australiensis*. Mr. BENTHAM in alluding to the matter remarks, "the rich herbarium collected at the public expense by the late A. Cunningham in his various expeditions were stowed away, many of them for a quarter to half a century, unarranged in their original parcels, without any thought of providing the staff and funds necessary to render them of use to scientific botanists." When at length these collections were examined, they were found to be of the greatest importance in the preparation of the *Flora*, and Mr. Bentham acknowledged that, in their variety and extent, they were second only to those of Robert Brown. Cunningham's health had been impaired by his zeal in collecting, especially in tropical climates where the thermometer ranged from 105° to 115° in the shade, and although by visiting New Zealand and parts of the Australian continent in search of new plants he seemed for awhile to regain somewhat of his former energy, his health gradually declined, and when I saw him about a year before his death he appeared to have become prematurely old. He died in Sydney in 1839 at the age of 48, nearly twenty years before his great predecessor R. Brown who had attained the advanced age of 86. With the death of Cunningham, the first period of botanical discovery in Australia may be said to have closed, and for many years, notwithstanding the voyages of navigators and the expeditions of explorers, little was done to place on any connected record the valuable information which they had acquired respecting Australian plants, or to arrange them in any systematic form. Such plants were described in appendices to voyages and travels not accessible to the general public, or noticed only in papers read before learned societies, so that the greatest uncertainty prevailed as to the number and distribution of species. Thus Brown's great work of 1810 (with his subsequent additions) remained the only reliable standard of Australian botany.

The arrival of FERDINAND VON MUELLER in Australia formed a new era in the history of its flora, and the present advancement of systematic botany in the Australian colonies must be attributed principally to his exertions and to those of the numerous amateurs and collectors whom he in-

spired by his writings and labours. Dr. von Mueller, now Baron F. VON MUELLER, commenced his career on Australian territory in 1852, and first in South Australia, and subsequently in Victoria traversed not only all the settled districts of those colonies, but also instituted many geographic explorations in the Australian Alps, which at that time were but little known. He likewise accompanied A. C. GREGORY during his expedition in tropical Australia, and at a later period visited Western Australia and reported on its Forest Vegetation. My eminent friend, whose career I have watched for many years, may therefore, like Cunningham, be regarded as an explorer, though from the time of his landing in Australia his main work has been the elaboration of its flora. With this view he not only made large collections of specimens personally, but by means of agents, either paid or unpaid, in the various Australian colonies, he amassed an herbarium unequalled in any part of the world for the number and variety of its species. Having such material at his disposal, he conceived the plan of publishing in a connected form a description of all known Australian plants. Such a work was certainly much needed. No such work had been attempted since the days of Brown, and although according to his computation, the number of Australian plants was supposed to be about 7,000, many of them were but little known, or only partially described in the works of various authors. Whilst the Baron was contemplating the preparation of such a publication, Mr. BENTHAM, the great botanist of the age, had also conceived a similar idea, and was actually corresponding with the late W. S. MACLEAY, F.R.S., on the subject. When the difficulties of publishing the Flora in the colony were duly weighed—especially those arising from want of access to typical specimens, the notes and drawings of early botanists, and the opinions of European scientists—it was agreed, principally through the efforts of Mr. Macleay, that the work should be published in England, and that Baron von Mueller should assist in the preparation of the same. This great undertaking was commenced in 1863, and the seventh volume was finished in 1878, so that the *Flora Australiensis* contains a full description of all Australian plants which were known to the authors at the time of publication. Since the completion of the *Flora Australiensis* new species have been described by the Baron in his *Fragmenta Phytographiæ Australis* (of which eleven volumes have been

published), and in other works printed in Victoria. The Baron in his *Census*, 1889, Part I., Vasculares, has also prepared a list of Australian plants comprising the most recent discoveries; 7,814 species being admitted from the Flora, and 1,025 being added by the author. Irrespective of introduced plants which now amount to nearly 200, the number of species is probably 9,000, and these according to the Baron's Census, to which I am so much indebted, are distributed in the following manner:—

Western Australia	3560	Victoria	1894
Southern Australia....	1892	New South Wales	3251
Tasmania	1029	Queensland	3758
Northern Australia....	1956		

These numbers include the species common to the different colonies, whilst of Australian plants common to other regions, the following species are recorded:—

In Europe	160	In America	315
Asia	1032	Polynesia....	558
Africa	515	New Zealand	291

The distribution of the species as enumerated by the Baron is highly suggestive. In Western Australia where purely Australian plants appear in their greatest profusion, the numbers are proportionately great, and they represent not only species but whole genera which are not represented in other parts of Australia. It is difficult to explain the cause of this phenomenon on the ground of soil or climate, but it is probably due to changes which occurred at some remote period when Australia instead of being one vast continent consisted of several islands, or at all events, portions of it were separated by water. As regards the flora of Australia in general, Mr. Bentham was of opinion that the great mass of purely Australian species must have originated, or been differentiated, in Australia and never spread far out of it, and that whilst the plants of Queensland and Northern Australia have an Asiatic character those of Victoria and Tasmania, especially in the Alpine regions, were connected through New Zealand with those of the Southern end of South America.

The order Tremandreæ, of which only seventeen species are known (Mueller), and most of these Western plants are exclusively Australian. Goodenovieæ, with 220 species (Mueller), is represented out of Australia by a solitary genus (Scævola), and though allied in some respects to other

orders, it is characterised by its singular indusium. The Epacrideæ (Mueller), of which 275 species are described, is almost entirely Australian, and takes the place of Heathworts, from which it is distinguished principally by the shape and openings of the anthers. In the order Dilleniaceæ, only two species of Hibbertia are known out of Australia, whilst Pachynema is limited to the N. and W. of the continent. The curious order Stylideæ is, with one exception, entirely Australian and represented by 97 species (Mueller), the structure of the inflorescence being more analogous to that of orchids than anything else in the vegetable kingdom. The Proteaceæ are a large order in Australia (597 sp. Mueller) most of the genera not extending beyond it; and the peculiar character of the species, differing as they do widely from each other in appearance, soon attracted the notice of the early settlers, and under the inappropriate names of "Native Tulip," "Wooden Pear," "Honeysuckle," "Beefwood," "Silky Oak," &c., became known to the colonists for the singularity of their flowers and fruit, or for some property which distinguished the wood. The extent and distribution of the order were but partially known before the publication of the *Flora*, for many of the Northern genera were not described in the days of Brown and Cunningham, nor was it supposed that the species generally were of any great utility.

In the extensive order of Leguminosæ, comprising some 1,100 species (Mueller), the genus Acacia, of which nearly 300 passed in review before Mr. Bentham, has recently received good illustration in the figures published by Baron von Mueller. The genus, though well marked is a difficult one to arrange in sections, and therefore the labours of the Baron in this direction will be appreciated by botanists as affording characters for classification.

Of the Myrtaceæ, no genus has given more trouble to botanists than that of Eucalyptus, and it may truly be said that previous to the publication of the *Flora*, the system of classification was not only unsatisfactory, but that even the names of the commonest species were uncertain. The labours of Bentham and Mueller have done much to correct the errors of former botanists, and to suggest methods for the better grouping of species; but to the latter belongs exclusively the merit of furnishing illustrations and descriptions of the most remarkable species, and of making known the uses of their wood, resin, bark, volatile oil, &c. In the

early part of the century only twelve species were recorded by botanists, but now probably 150 have been found in different parts of Australia, and of these 100 may be recognized in the figures of the Baron's *Eucalyptographia*.

Of Myoporinæ the same author records seventy-six species, chiefly Australian, and two genera exclusively so (*Pholidia* and *Eremophila*). Here again the Baron has contributed to a correct knowledge of Australian botany by his elegant figures, seventy-four in number, including several species of *Eremophila* which are worthy of a place in any conservatory.

Though not principally Australian, the species of Salsolaceæ are highly important as furnishing forage plants to sheep and cattle in dry seasons. Many of these the Baron has also figured with a view of aiding pastoralists and graziers in the identification of species, and of ascertaining how far the prevalence of certain plants of the order may enhance the value of runs. In the early days of the colony Bauer's drawings were very useful in making known some of the beauties of the Flora, but these have been far surpassed in number and extent by the figures published by the Baron, including not only Eucalypts, Acacias, Myoporinous and Salsolaceous plants, but also many species of the Flora generally which have economic or useful properties. The extension of botanical knowledge has led to the discovery of many plants remarkable not merely for ornamental purposes, but for commercial and medicinal value.

The various kinds of Australian timber are now much better known in Europe than before the publication of the Flora, for they can be identified by their scientific names. Formerly some of the best woods were transmitted to England with nothing attached to them but popular names, which, though understood in the districts from which they were sent, were unintelligible to European purchasers.

The two great orders Leguminosæ and Myrtaceæ furnish specimens of wood not to be surpassed in strength and durability. *Castanospermum australe* (A. Cunn.) is remarkable for the large quantity of dark-coloured heartwood that it produces, and *Barklya Lyringifolia* (Mueller) for its very tough grain; whilst the genus *Acacia* affords numerous species which can be utilised for the beauty and hardness of their wood, the tanning properties of their bark and the copiousness of their gums.

Amongst the Myrtaceæ the vast genus *Eucalyptus* is dis-

tinguished for the various kinds of wood which can be applied to practical purposes, such as house-building, fencing, railway sleepers, naves, felloes and spokes of wheels, staves of casks, piles, handles, cabinet work, &c. Some of the species yield valuable bark and resin, while others are becoming favourite trees for plantations in different parts of the world on account of their absorbing properties and the influence which they exercise on the atmosphere. In the same order also certain species of *Melaleuca, Angophora, Tristania, Syncarpia* and *Eugenia* are valued for their woods; but none are more highly esteemed than those of the Meliaceæ or Cedar family, of which the Red Cedar (*Cedrela Australis*, Mueller) is most admired and the most generally used by cabinet-makers. *Dysoxylon* and *Flindersia* of the same family are utilised for similar purposes. *Ceratopetalum apetalum* (Don) of the Saxifrageæ, *Trochocarpa laurina* (Brown), and *Monotoca elliptica* (Brown) of the Epacrideæ, and many other species allied to them are employed by artisans. On the whole, now that the woods of Australia are becoming better known, it is found that the unfavourable reports furnished by the early colonists were formed from a very limited knowledge of the Australian forests. The progress which has been made in this respect is very evident from a comparison of the woods collected by the late Sir WILLIAM MACARTHUR for the Universal Exhibition of 1867, with the lists recently furnished (1888) by Mr. F. M. Bailey, F.L.S. In the former, the Eucalypts and many others appear chiefly with popular names, whilst in the latter they are arranged according to their respective orders, genera, and species as given in the Flora or in the Census of Baron von Mueller.

Many species of Eucalyptus contain medicinal properties. Gum kino has long been known to the scientific world, and volatile oil distilled from gum leaves was used by the early colonists. The aboriginal inhabitants were aware of the therapeutic virtues of Eucalypt leaves and the efficacy of the liquid kino exuding from Angophora, but it remained for more recent times to discover the wonderful properties of *E. globulus* (Labill.), and to secure for *Folia Eucalypti, Oleum Eucalypti*, and *Eucalyptol*, a place in the Pharmacopœia. Many species of Acacia have astringent properties, and a decoction of their bark is used in cases of diarrhœa and dysentery, and also to make embrocations for the cure of cutaneous disorders. *Alstonia constricta* (Mueller) is used as

a febrifuge by persons in the interior, and the so called "Sassafras Tree," *Atherosperma moschatum* (Labill.), and *Doryphora Sassafras* (Endl.) are employed medicinally as a tonic. The bark of *Cedrela australis* (Mueller) has been regarded as a substitute for Cinchona, and *Chionanthus picrophloia* (Mueller) is used in fevers. *Duboisine sulphas*, said to be procured from the leaves of *D. myoporoides* (Brown), has been introduced into the Pharmacopæia as a remedy for ophthalmia. The intoxicating properties of this species were known to the blacks, but Dr. BANCROFT, an eminent physician of Brisbane, was the first to set forth in an elaborate paper, read before the Philosophical Society in 1872, the remarkable properties of *D. Hopwoodii* (Mueller), or "Pituri" of the blacks, which is much more powerful in its effects on the human system. *Erythræa australis* (Brown), and *Sebæa ovata* (Brown), have some of the properties of gentian, and *Mentha satureoides* (Brown) is considered as tonic. *Euphorbia pilulifera* (Linn.) has been found useful in certain stages of asthma, and *Myriogyne minuta* (Less) as a popular remedy for ophthalmia. *Petalostigma quadriloculare* (Mueller) has a bitter principle resembling that of quinine, and *Melaleuca genistifolia* (Sm.) yields an oil similar to cajeput. In the early days of the colony the leaves of *Leptospermum* were used as an antiscorbutic, and those of *Smilax glycyphylla* (Sm.), the Sarsaparilla of the colonists, as "sweet tea." It is to be regretted that much of the knowledge possessed by the blacks respecting the medicinal and other properties of indigenous plants has perished with them in the colony of New South Wales, but Mr. E. Palmer, M.P. of Queensland, has collected some interesting information on this subject from the blacks of Northern Queensland (see his Paper read before the Royal Society of New South Wales, August, 1883). Baron von Mueller, amidst his multifarious engagements, has devoted some attention to the same subject (see Documents relating to the Intercolonial Exhibition, 1867), and Dr. Bancroft has done much in reference to *Duboisia Hopwoodii* (Mueller), and *Xanthoxylum veneficum* (Bailey).

The singularity and beauty of Australian plants soon attracted the notice of the early voyagers and settlers, and the seeds of many species found their way to European conservatories. Dampier's specimens were forgotten for a while, but Bauer's drawings (made under the auspices of Sir Joseph Banks) and those in the appendix to White's *Voyage to New South Wales*, encouraged a taste for Australian species,

whilst the seeds and plants collected by Banks and Solander during Cook's voyage, were soon cultivated at Kew and elsewhere in Europe. In looking over a list of Australian plants as known in the last century, that is, twelve years after the foundation of the colony of New South Wales, it will be seen that the knowledge of the Flora was very limited. Taking the four orders Leguminosæ, Myrtaceæ, Proteaceæ, and Epacrideæ as illustrative of the fact, it will be found that of the first 39, of the second 44, of the third 30, and of the fourth 8 species only were then known in Europe. Many of these were collected and forwarded under circumstances of difficulty, for owing to the want of provisions in the early days of the colony, the dangers arising from penetrating into an unknown country, and the deficiency of proper material for drying and preserving specimens, little idea can be formed of the labours encountered by the earliest naturalists in Australia. Moreover, the voyage to Europe in those days occupied many months, numbers of plants perishing in transmission, while seeds damaged by salt water or long keeping were of course useless for the purposes of cultivation.

It may be interesting, as showing the limited knowledge of Australian plants at the period indicated, to refer particularly to the species described in the work of WILLDENOW published between the years 1797 and 1810. Willdenow was the great systematic botanist of his day, the follower of the renowned Linnæus, and the editor of his *Species Plantarum*. His work, therefore, is one of authority, and it may safely be quoted as showing how small an amount of knowledge in reference to Australian plants was possessed by continental botanists before the publication of Brown's *Prodromus*. The species are arranged, as follows, according to the Linnean system.

Pimelea linifolia (Sm.)
Protea pulchella (Schrad.)
Banksia serrata (Linn.)
„ *grandis* (Willd.)
„ *integrifolia* (Linn.)
„ *pyriformis* (Gaertn.)
„ *dentata* (Linn.)
„ *spinulosa* (Sm.)
„ *ericifolia* (Linn.)
„ *gibbosa* (Sm.)
Embothrium speciosissimum (Sm.)
„ *buxifolium* (Sm.)
„ *sericeum* (Sm.)
„ *silaifolium* (Sm.)
Opercularia umbellata (Gaertn.)
Sprengelia incarnata (Sm.)
Epacris grandiflora (Willd.)
Styphelia tubiflora (Sm.)
„ *ericoides* (Sm.)
„ *strigosa* (Sm.)
„ *scoparia* (Sm.)
„ *daphnoides* (Sm.)
„ *lanceolata* (Sm.)
„ *elliptica* (Sm.)
Goodenia ovata (Sm.)
„ *albida* (Sm.)
„ *lævigata* (Curt.)
„ *bellidifolia* Sm

Goodenia paniculata (Sm.)
„ *stricta* (Sm.)
„ *ramosissima* (Sm.)
„ *heterophylla* (Sm.)
„ *hederacea* (Sm.)
Billardiera scandens (Sm.)
Drosera peltata (Sm.)
Tetratheca juncea (Sm.)
Correa alba (Andr.)
Dodonæa triquetra (Wendl.)
Bæckia densifolia (Sm.)
Pultenæa stipularis (Sm.)
„ *paleacea* (Willd.)
„ *linophylla* (Schrad.)
„ *juncea* (Willd.)
„ *villosa* (Willd.)
„ *daphnoides* (Wendl.)
Ceratopetalum gummiferum (Sm.)
Leptospermum Thea (Wendl.)
„ *flavescens* (Sm.)
„ *attenuatum* (Sm.)
„ *lanigerum* (Sm.)
„ *pubescens* (Ait.)
„ *parvifolium* (Sm.)
„ *arachnoideum* (Sm.)
„ *juniperinum* (Sm.)
„ *baccatum* (Sm.)
„ *ambiguum* (Sm.)
Fabricia myrtifolia (Gaert.)
„ *lævigata* (Gaert.)
Metrosideros hispida (Sm.)
„ *floribunda* (Sm.)
„ *costata* (Sm.)
„ *globulifera* (Sm.)
„ *linearis* (Sm.)
„ *lanceolata* (Sm.)
„ *saligna* (Sm.)
„ *viminalis* (Sm.)
„ *capitata* (Sm.)
Eugenia elliptica (Sm.)
Myrtus tenuifolia (Sm.)
„ *trinervia* (Sm.)
Eucalyptus robusta (Sm.)
„ *pilularis* (Sm.)
„ *tereticornis* (Sm.)
„ *resinifera* (Sm.)
„ *capitellata* (Sm.)
„ *saligna* (Sm.)
„ *botryoides* (Sm.)
„ *hæmastoma* (Sm.)
„ *piperita* (Sm.)
„ *obliqua* (l'Her.)
„ *corymbosa* (Sm.)
„ *paniculata* (Sm.)
Mesembryanthemum æquilaterale (Haw.)
Dillenia scandens (Willd.)
Pelargonium australe (Willd.)
Platylobium formosum (Sm.)
„ *parviflorum* (Sm.
Bossiæa heterophylla (Vent.)
Glycina clandestina (Wendl.)
„ *rubicunda* (Curt.)
„ *coccinea* (Curt.)
Indigofera australis (Willd.)
Melaleuca viridiflora (Gaertn.)
„ *laurina* (Sm.)
„ *squarrosa* (Sm.)
„ *styphelioides* (Sm.)
„ *ericifolia* (Sm.)
„ *nodosa* (Sm.)
„ *armillaris* (Sm.)
„ *genistifolia* (Sm.)
„ *linariifolia* (Sm.)
„ *thymifolia* (Sm.)
„ *hypericifolia* (Sm.)
Aster tomentosus (Schrad.)
Thelymitra ixioides (Sm.)
Diuris maculata (Sm.)
Stylidium graminifolium (Swartz.)
„ *lineare* (Swartz.)
Casuarina distyla (Ventr.)
„ *torulosa* (Uit.)
Zamia spiralis (Salisb.)
Acacia verticillata (Willd.)
„ *juniperina* (Willd.)
„ *suaveolens* (Willd.)
„ *floribunda* (Willd.)
„ *linifolia* (Willd.)
„ *abietina* Willd.)
„ *stricta* (Willd.)
„ *longifolia* (Willd.)
„ *glaucescens* (Willd.)
„ *falcata* (Willd.)
„ *myrtifolia* (Willd.)
„ *hispidula* (Willd.)
„ *discolor* (Willd.)
„ *lophantha* (Willd.)
„ *decurrens* (Willd.)
Ficus australis (Willd.)
Lycopodium densum (Labill.)
„ *uliginosum* (Labill.)
„ *ciliatum* (Willd.)
Tmesipteris tannensis (Bornh.)
Gleichenia circinata (Swartz.)
Schizæa fistulosa (Labill.)
„ *bifida* (Swartz.)
Acrostichum alcicorne (Swartz.)

Grammitis Billardieri (Willd.)
„ *heterophylla* (Labill.)
Polypodium diversifolium (Willd.)
„ *quercifolium* (Linn.)
„ *rugulosum* (Labill.)
Lomaria nuda (Willd.)
Asplenium decurrens (Willd.)
„ *flabellifolium* (Cav.)
Pteris vespertilionis (Labill.)
„ *esculenta* (Forst.)
Blechnum cartilagineum (Swartz.)
„ *lævigatum* (Cav.)
Blechnum procerum (Labill.)
Woodwardia caudata (Cav.)
Lindsœa lanceolata (Labill.)
„ *microphylla* (Swartz.)
„ *lunata* (Willd.)
Adiantum hispidulum (Swartz.)
„ *assimile* (Swartz.)
Davallia pyxidata (Cav.)
Dicksonia antarctica (Labill.)
Hymenophyllum flabellatum (Labill.)
„ *australe* (Willd.)

When Willdenow's list of Australian plants is compared with the descriptions given in the seven volumes of the *Flora Australiensis* and the eleven volumes of *Fragmenta* by Baron von Mueller, as well as with the *Census* of Australian plants by the same author, some idea may be formed of the wonderful progress which has been made in Australian botany since the beginning of the century. From 1800 to 1810, CALEY continued the great work of collecting specimens and of developing the rarities of a new Flora; but it remained for ALLAN CUNNINGHAM to traverse parts of Australia unknown to his predecessors and to transmit to Europe seeds and plants not previously discovered. He was a man of taste and energy, and from his arrival in 1816 to his death in 1839, he exerted himself to promote the great object of his mission, first as "Botanical Collector to the Royal Garden at Kew," and subsequently as Colonial Botanist and Director of the Botanical Garden in Sydney. In these capacities he did much to develop the resources of Australia, and as settlements were being established in Western and Southern Australia, as well as at Port Phillip (now Victoria), the extent and variety of the Australian Flora became more and more manifest through the labours of professional or amateur botanists, and a new industry, viz., that of collecting seeds for exportation to different parts of the world, was established in the colony. Thus, in various ways, continual additions were made to the knowledge of Australian plants; and as their floral beauties increased under the fostering care of cultivation, they have obtained a favourable place in the greenhouses and hot houses of Europe.

It is only of late, as already noticed, that the extent of the Flora has been fully known, for until the publication of Baron von Mueller's *Census*, the number of species and their respective distribution were matters of uncertainty. Now

the numbers, so far as species have yet been discovered, are carefully estimated, and each plant is referred by systematic arrangement to its proper genus with the date of its discovery and its distribution in the Australian colonies.

All plants have their places in the economy of nature and serve the purposes for which they were designed by a beneficent Creator, but, in the eyes of men, some species are more ornamental than others, better adapted for cultivation, and whilst "arrayed in robes of lovely hue" indicate "a Father's care" even to those who do not study the mysteries of organism or the symmetry of proportion. The order Leguminosæ with 1065, the Myrtaceæ with 663, the Proteaceæ with 597, the Compositæ with 380, the Epacridæ with 275, and the Orchideæ with 271 species, afford numerous instances of this kind. Amongst the Leguminosæ, Australia is rich in plants herbaceous, shrubby, or arborescent. *Clianthus Dampieri*, the various species of *Swainsona, Crotalaria, Kennedya, Oxylobium, Indigofera, Cassia*, and *Bauhinia*, are now reckoned amongst garden plants, whilst the genus *Acacia*, affording in itself examples of minute elegance or robust stature, is adapted alike for the shubbery or the plantation. Of the larger species of Leguminosæ, *Castanospermum australe, Barklya syringifolia, Pithecolobium pruinosum*, and *Albizzia canescens* are beautiful trees and capable of enduring a considerable amount of variation in temperature. The Myrtaceæ also are of all sizes from the minute *Bœckia* to the gigantic *Eucalypt*. Western Australia abounds in elegant species of Fringe Myrtles (*Darwinia, Verticordia, Calythrix, &c.*), small shrubs remarkable for their calyx adhering to the ovary and breaking into fringes or extended into bristles. These are much admired in cultivation. There may also be mentioned as peculiar to the West, species of *Regelia* and *Beaufortia*, whilst those of *Callistemon, Melaleuca*, and *Leptospermum* may be found in varying proportions in Eastern and Western Australia, enlivening the bush with their white, purple, or crimson flowers. The large genus Eucalyptus has in the Southern and Western Colonies some species distinguished from others by their showy crimson flowers, *E. ficifolia* (Mueller), and *E. calophylla* (Brown) may be reckoned amongst the marvellous beauties of the genus, whilst as Baron Mueller observes, *E. phœnicea* (Mueller) and *E. miniata* (Cunn.) vie with them in ornamental splendour. The species generally are not very umbrageous, but *E. robusta* (Sm.) and a few others are exceptional in this respect, and *E. globulus* (Labill.),

the far famed "Blue Gum" of Tasmania, is remarkable for the rapidity of its growth. Few trees in Eastern Australia afford a more grateful shade than the gnarled and spreading *Angophora*, the larger species of which may be termed "Rain-trees" on account of the drops of water which at certain seasons fall from their leaves. Several species of *Eugenia* (a genus also not extending to Western Australia) are likely to be cultivated for the beauty of their foliage and flowers, as well as for the flavour of their fruits. The Proteaceæ furnish some of the most singular species in the Vegetable Kingdom. The "Wooden Pear" (*Xylomelum pyriforme*, Knight), the "Native Tulip" (*Telopea speciosissima*, Brown), esteemed as the most splendid of Australian flowers, and the peculiarity of *Dryandra* and *Banksia* were looked upon as great novelties in the early days of New South Wales, and figures of them were soon published in Europe. In later days, *Grevillea*, *Hakea*, and *Stenocarpus* have each of them found a place in shrubberies, and few gardens are destitute of the most noted species; whilst *Buckinghamia celsissima* (Mueller), and *Darlingia spectatissima* (Mueller)—some of the recent discoveries in Northern Queensland—are finding favour in southern cultivation so far as the climate permits. The great order of the Composites, of which many species are inconspicuous herbs or mere weeds, does not offer proportionally many plants for cultivation, but a few of the "everlasting" kind (such as *Helipterum Manglesii* (Mueller), *H. roseum* (Benth.) *Helichrysum elatum*, (Cunn.), and *H. bracteatum* (Willd.), and some of the Asters, including the "Musk-tree," *A. argophyllus* (Labill.), and *A. dentatus* (Andr.), may be regarded as exceptional. *Brachycome*, *Calotis*, and *Minuria* comprise some very pretty species which might be utilised for borders, and *Cassinia aurea* (Brown), *C. spectabilis* (Brown), and *Humea elegans* (Sm.), are much larger plants and not unknown in European collections. The Epacrids, which in Australia take the place of Heaths, have attracted attention for the last century, and under cultivation many species have improved in appearance or have become double. The following may be especially noticed:—

Epacris longiflora (Cav.)
„ *impressa* (Labill.)
„ *purpurascens* (R. Br.)
„ *microphylla* (R. Br.)
Styphelia adscendens (R. Br.)
„ *tubiflora* (Sm.)
Styphelia triflora (Andr.)
Andersonia sprengelioides (R. Br.)
Sprengelia incarnata (Sm.)
Lysinema, *Leucopogon*, and *Astroloma* in several species.

The larger or more shrubby species of *Richea* and *Dracophyllum* are mostly Alpine plants, and have a monocotyledonous aspect, some rising to the height of thirty or forty feet. *D. Fitzgeraldi* (Mueller), of Lord Howe's Island, is perhaps the most remarkable of the order, attaining a height of ninety feet, and having leaves a foot or more in length. Paxton speaks of the smaller Epacrids as "very elegant greenhouse plants," and Sir W. Macarthur used to say that, if anyone desired to see them in perfection, he must visit the European conservatories. Australian orchids, though not to be compared with those of the East and West Indies or the warmer parts of America in point of numbers, variety, or brilliancy, yet present on the whole many features of structural beauty and organic peculiarity whereby they commend themselves to the artist and the botanist. It is true that many of the species are minute plants, terrestrial in habit, and appearing only for a few short weeks in spring, but even these, when viewed microscopically, give the scientist the means of studying the various modes of fertilisation, the agencies whereby nature secures the perpetuation of species, and the links which seem to connect one form with another. The late much lamented Mr. R. D. FITZGERALD, F.L.S., in his splendid work on *Australian Orchids*, figured nearly two-thirds of all known species some terrestrial, and some epiphytal; and although the majority may not interest the casual observer the following must be regarded as worthy of consideration for their size or beauty :—

Sarcochilus Fitzgeraldi (F. v M.)
Dendrobium canaliculatum (R. Br.)
„ *rigidum* (R. Br.)
„ *falconirostre* (Fitz.)
„ *cucumerinum* (Lindl.)
„ *phalænopsis* (Fitz.)
„ *Moorei* (F. v M.)
„ *superbiens* (Reich.)
„ *undulatum* (R. Br.)
„ *speciosum* (Sm.)
„ *Kingianum* (Bidw.)
Galeola foliata (F. v M.)
Calanthe veratrifolia (R. Br.)
Spathoglottis Paulinæ (F. v M.)
Sarcochilus divitiflorus (F. v M.)
Cœlandria Smilliæ (Fitz.)
Dipodium punctatum (R. Br.)
Caladenia lobata (Fitz.)
Prasophyllum elatum (R. Br.)
Thelymitra ixioides (R. Br.)
„ *grandiflora* (Fitz.)
„ *antennifera* (Hook.)

Many of the smaller species figured by Mr. Fitzgerald are peculiar to Australia, but as here and there species occur which are not limited to that continent, they form, as it were, a connection between the botany of Australia and other regions, which, at some remote period, were not separated from it by the intervening ocean. All the species, however, as yet figured, illustrate amply an interesting portion of the

flora, and will long continue as memorials of the author's artistic skill.

The Goodeniaceæ, Malvaceæ, and Liliaceæ, have numerous representatives in most parts of Australia. The elegant *Leschenaultia splendens* (Hook.), with its characteristic stigma, the pretty and strongly scented *Boronia serrulata* (Sm.), and *B. megastigma* (Nees), the gigantic *Doryanthes excelsa* (Corr.), and the pure *Crinum*, the showy species of *Hibiscus* and *Gossypium*—all of these display the glory of their respective orders. So also the rivers of the North are enlivened by the variously coloured petals of *Nymphæa gigantea* (Hook.), and the delicate tints of *Nelumbium speciosum* (Willd.); whilst the lofty conifers *Araucaria Cunninghami* (Ait.), and *A. Bidwillii* (Hook.), and the palm-like tree ferns (*Alsophila australis*, Brown), and *A. excelsa* (Brown), impart a semi-tropical character to the regions in which they abound. Of the true palms, *Ptychosperma Cunninghami* (Wendl.), and *Livistona australis* (Mueller) are rapidly disappearing in the settled districts; but in unfrequented places in Northern Queensland, and also at Lord Howe's Island, several species of *Ptychosperma* and *Kentia* still flourish in all their graceful beauty.

Great changes are going on in the Vegetable Kingdom throughout the world, and though many of those changes are not perceptible to the present generation, a reference to past history will inform us that regions once covered with forests have become desolate wildernesses, and unfruitful soil has been made subservient to the purposes of cultivation, and that species of plants which once flourished in some particular country have long ceased to do so. What occurred in geological periods, when, by the uplifting or depression of the earth's crust, the flora of many countries became differentiated or made way for other forms, is going on gradually still; and it is certain that, in the course of generations to come, as the flora of Australia was very different in ages past from what it now is, so a new order of plants may arise and take the place of the great orders which at the present period flourish on the continent. A reference to the vegetable fossils which have been found in the auriferous drifts of New South Wales and Victoria makes this supposition highly probable.

Without contemplating, however, those stupendous changes which must have occurred since many genera, now called exotic, connected the Tertiary Flora of Australia with that of northern and tropical America and Oceanica (Ettinghausen),

the experience of the past century affords some indication of changes which may yet be realised. Since the British landed on the shores of Australia in 1788, the work of destruction has been going on amongst indigenous plants. That destruction was, no doubt, in operation when as yet the white man had not set his foot on the land, for the destroying tempest, the ravages of insect pests, the periodical fires in the bush and the alternation of flood and drought, had exercised their influence on the vegetation independently of the slow and imperceptible changes arising from climatic and geologic considerations. With the advent, however, of the white man in Australia a new era commenced in its Flora and henceforth the process of cultivation, the introduction of foreign plants, either accidentally or designedly, and in some instances the wanton destruction of certain species, have all combined to impart a novel character to the Flora of the settled districts, and of initiating a modified system of vegetable growth whereby the old has sometimes made way for the new, or the new and the old have become strangely associated together.

When the first settlers landed at Port Jackson the native forest appeared in its primeval grandeur, and numerous species of shrubs and flowers greeted their wondering gaze with novel forms of vegetation. This state of things did not long continue. Large trees, many probably the growth of centuries, fell before the workman's axe for the purposes of building, fencing, and burning; whilst the smaller plants were soon cleared away as useless impediments in the way of cultivation. In many countries there are wild fruits and vegetables which can be utilised by the settler. This was not the case with that part of Australia where Sydney now stands, and therefore one of the earliest objects of the colonists was to clear the ground for the cultivation of such plants as were considered suitable for food. In doing this a great destruction of native plants ensued, and now after the lapse of a century it is impossible to find some of the plants which Brown and the early botanists described as occurring in the neighbourhood of Sydney, whilst streets of houses or cultivated spots occupy the area where the towering Eucalypt, the curious Protead, the lovely Epacrid, or the host of delicate orchids, once reigned in undisturbed profusion. The introduction also of foreign plants has had a wonderful influence in destroying the native vegetation; and as the population spread further from the coast, the same result

occurred in a greater or less degree, so that in all the settled districts the Flora began to assume a mixed character. Nor has this arisen solely from the introduction of esculent plants adapted to the soil and climate. Many species have found their way over the ocean and established themselves in an accidental manner, or as following the steps of civilised man.

Wherever the land has been turned up the so-called couch grass (*Cynodon dactylon* Pers.) has taken the place of other grasses, and from Port Jackson to the Blue Mountains it has become very useful as fodder, though in gardens it is regarded as a great nuisance. So also Brown's *Paspalum littorale* (referred to *P. distichum*, Linn.), which in the early days was limited to the sea coast, now flourishes on the cultivated flats of our Eastern Rivers; whilst *Cyperus rotundus* (Linn.), which in the days of Caley (1810) was known only in the Government garden at Parramatta, has become an intolerable nuisance to many gardens in N.S. Wales. It is astonishing to notice how various species of *Rumex* and *Amarantus* have encroached on cultivated fields, and how in some instances the native plants have been smothered by such Composites as *Wedelia hispida* (Ktl.), *Aster dumosus* (Willd.), or different species of *Centaurea*, *Carduus Marionus* (Linn.), *Cryptostemma calendulaceum* (R. Br.), and two species of *Hypochœris*. In alluding to this subject the late Rev. J. E. Tenison-Woods, F.L.S. (a learned man of varied scientific attainments), remarks: "The features of Australian Vegetation are also being altered by introduced plants. *Rubus rubiginosus*, or the Sweet Brier, has taken kindly to the arid western tableland, and covers the ground for miles with a dense thicket, which it is difficult to eradicate. It is worse than either the thistle or burr (*Xanthium*). The sweet brier is an equally troublesome pest in Tasmania. On the east side of the range, *Verbena Bonariensis* and *Asclepias curassavica*—both garden plants from America—are troublesome weeds. We have also an unexplained spread of an indigenous tropical plant (*Sida rhombifolia*), which infests good soil to an alarming extent. Every year also we have to chronicle the spread of some common European weed which very easily overcomes the native vegetation." In some places *Lantana Camara* (Linn.), and in others several species of *Opuntia* are detrimental to cultivation, whilst in gardens the ordinary species of *Euphorbia*, *Stellaria*, *Cerastium*, *Malva*, and *Sisymbrium*, spring up in great abundance. Contemporaneously,

with the introduction of foreign plants, the gradual extinction of native species has been accelerated by the increase of sheep and cattle which feed on the more delicate plants, the wanton destruction of floral beauties for flower shows and decorative purposes, and the wholesale slaughter of Eucalypts by ring-barking. Some years ago the Cabbage Palm and the Tree Fern flourished in the vicinity of Sydney, and many orchids which once sprang up where the city and its suburbs have usurped the soil, have ceased to do so. Change, therefore, is stamped on the Flora of Australia, and though the change is more perceptible in the oldest of the colonies than in those recently established, it is evident that as the white man has extended his operations, so in proportion native shrubs have become less frequent. And this is quite independent of the fact that from some cause or other whole forests of Eucalypts have perished. Whether this has arisen from insects, opossums, flood and drought, or from fungi, has not been clearly ascertained, but such destruction must materially affect the Flora, even supposing that when the causes of destruction have been removed, the larger species spring up again. But perhaps in process of time as the "Select Plants" recommended by Baron von Mueller for industrial purposes spread over the country, it may be found that some species are likely to prove more serviceable than the stunted kinds of Eucalypt which now prevail in certain parts of the country, and forests of new and valuable trees may take the place of those which under other conditions have long been cumberers of the ground. And this leads to another matter of infinite importance to the development of the coming Flora, viz., the extensive planting of forests under the direction of the respective Colonial Governments. This subject has been ably explained in the Baron's *Forest Resources of Western Australia*, and if only a small portion of the trees which he has suggested for cultivation in that part of Australia now become acclimatised, it is evident that they will produce a great revolution in the Flora, not merely affecting the general appearance of the country, but "as the rainfall of a country depends in a great measure upon the abundance of its trees" (*Sinai and Palestine*. by the Rev. F. W. Holland), an increased moisture would lead to the introduction of many smaller plants which need shade and rain for their growth. Ancient Phœnicia, "the land of palms," furnished it is said, an example of the advantages arising from the existence of forests. Lying

under the shadow of Lebanon, it abounded in streams, streamlets, and rivers; the last then navigable for some distance from the sea, by reason of the *greater flow of water caused by the primeval forests* which in those days clothed the neighbouring mountains. The plantation of forests will no doubt exercise an influence in many ways, and especially in reference to the Flora; but probably the process of irrigation, which in another half century will be carried on in the arid and sterile regions of the West, is destined to produce still greater changes. Irrigation was much practised by the ancient nations, and the ruins of former works still exist in parts of the East to testify to its utility. What was done in Egypt, Persia, and India, may therefore be done in Australia, and the means of subsistence for the population may be indefinitely increased. It is calculated that the extent of irrigated land in the Valley of the Po may be about 1,600,000 acres, and the increase of rental thus caused £830,000. Such irrigation, not to speak of the immense advantages in a commercial and financial point of view, must have had great influence on the vegetation of Southern Europe, and it is not too much to expect that a periodical watering of the land and the formation of extensive lakes in the dry parts of Australia would cause many an elegant shrub or useful herbaceous plant to flourish where now only harsh and unpalatable species occur.

Whilst dwelling on the Flora of the future it is only reasonable to expect that the uses of many plants only partially known will be more appreciated than they are at present, and that many articles of vegetable origin, which are now imported at considerable expense, will be found to exist in Australia. This may be especially true of medicinal plants. The country abounds in such species, and numerous kinds, which hereafter may find a place in the *Pharmacopœia*, are but imperfectly known by the settlers. The Medical Botany of Australia affords a fine field for the inquiries of the specialist, and so a similar region of investigation remains for those whose tastes may lead them to the study of Cryptogamic Botany. What HARVEY has done for Australian Algæ is a noble contribution to the knowledge of Marine Beauties, and it is to be hoped, that in the botany of the future, thousands of minute species in the lower kingdoms of Nature may find a local habitation and a name in the Flora of Australia.

Other subjects in connection with the progress of botany

—such as the nomenclature of the Flora, the distinction between species and variety, the simplification and division of genera, and the rearrangement of natural orders—remain yet to be considered. Any one who reads the preface to Lindley's work on the Vegetable Kingdom will see how anxious the Professor was to improve the nomenclature of botany and to suppress as far as practicable names of unusual dimensions and difficult to pronounce. Though something has already been done in this direction, it is still desirable to effect further improvements, for such long words as *Ceratopetalum apetalum*, *Aphanopetalum resinosum*, *Amorphophallus variabilis*, *Amorphospermum antilogum*, and *Tabernæmontana orientalis*, show that notwithstanding the changes effected by Bentham and Mueller, the nomenclature of the Australian Flora needs reform. Words formed from Latin or Greek, expressive of some feature peculiar to a species, are certainly the most suitable for general use, and are understood by the educated in all countries, but then such words should be limited to a few syllables, and, if possible, be euphonious. But long names, especially as specific, are frequently complained of, and none more so than those in honour of some great man. Much as many of the Baron's names may be admired for their elegance and expressiveness, one can scarcely defend *Kentia Belmoreana*, *K. Canterburyana*, *K. Wendlandiana*, *K. Forsteriana*, or *Eucalyptus Planchoniana*, and *E. Foelscheana*, on the ground of brevity or expressiveness. But the illustrious author of the *Prodromus* was not altogether free from a similar charge, though only to a limited extent, for in order to immortalise the names of those whom he delighted to honour we have the genera *Bellendenia*, *Franklandia*, *Levenhookia*, and *Leschenaultia*, names certainly derived from distinguished authors and botanists, but not calculated to improve the nomenclature of science. There may be exceptional cases, in which men from the pre-eminent position they have held, seem entitled to every distinction, but as a general rule the naming of genera after some noble or learned person teaches nothing by which a genus is characterised, nor can it be done on all occasions without making invidious distinctions. It must be left, therefore, for botanists of the future to decide whether it is better to make the Flora an instrument of personal glorification, or to impress on genera such names as may guide the student in his endeavour to trace out the differences of natural objects. The multiplication of hard

words, whether of classic or of personal origin, is the source of frequent complaint against botany, and needs reform; but in correcting one error care must be taken not to fall into another, for the adoption of popular names, such as some persons suggest, would be of little service beyond an English-speaking community, nor would they escape the charge of leading to confusion in a country in which different districts call the same thing by different names.

The distinction between species and varieties is a matter of greater difficulty for the botanist of the future. In days past, perhaps, botanists were too fond of increasing the number of species, considering that every character in species was fixed, and that every deviation from some original type was to be regarded as distinct. Experience has proved that certain species are subject to a vast amount of variation; that surrounding circumstances (such as soil, climate, and elevation above the sea-level) tend to perpetuate such differences; and that cultivation in some instances produces abnormal forms not simply in size and colour, but in marked features. Such being the case, it happens that what some botanists regard as species others describe as mere varieties; and hence in comparing the *Flora Australiensis* with Baron von Mueller's *Census of Australian Plants*, it may sometimes be found that there are differences of opinion as to the specific value of certain plants, and that characters once deemed essential are not regarded as uniformly permanent. Since the publication of Lyell on the *Antiquity of Man*, and Darwin on the *Origin of Species*, naturalists have modified their views on the subject of species, and have differed considerably on the characters which constitute such, and therefore it is not surprising that great men like the late Mr. Bentham and Baron von Mueller should differ in their estimate of species. One cause of difference is the fact that the former had to form his conclusions almost entirely from dried specimens, whilst the latter in many instances had the opportunity of observing plants in their native state, and of noticing peculiarities in individuals. Without referring to such protean genera as *Eucalyptus* or *Acacia*—in which there seem to be connecting links between some of the so-called species—several genera among the Leguminosæ present great difficulties to the systematic botanist, and future scientists must yet decide how far apparent differences affect specific value. The same remark applies to the Orchideæ, an order comprising many minute

species, some of which approach very near to each other. Great light has been thrown on this subject by the published figures of Mr. R. D. Fitzgerald, F.L.S.; and as the various kinds are cultivated with a view of ascertaining their liability to divergence, some aid may be given to the discovery of a method whereby the distinction between species and varieties will be better understood. It would appear that the alterations in species during many generations are not such as some enthusiastic followers of Darwin have supposed, for from fossil cereals and other plants discovered in the Swiss Lake dwellings, there is evidence to prove that many of the species are the same in character as those which exist in Europe now. In Australia, the knowledge of such matters is very limited, and a century has not yet elapsed since Brown published the first systematic account of Australian plants, but it may happen in the course of palæontological discovery that the fossilised remains of plants in particular strata will reveal the antiquity of the Australian Flora, and show how far species may have become differentiated in the process of ages. On a subject so abstruse, it may be useful to quote the opinion of one so eminent as Sir J. D. Hooker. He contends that "species are neither visionary, nor even arbitrary creations of the naturalist, but realities, though they may not remain true for ever. The majority of them," he remarks, "are so far constant within the range of our experience, and their forms and characters so faithfully handed down through thousands of generations, that they admit of being treated as if they were permanent and immutable. But the range of our experience is so limited that it will not account for a single fact in the present geographical distribution or origin of any one species of plant, nor for the amount of variation it has undergone, nor will it indicate the time when it first appeared, nor the form it had when created" (*Introductory essay on the Flora of Australia*). Since the publication of Sir J. D. Hooker's valuable essay, great progress has been made in scientific inquiries, and it is not improbable that a careful examination of species under cultivation and the study of embryonic peculiarities in individuals may suggest *that* which is fixed and permanent in plants, and *that* which is simply accidental or contingent. Amongst European botanists this question of species and variety has long been a perplexing one, and it is striking to notice that botanists of eminence cannot agree together as to the number of species in particular genera.

In the botany of the future in Australia similar difficulties may arise, indeed some have already arisen, but in a new field of inquiry traditionary views and long established errors have not the same influence as in old countries, nor are botanists called to ascertain how far cultivation in ages past may have led to abnormal development. The future Flora of Australia therefore may not be so fraught with perplexities of this kind as that of Europe, and those which now create a difference of opinion amongst Australian botanists may yield to the progress of science and give new illustrations of the wisdom which characterises the great Creator's works.

There are also, with regard to genera, difficulties which need reform, not merely in lessening the number but in grouping the species of the larger ones. Though the term genus is simply a common substantive name given to a number of species which resemble each other, yet difference of opinion may prevail as to the propriety of extending the number of genera or of placing a species under a particular genus. Baron von Mueller with a view of simplifying the study of botany, and of assisting the memory by limiting the number of names, prefers the formation of large genera with appropriate subdivisions. Thus, for instance, in the great order of Epacrids, he has amalgamated under *Styphelia* several of Brown's genera, and in a similar manner he has incorporated *Pleurandra* with *Hibbertia*. So likewise, in the order Salsolaceæ, he has reduced several of the old genera to *Bassia*, and in the Amarantaceæ *Trichinium* to *Ptilotus*. If in the future a further amalgamation could be effected, the study of Australian botany would be facilitated by the suppression of many long names (some genera including but one or two species), and the retention only of those which express the essential character of plants nearly allied. In former times it was the fashion to make too many genera, and Baron von Mueller's admirable *Census* is a proof of what may be done to lessen the number. Regarding his noble efforts as an instalment of reform, the imagination looks forward to a period when the Vegetable Kingdom, so far as genera and species are concerned, may be considerably simplified, and people may cease to think that botany is a science of bewildering terms and hard names rather than the contemplation of characters impressed on the beauties of Nature by the infinite skill of the Creator. It is said that a rose would smell as sweet by any other name, and so it would; but then

there is something incongruous in fixing some name of little meaning on any of Nature's gems, or of subjecting them arbitrarily to a generic association unsuitable to them.

And then again there is a difficulty to be overcome in the formation of sub-genera, or the grouping of species in the larger genera. From the days of Brown to those of Bentham and von Mueller this has been felt especially in *Eucalyptus* and in a less degree of *Acacia*. Before the conception of the cortical or anthereal systems, species were thrown together without any suitable arrangement; but in the *Flora Australiensis* and the Baron's *Census*, the latter system has rendered the grouping of species of Eucalyptus possible. Still, however, there are objections to both systems, for whilst the one is useful in the field and the other in the cabinet, they are both liable to exceptional anomalies, and there is inconsistency in placing in close proximity to each other species which differ materially. Here then is a problem yet to be solved. Whilst therefore thanking those great men for what they have done to remove past errors, and render the identification of many species an easy task, thus affording the means of grouping trees in some respects similar, men of observation can regard the present arrangement of the genus as provisional only, and an instalment towards better things to come. With regard to the genus *Acacia*, in the describing of which Mr. Bentham experienced so much trouble, Baron von Mueller has furnished a series of figures whereby the character of many species will be clearly seen, and when his work is completed the grouping of the species will be comparatively easy. As in *Eucalyptus*, the flowers of very different trees or shrubs are very similar, and Mr. Bentham when dealing with dried specimens, remarked that he found "species with the most discrepant pods sometimes almost identical in foliage, and on the other hand pods apparently identical sometimes belonging to species widely different in foliage and even in flower." In *Acacia* therefore the grouping of the species must be regarded as only provisionally settled until the pods of all the species have been collected and carefully examined, and a system devised founded on the shape and nature of the fruit.

The arrangement of the natural orders is the last difficulty which I propose to consider—a difficulty rendered highly perplexing by the fact that our most eminent botanists have entertained different opinions on the subject. Passing over some of the minor differences, it may be sufficient to notice

that the main divergence in the two great works—the *Flora* of Bentham and the *Census* of Mueller—is due to the position of the Monochlamydeæ amongst the natural orders, for whilst the former places them separately (Vols. V. and VI. partly), the latter distributes them amongst the petalliferous orders. His reasons for this departure are given in the preface of his *Census*, in which he expresses his conviction "that so long as the Monochlamydeæ remain isolated and associated with the Gymnospermeæ, we must necessarily have an imperfect natural system." And then he adds, as showing the inconsistency of the arrangement in the *Flora*, "Even amongst the Thalamifloræ and Calycifloræ represented in Australia, we have already not less than fifty-eight genera which are entirely apetalous, or contain species in which the corolla remains undeveloped."

The Monochlamydeæ, as given in the *Flora* are twenty-one, viz.:—

1. Phytolaccaeæ.
2. Chenopodiaceæ.
3. Amarantaceæ.
4. Paronychiaceæ.
5. Polygonaceæ.
6. Nyctagineæ.
7. Myristiceæ.
8. Monimiaceæ.
9. Laurineæ.
10. Proteaceæ.
11. Thymeleæ.
12. Eleagnaceæ.
13. Nepenthaceæ.
14. Euphorbiaceæ.
15. Urticeæ.
16. Casuarineæ.
17. Piperaceæ.
18. Aristolochiaceæ.
19. Cupuliferæ.
20. Santalaceæ.
21. Balanophoreæ.

In order to meet the views of the Field Naturalist's Club in Victoria, Baron von Mueller has published a *System of Victorian Plants*, according to the dichotomous method of Lamarck, but this system was not chosen by the Baron at his free will, nor is such an arrangement likely to prove useful in the ultimate mode of settling the natural orders of Australia. In the botany of the future, the alliances of Nature will be preferred to the ingenious contrivances of art, and therefore it may justly be presumed that no system which is beset with the danger of leading astray through the misunderstanding of any solitary characteristic, will obtain adoption in the general Flora of the future. The Baron's work must have given him a vast amount of labour, as it was "to be rendered alike available for elementary schools and for high educational institutions; it was to serve the amateur gatherer of plants in the field as well as the professional investigator in the exercise of stern duties, and yet

such a work was to be inexpensive, concise, and reliable!" There can be no doubt that the intentions of the author have been highly appreciated—his two volumes having in a great measure answered the purposes for which they were designed—but after all it must be admitted (as the learned author is fully aware) that in a small genus or order the dichotomous splitting-up of characteristics is but of little help (as one may just as easily look over short diagnoses) whilst in a large genus or order the system is frequently misleading. If headings are made in a large genus or order and then the salient points are brought out clearly in a brief diagnosis, a complex of characteristics (which we lose sight of in the dichotomous method) is obtained whereby not merely the name of the species is ascertained but a clue given to the better understanding of its properties. Since the gradual disuse of the Linnean system the arrangement of the natural orders has been viewed differently by authors of eminence, but all seem to be now agreed in following natural alliances as nearly as possible and of placing in close proximity those groups which are connected with each other. The illustrious Robert Brown, when laying the foundation of Australian botany, was one of the first to recognize the advantages of the Natural System; but the *Prodromus Novæ Hollandiæ* records only a limited portion of the vegetation known in 1810. The labour therefore of extending that work, of elaborating new orders and describing genera and species according to the additional light thrown upon them, devolved on the great systematic botanists, Bentham and Mueller, and it must in justice be added that they have proved themselves worthy successors of the Father of Australian Botany.

At the present time about 9,000 species, exclusive of the lower Cryptogams, have been subjected to scientific investigation. How many more are yet to be discovered, and what influence they may have in the modifying or reconstruction of the Flora are mere matters of speculation. New species are being found occasionally as travellers penetrate into remote parts, but now that Australia has been traversed from one end to the other, it is scarcely probable that many new types of vegetation will be discovered on which additional orders or genera may be established. It is to be hoped, however, that as each succeeding species falls into its proper place in the systematic arrangement, the nomenclature of plants will be simplified, the specific distinctions better understood, the genera

lessened in number, judicious subdivisions devised, and that to crown all, the aspirations of BROWN, BENTHAM, and VON MUELLER will be consummated in a perfect disposition of the orders. In New South Wales there are many reasons why such things may be hoped for, because in that, the oldest of the Australian colonies, the Linnean Society of the colony has already done so much for the furtherance of botanical science, and yet promises to do more. The Society may feel a just pride in referring to the labours of such men as the late Rev. J. E. TENISON-WOODS, Professor STEPHENS, Mr. C. S. WILKINSON, F.G.S., and Sir WILLIAM MACLEAY, who by their writings, as recorded in the Transactions of the Society, have contributed so much to the study of natural history, whilst it must be mentioned that the munificent benefactions and endowments of the last naturalist have not merely eventuated in the establishment of the "Linnean Society of Sydney" on a firm basis, but are designed to perpetuate for future generations the means of pursuing those researches with which the name of MACLEAY must ever be associated.

On the motion of the CHAIRMAN a cordial vote of thanks was accorded to the author for his very able and interesting paper.

DISCUSSION.

The CHAIRMAN.—Is it your pleasure to return thanks, I cannot say to the author of this paper, but to his representative, and particularly to Surgeon-General Gordon for his kindness in reading it, the pleasure of listening to which has, I am sure, been enhanced by the running paraphrase which he has thrown in from his own individual experience? We should be very happy to hear any observations upon the subject of the paper from two gentlemen here who will probably offer a few remarks, and from any others who may be pleased to do so. The two gentlemen I refer to are Sir Frederick Young and Mr. Petherwick.

Sir FREDERICK YOUNG.—Sir, ladies and gentlemen, I came here, perhaps with some others in the room, not with a view of taking any part in the discussion, but to learn a great deal from the

valuable paper which Surgeon-General Gordon has been good enough to read to us on this very interesting subject. I propose, therefore, in my one or two remarks that I will venture to make to confine myself to allusions to the great importance of the cultivation of botany for the sake of the material advantages which it gives to the inhabitants of course, no doubt, not only of particular parts of the earth in which botany is studied, but to all mankind. The fact of the knowledge which is derived from the scientific pursuit of the study of botany in discovering the value of various moods is alluded to here in reference to the various kinds of Australian timber, which are much better known in Europe now than before the publication of the *Flora*, for they can be identified by their scientific names. That is a most important thing, and we know what great developments are taking place at the present day from the greater knowledge of the qualities of the different timbers that abound in Australia. Then, again, there is an interesting remark which the author of this paper makes with regard to all plants which have their place in the economy of nature, and serve the purposes for which they were designed by the beneficent Creator. Again, I observe that Surgeon-General Gordon rather invited some remarks with regard to the importance of irrigation. Now it is well known to all those who are acquainted with Australia, that great development has taken place with regard to artesian wells in the Colony of Queensland, from which the most important results have already been obtained. I have not before me the figures, but I am perfectly well aware, as every one connected with Australia must be aware, of the enormous benefits that have been derived during the last few years from the sinking of artesian wells in the country. A parallel instance is to be found in another part of our great Colonial Empire with which I am more personally acquainted, and that is South Africa. When I was in Bechuanaland five years ago I had some personal communication with Sir Sydney Chever, the Admiralty Administrator of that day. Part of that country is called "a waterless desert," but it is known, and always has been, that there are underground waters to a great extent there, and that they only require to be properly tapped in order to make that part which is called "a waterless desert" into a fruitful field, to the immense advantage of the future generations of population with which I have no doubt that land will one day teem. (Applause.)

Mr. PETHERWICK.—I should like just to say a few words as to the work that has been done by an individual like the author, working quietly and unassumingly for fifty years in Paramatta. His work has been good, although his name is not published attached to any very great work like that of Hooker or von Mueller or Bentham, still he has in his way accumulated information which has been made use of in the larger works of the country. Dr. Woolls went to Australia more than sixty years ago, I think. He had written little works and was a student of botany, and went out there to what was a comparatively new field of exploration at that time, when, as he says in his paper, nothing or very little had been published except Brown's *Prodromus*. That, of course, compared with the later works, was very small indeed. Dr. Woolls settled down at Paramatta, and there he has been at work for fifty years, and although he has not published any very great authoritative work, his influence has been exerted in a quiet way, and there are hundreds of amateur botanists in Australia who owe their incentive to his good influence.

Professor ORCHARD.—We have all been very much interested in what the author has stated on pp. 115 and 116 as to the botanical knowledge possessed by the aborigines, and the great extent to which they seem to have made use of the indigenous plants of Australia. That is a circumstance which points to the conclusion, tolerably evident indeed on other grounds, that the primeval doctors went to the vegetable, rather than to the animal, world for their drugs and medicines. What Dr. Woolls states on p. 127 with regard to the importance of the correction of the nomenclature of botany applies, I think, not only to the botany of Australia, but to that of other places as well. There can be no doubt that the importance of nomenclature to the inductive sciences is very much greater than we are apt to imagine, and the names ought to be aids to the scientific memory. That is the principal purpose, I apprehend, of any scientific nomenclature—not, as Dr. Woolls truly says, to make invidious distinctions between one worker and another by bringing into use personal names. The names should be distinctly contributions to the more easy acquisition and better retention of scientific knowledge.

Mr. SLATER.—Mr. President, concerning the great subject of artesian wells, I have received some original communications from my youngest son, who was engaged for eight years in Queensland

in practically working out the matter. He has seen deserts changed into gardens by means of the water thus found. He has met with districts where, after the expenditure of much labour and money, the water brought to the surface has been brackish, so as to be destructive instead of beneficial. Whether this same mischief will extend to the districts in South Africa where water is so much needed I cannot say. As regards injurious influences affecting vegetation, it may be interesting to remember that Sir J. D. Hooker points out, as predominant above all others, the goat. From his travels in various parts of the world, and comparing the present state of the countries through which he has passed with what has been historically reported of them, he feels himself warranted in saying that the damage done by war is insignificant in comparison with the ravages committed by goats. It is much to be regretted that they multiplied so in South Africa. The ancient nations of the East were not very far wrong in regarding the goat as a type of evil. In some parts of Africa the effects they have had in destroying forests are so striking that a detachment of the Cape Mounted Rifles on the march actually cheered when they saw a tree. The way in which the creatures do the mischief is exceedingly simple: they browse off all the young seedlings; and as the giants of the forest do not live for ever, when they fall and perish there is nothing to take their place. The rainfall then, instead of coming gradually on to the soil, falls on it in terrible deluges, interrupted by long periods of drought, and by its heavy floods washes away the soil, and carries it down into the beds of the rivers, and blocks them up, and compels the waters to spread out of their channels, and thus turn the surrounding districts into swamps. In either way the mischief done is untold. But I am no botanist, and can therefore, unfortunately, not throw any light on the main subject of Dr. Woolls's paper.

The PRESIDENT.—Ladies and gentlemen, I just wish before we close, as time is now far spent, to offer one or two observations only, with your permission. There can be no question about the extreme value and interest of this paper, and I think we may consider that our Society is fortunate in the fact that Dr. Woolls was spared long enough to complete this paper before passing to another and a better world. I think one of the chief interesting points in this paper is the reference to the distribution of the plants of

Australia. You will see from the paper that they have representatives from all the continents of the globe; and some of these migrated plants we can easily account for. We can account for the large number of Asiatic species which have travelled down the Malayan Archipelago, and for a number of the species of New Zealand and Polynesia, but when we come to Africa, with 515 species common to Africa and Australia, and to 315 species common to Australia and America (I presume South America), the problem is evidently very much more difficult to solve. But geology comes to our assistance here, because not only the plant fauna, but the recent Tertiary fauna, of South America is represented in Australia, and gives indication of a not very ancient —indeed, a most recent—connection between South America and Australia. Then with regard to the community of African species, it is also known on geological grounds—on the comparison of the former fauna of the two countries—that Southern Africa was connected with Northern India by a tract of land which is now under the Indian Ocean; and therefore we can understand how the plants migrated along this line into India, and then southwards through the archipelago of islands down into Australia. All these questions are of extreme interest as showing how very different is the distribution of land and sea, continent and ocean, at the present time, in regard to their outline, from what it was at a not very distant period of the world's history. In this manner we can account, I think, for the remarkable fact which is here stated, that Australia in its flora represents all the continents of the globe.

Surgeon-General GORDON.—There is one thing I should like to remark upon, and that is the interest with which I have listened to, and the great information I have derived from, some of the remarks that have been made, more especially on the subject of irrigation. It is within our own knowledge that, with regard to the effect of vegetation and water mutually upon each other, only a few years ago when the great Suez Canal was begun there was scarcely an atom of vegetation along it, whereas now there is a strip of vegetation springing up all along its banks. Of course the matter that was mentioned with regard to the risk that there is, and that the circumstance had actually occurred, of brackish water having been got up from the lower reservoirs instead of fresh water, simply confirms what I had previously heard, and it also

gives a suggestion to those who are engaged in extending the system of irrigation to other countries.

The PRESIDENT.—It is well-known that some rocks give fresh water and others salt water. That is a thing which depends very much on the manner in which they are formed. These artesian wells pierce down into the strata which are very often of marine origin, contain sometimes salt in their pores and crevices—the salt water of the primeval ocean in which they were formed—and it is only by actual experiment that it can be determined whether the water which comes from them will be salt or fresh.

The SECRETARY, having read a few letters expressive of sympathy on the death of Dr. Woolls, said:—Having been personally acquainted with Dr. Woolls for many years, I may be permitted perhaps to add a few words to what has been said. Dr. Woolls was seventeen years old when his father died, and he went out there in the year 1831. He first was taken notice of by Bishop Broughton, the first Bishop of Sydney, who died shortly after I myself arrived in the colony. Dr. Woolls at first devoted himself to literature, and then he was appointed assistant master in Paramatta School. After that he went out to an old friend, a Mr. Cope, in Sydney, and was appointed assistant master in his school. Finally he took up the study of botany and settled down at Paramatta—that was about the year 1836—and from that time he has devoted himself entirely to the study of the botany of Australia. Sir Frederick Woolner has assured me that there was not another man in the whole of Australia who was such a capable botanist as he. (Loud applause.) I regret to say that it was only just after finishing the paper that the author was attacked with paralysis.

The Meeting then broke up.

Comments by Baron Sir F. VON MUELLER, Ph.D., M.D., LL.D., F.R.S.:—

The Council of the Victoria Institute having through its indefatigable and accomplished Hon. Secretary done me the honour of submitting to me for remarks the proof print of a treatise on the "Australian Flora," by the Rev. Dr. Woolls, I wish in the first

instance to pay a tribute to the Manes of my lamented friend, whose last essay is now before us, it having become almost posthumous when it was finished. A correspondence with Dr. Woolls, which extended almost over forty years, in which epistolary intercourse we exchanged probably not less than 1,500 letters, or perhaps more, gave opportunities to numerous Phytologic discussions, he having mainly through myself been drawn into his botanic path, and during this long period, which came to a sudden end through an accident, sustained by him as an octogenarian, he contributed most zealously and thoughtfully to my collections. It is therefore with a deep interest that I now read what proves the last of his extensive literary efforts; and I fulfil with mournful feelings the wish of the Victoria Institute to offer some brief notes on his memoir.

As regards investigations on Dampier's plants, to which the author early alludes, it may here be stated that already R. Brown chose one of the plants gathered by that renowned traveller, for a dedication, and that after Cunningham's elucidations on Dampier's own ground, some further notes on the memorable xylograms given by Dampier, were promulgated by the Royal Botanic Society of Edinburgh, in its seventh volume, when I referred also to Plukenet's and Dryander's records; further that Professor Lawson, when at Oxford, added from inspection of the original material to the published elucidations on this subject

Sir Joseph Hooker, in treating for the preface to the Flora of Tasmania the development of our knowledge of Australian plants historically, refers also to Dampier's merits as a botanic observer pointedly.

Following up Dr. Woolls' notations, it is at this moment of particular interest to learn from Sir Joseph Hooker of the intention to get under his surveillance published in London very soon the original diaries of Sir Joseph Banks (his sponsors) as written during Cook's first voyage, and this is sure to throw additional light on the Australian vegetation; as for instance, the incidents connected with the earliest discovery of a Musa in our part of the globe. As affecting the recorded discoveries of Banks' and Solander it may be proper here to recollect that the elder Gaertner from 1788–1791 brought first under notice several of the plants of that expedition, chiefly from carpologic specimens. We should also not lose sight of the fact that Robert Brown's researches were not confined to continental Australia, as this great phytologic investigator had the happy chance to visit also Tasmania previously; thus indeed it was that the first alpine plants (from what is now called Mount Wellington) became known.

Why R. Brown stopped short at the volume of his celebrated *Prodromus*, in which the Ferns, Monocotyledonæ, Apetalæ, and part of the Monopetalæ are contained, is better known in Britain than here; but it is a fact which influences the bearing of that so

prominent man to the systematic elaboration of the Australia Flora.

Dr. Woolls emphatically expresses what we early explorers had to endure, while often contending with hostile autochthones, not rarely famishing from want of food, and what is far more terrible, the want of water, especially in desert heat, finding our way by the sextant and compass, during lengthened time sleeping under the canopy of heaven. Few outside of Australia can estimate Allan Cunningham's position as a traveller, though his land-tracks remained not the most extensive among the lines of other land-travellers, especially when the extent of Gregory's expedition away from any settlements for nearly one year and a half is considered; but such chances as R. Brown and Allan Cunningham could seize on for coast-observations, through grand maritime expeditions, stand unique in the history of sciences. More of Cunningham's than of R. Brown's plants found their first public place in the famous suite of volumes of De Candolle; and what Professor Lindley and Sir William Hooker, and still more Robert Brown, have done for the volumes of Sir Thomas Mitchell's and Captain Sturt's great land expeditions is well recognised at home and abroad.

As Bentham has given at the commencement and at the end of the *Flora Australiensis* a *résumé* of what during the second half of the century had been accomplished for Australian phytologic exploration, and as these records regarding still later times have been supplemented by Mr. F. M. Bailey in an inaugural address at the Royal Society of Queensland, wherein his own important working is also detailed, and passingly in some publications of my own, it seems unnecessary adding to what Dr. Woolls so ably expressed in this direction. It may, however, be but right to point out at this stage of the present review, that my own personal researches fall also into the first half of the century, because the writer instituted numerous observations at and near St. Vincent's Gulf already in 1847, went twice to Murray River in 1848, and rode overland from thence in the same year to the boundary of the colony of Victoria, what was at that period almost unsettled country, mainly with the object of determining the range of Tasmanian forms of plants westward.

From merely such data it is easily understood how one of the largest of the herbaria anywhere in existence arose in Melbourne, especially as were incorporated into it by spontaneous free gift, the writer's own private collections, commenced in 1839, and as he acquired also early home collections rich in plants typic for species even back into the last century. For authentic testimony as to localities of growth, display of variability, the Australian division of our Herbarium is the richest in the world, and would under ordinary foresight serve for fundatory information through centuries. But local herbaria have been started in most of the

Australian colonies, though chiefly limited to the plants of each dominion. Endless studies, worrying perplexities, great expenses and invaluable loss of time have been saved in all these southern colonies by the vast extent of namings of specimens for the public and private collections, representing an amount of endless patient toil and application of knowledge, a boon the lasting influence of which does not impress itself readily on all the workers, who thus had cleared their paths and had guiding marks in all directions; and yet the facility and safeguard cheerfully and disinterestedly offered have hardly ever yet in a single instance throughout these colonies been recognized by a word of public appreciation of those whose researches—while working with the aid of safely-named collections—became so very much easier, or when later botanists were thereby started on their career.

Substantial gratitude would never have been expected nor accepted, but a thankful thought about the originator of the great Melbourne Herbarium is hoped for even in far futurity. Since the death of my revered friend has appeared in Professor Leveillé's *Le Monde des Plantes*, at Le Mans, a computation of the plants known up to 1892; this therefore brings the numbers and the notes connected therewith three years further than those of the second *Census of Australian Plants* from which Dr. Woolls quoted.

Where still uncertainties remained to be cleared up after local researches, the doubts were removed mainly by Bentham in the course of his issue of the *Flora Australiensis*.

Subjoined are the final results:

Statistics of Australian indigenous plants, so far as known up to the end of 1892:—

Total number of Orders of Vasculares	156
,, ,, Genera ,, ...	1424
,, ,, Species ,, ...	9021
Of these species occur in extratropic West Australia	3660
,, ,, extratropic South Australia	1969
,, ,, Tasmania	1051
,, ,, Victoria	1949
,, ,, New South Wales ..	3356
,, ,, Queensland	3873
,, ,, North Australia	2037
Admitted in the *Flora Australiensis* indigenous species (after some reductions).	7814
Additions recorded in these preliminary statistics..	1207

Proportion of distribution through the respective colonial territories :—

	Per cent.
In West Australia..	40·6
,, South Australia	21·8
,, Tasmania	11·6
,, Victoria..	21·6
,, New South Wales	37·2
,, Queensland	42·9
,, North Australia	22·5

Of the total number, 7,588 species are endemic in Continental Australia and Tasmania; therefore 1,433 or 15·8 per cent. extend also to other countries. Of these 166 are found in Europe, 1,057 in Asia, 531 in Africa, 323 in America, 638 in Polynesia, 350 in New Zealand.

Species added since the publication of the first *Census of Plants*, 375, since the issue of the second *Census*, 182, irrespective of some systematic changes or reductions.

Geographic entries added since the issue of the second Census, 555.

The total of the vascular indigenous species of all Australia will in all probability finally prove to be less than 10,000.

The deepest impression which such calculations will probably make on readers, may be caused by the amazing endemism, and should that startling emotion be merely ephemeral? The generation of the sturdy and enterprising founders of these colonies has almost passed away. Their descendants should love the flowers of their native country, should prevent defacing or demolition of even the last vestiges of the pristine vegetation, should in a patriotic spirit reserve from alienation commensurate areas wherever the sylvan or floral traits display the most marked features, and should thus seek to deserve from future beholders some feelings of admiration for providing with the loftiest of forethoughts the purest of pleasures.

Concerning the sanitary effects of the Eucalypts, dwelt on by the departed essayist, a very extensive article from my pen was furnished to the *Sydney Medical Gazette*. The successive international Exhibitions since 1855 have brought forward gradually a large mass of information on the utilitarian aspect of the Australian vegetation, and in his position as a Commissioner, even as far back as forty years ago, it fell also to the share of the writer to advance these interests by original efforts. From various sources in all our colonies, through the successive reports, accumulated technical knowledge, which could only to a limited extent be given in such a manual as the *Select Plants for Industrial Culture and Naturalisation*, of which the ninth edition (of those in the English language) will early pass through the press. Mr. J. H. Maiden, the curator

of the Technological Museum of Sydney, has in an admirable volume, *The useful Native Plants of Australia*, 1889, not only collected together the scattered information extant, but has furthermore enriched the work with a multitude of original results, chiefly from his own chemical laboratory.

The active principle of the bark of Petalostigma, to which Dr. Woolls refers as similar to quinine, bears, however, no chemical resemblance to that alkaloid. Respecting his startling enunciations on the phytographic names of plants, he stands probably alone, though new vernaculars might be put forward. I might have been tempted to exercise some censorship on his communication to the Victoria Institute, had the lamented author (in a wish, as he wrote to me at the time, to pass an eulogium) not refrained from placing the manuscript before me, so that it will be best not to correct the minor inaccuracies which occur, more especially so as his essay will have been before a meeting of the Institute prior to this lengthened corollary, now supplied as desired, can reach London; and as I cannot be aware what the comments may have been at your gathering, but which on the whole must have been laudatory, even if this was not his "swan-song."

In so large a subject as that on which he treats, it is impossible to follow up his remarks very exhaustively, it may nevertheless here be stated that for Mr. Malcolm Fraser's latest West Australian year-book a general vegetation sketch of the extratropic portion of that vast territory has been provided, and this may serve as an addition of what I had written myself on various occasions since the two contributions in *Hooker's Kew Miscellany* of 1853 appeared.

Some homage is also due to Sir William Denison, who as Governor-General of Australia at his time conceived the idea of, and gave the first impulse to, the elaboration of our Colonial Floras. Indeed, in letters to myself during the earlier years of the second half of the century His Excellency detailed his views not only on the preparations of Floras but also of Faunas, and now after forty years' more research and preliminary publications the time is fast approaching when for special higher education and utilitarian application complete standard works on Australian zoology are needed; also the subject of providing "Colonial Floras" under the powerful influence of Sir Joseph Hooker, was also early promoted by your venerable and enlightened Vice-President, Sir Henry Barkly, whilst governing the colony of Victoria.

All the Australian colonies have now their local Floras, that for New South Wales by Moore and Betche, some collections for it accumulating already in Sydney through Leichhardt, soon after Cunningham had passed away, whose herbarium, however, remained not in Australia. Mr. Bailey ably furnished a synopsis for Queensland, Professor Tate an excellent manual for South Australia, bringing geology and phytology also more particularly

into contact. Although West Australia with as yet a small population stood not in need of a work on its plants for local requirements, but much material was brought together already by Drummond and Preiss. Sir Joseph Hooker's work on Tasmania is world-famed, and gave also a further insight into the alpine vegetation, the elucidation of the Flora of the Australian Alps falling to the share of the writer, with a slight exception, through Dr. Lhotzky's travels.

The solid treatment of the vegetable forms of life by the genius of Bentham in the Universal Flora of the fifth continent, founded on European experiences, should tend to prevent for all future in Australia a danger from which many other regions of the globe did not always escape—the want of a rational recognition of specified limits, and the consequent undue multiplication of generic and specific definitions which has embarrassed so many of workers elsewhere. An intricate, perplexing, and burdensome synonymy could be thus, we trust, for ever avoided.

As Dr. Woolls says, for record of new forms really specific of vascular plants our Flora seems now nearly exhausted, though some South Asiatic and Polynesian plants may yet be traced across to us. The Evasculares give, however, still scope for the discovery of actual novelties and multifarious detail observations. Vast exertions are, however, still needed by local observers, particularly in the far interior regions of our continent, to fix more exactly the geographic range of numerous species of both phanerogams and cryptogams.

The venerable and erudite author had evidently in view, when engaged in this, the last of his writings, that a clearer perception should be arrived at as regards the relation of the science of plants to general requirements of life; he himself having been unceasing to diffuse information. I feel touched with the praise which he, carried too far away by the ardour of his friendship, lavished on me, and the recollections of my scientific intercourse with such a good man will remain among the most elevating thoughts of my own life. It is particularly gratifying that his long literary labours should end before the Victoria Institute, which in its religious tendencies leads always up to the highest contemplations of human destiny under divine ruling for eternity.

P.S.—Mr. Aird, of Sydney, has kindly made some corrections in the proof, consequent on the death of the learned author of the paper.—Ed.