a Field for Geographical Research, and would be delivered by Mr. Thiselton-Dyer. It was hardly necessary for him to say many words in introducing Mr. Thiselton-Dyer to the Meeting. His name was well-known in scientific circles, as that of one of our younger botanists of high repute. The position he filled at Kew could not be creditably filled except by a botanist of great ability. It was a post which gave the person who held it opportunities of learning the most recent facts of Geography, so that he could point out better than any one else what were the botanical *lacunæ* which travellers should endeavour to fill up. The Paper would contain remarks on the method of gathering information concerning economical products of different countries, and few persons were better qualified than Mr. Thiselton-Dyer to deal with that subject, for to him had been practically entrusted for some time past the scientific revision of the unrivalled Museum of Economic Products at Kew.

Lecture on Plant-Distribution as a Field for Geographical Research. By W. T. THISELTON-DYER, M.A., B.SC., F.L.S., Assistant-Director, Royal Gardens, Kew.

WHEN the scheme of these discourses on scientific geography was first announced, I must confess that I looked forward to that which I am myself about to deliver with very different feelings; for I certainly supposed that we should have had the advantage of hearing some one of the botanists of this country, whose well-known and long-continued devotion to the subject would have made it easy to handle it in a masterly way. Mr. Bentham, for example, would have brought to it the matured results of many years' reflection in a field which he has made peculiarly his own, as well as the authority which must attach to the generalisations of one who has worked out and published the taxonomy of a greater portion of the earth's vegetation than any other living botanist. Sir Joseph Hooker, no less a master of the speculative side of the subject (if, indeed, we do not owe to him our first steps in the direction of its modern progress), would have imparted to you the vivid impressions of different areas of vegetation, of which I am not aware that any living botanist has actually seen so many. And my colleague, Professor Oliver, in his turn, would have brought to the task a unique qualification, for I can hardly suppose that any botanist has ever critically examined, in the shape of herbarium specimens, so much of the flora of the whole world as he must have done. None of these gentlemen, however, were disposed, from the pressure of other engagements, to undertake the task which has fallen upon me, and which I confess I have accepted with no small anxiety; for I am very desirous of securing your sympathy and, I hope, your co-operation as a society in a branch of scientific work, in which I think England at present stands quite in the first rank.

To fix our thoughts, let us suppose for a moment that the

surface of the globe were symmetrically divided into sea and land, and that these were in fact distributed in bands bounded by parallels of latitude. Supposing further, that such a state of things could be permanent—which I imagine it could not be—we should have the physical conditions of vegetable life uniform for each latitudinal zone. The character of the vegetation would depend on temperature alone; and as regards its aggregate mass, we should find it attaining its maximum at the equator, and sinking to its minimum at the poles. It is quite certain, however, that under such ideal circumstances the earth's vegetation would be very different to what it is, and the reason will be apparent enough on a little reflection. Looking at a map of the world, we see that the actual distribution of land and water is as unsymmetrical as it well can be, and we know that this geographical asymmetry is correlated with a no less striking diversity in climate. Vegetation in any given spot maintains its own only by having solved the problem of existing in the best way under the given circumstances. Introduce a new competitor for a particular site that can solve the problem rather more closely, and the old occupant must needs give way. It is quite evident, then, that the geographical intricacy, whether of outline or contour, in the existing land-surface must be matched by the elaborate diversity of its floral covering, and that any easily recognised broad areas of uniform vegetation will be sought for in vain.

And as far back as we can push our inquiries the same state of things obtained. The main features of the great continents and oceans, whether in the old or new world, seem to have been permanent from the earliest geological time;* but their minor details have enormously varied. The mutations in level of the surface have severed and united different land areas again and again, and have consequently isolated or blended their respective floras. Great secular changes of climate have also forced the migration and re-migration of floras which have moved as the conditions under which they can exist have moved. Isolation on the one hand, and migration on the other, have heavily decimated them; and when we meet with a plant which seems to have no close family allies, but to stand alone in peculiarities of structure, we recognise it as the last survivor of its group in some contracted area from which there was no escape from more powerful competitors or unfavourable conditions, or as having been the only

* See Dana, 'Manual of Geology,' p. 732; Wallace "On the Comparative Antiquity of Continents," 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 508.

one able to triumph over the innumerable obstacles in the way of its transit from its old home to its new.

The modes of transference of plants from one part of the earth's surface to another fall into two great categories. The normal dispersion, whether by the aid of winds, migratory animals or rivers and oceanic currents, must be, roughly speaking, a latitudinal one, and tend to intermingle floras which, though differing in themselves, live under very similar conditions at the same time. Secular changes of climate will act along lines at right angles to the former agencies—meridionally, in fact—and will therefore effect the substitution of very different floras; and if, when the changes have been reversed, we find fragments of the migrating flora left behind, it is only in sheltered valleys or in proximity to the sea in the case of a colder climate than that they came from originally, or on high mountain ridges in the case of a warmer one. These great longitudinal migrations—enormous as must have been their effect in changing the vegetative aspect of the earth's surface—have not done much in mixing the floras of *laterally contiguous* continents. The great hosts of plants have oscillated between the poles and the equator, and the friction attendant on their movement—if I may use such an expression—has thinned their ranks, and perhaps extinguished whole battalions; but the plants which we see to-day are to an enormous extent the descendants of those which in an antiquity not to be measured in terms of ordinary time inhabited the same great land-surfaces.

Considerations of a similar kind having gradually led to the philosophic treatment of the facts regarding the distribution of animals, I believe that we shall be able to work out those regarding plants in ultimate accordance, and find, to use the words of Mr. Wallace, that "the great primary divisions of the earth for purposes of Natural History correspond with the great permanent features of the earth's surface—those that have undergone least changes in recent geological periods. Later and less important changes will have led to discrepancies in the actual distribution of the different groups, but these very discrepancies will enable us to interpret those changes, of which they are the direct effects, and very often the only evidence." . . . . "The flora of each region should exhibit a characteristic substratum of indigenous forms, though often much modified, and sometimes nearly overwhelmed by successive streams of foreign invasion." * "Naturalists," to quote Mr. Wallace again, "need not be bound by the same rule as

* 'Natural History Review,' 1864, pp. 122, 123.

politicians, and may be permitted to recognise the just claims of the more ancient inhabitants and to raise up fallen nationalities. The aborigines, and not the invaders, must be looked upon as the rightful owners of the soil, and should determine the position of their country in our system of zoological"—to which I must no less add, of botanical—"geography." *

Now, however efficiently a scientific botanist may study the plants of a country, in which he happens to be residing, in the living state, it is clearly impossible that they can be compared with those of other countries unless specimens can be preserved suitable for examination, and deposited in some central situation available to students. From this necessity has gradually grown up at Kew, as elsewhere, the immense Herbarium which is so important a feature in our organisation at the Royal Gardens, and which I imagine I am not influenced merely by feelings of official pride in stating to be the most extensive in existence. A Herbarium in modern times is not a thing got together from the mere blind passion of accumulating rare and curious things, but is an instrument of scientific investigation—a method of bringing together in a convenient space the materials for studying and comparing the constituents of the world's vegetation.† It is composed of contributions large and small, brought together from the most diverse sources. It consists in the main of large collections due to the energy of our Indian and colonial botanists and which we owe to private liberality or have received from their several governments, of collections made by botanists in foreign countries and which we have obtained either by purchase or exchange, of others made by great travellers such as Burchell and Spence and which in various ways have come into our possession, and lastly of an innumerable host of contributions sent to us by correspondents in all parts of the world.

In fact there is no contribution, however small, which we are not prepared to thankfully accept from any country—and how many there are—the vegetation of which is still imperfectly explored! Except perhaps insects, there is no class of natural-history objects which it is so easy to collect and preserve as plants. Any ordinarily intelligent person could in ten minutes learn all the

* Wallace, *l. c.*, p. 119.

† How real is the advantage of centralisation in such scientific studies is proved by the fact that Dr. Brandis, the Inspector-General of Indian forests, found it necessary to come to this country to spend two years in preparing at Kew, rather than in India, his Indian Forest Flora.

technical points which must be attended to in securing a specimen fit for botanical study. When once properly pressed and dried, botanical specimens are subject to no injury except from damp. The superb collections, to take only a few recent examples, made by Beccari in Borneo, Schimper in Abyssinia, Welwitsch in Angola, Grant * and Schweinfurth in Central Africa, show how little obstacle the difficulties and impediments of travel in even trackless and unexplored countries really oppose to an enthusiastic and determined naturalist.

Our correspondents in countries where botany is at present little known generally labour under the disadvantage of being settled near the coast, with the rarest possibilities of getting access to the interior. What we do get from them only stimulates our curiosity and desire for more. Our indefatigable correspondent Dr. Kirk, the political agent at Zanzibar, never misses an opportunity of securing for us anything upon which he can lay his hands in the shape of a new African plant. Thus when Mr. New, the African Missionary, unhappily since dead, projected an ascent of Kilima Njaro, the loftiest African mountain, and the snow-line of which, as far as I know, had never been reached by a human being before, Dr. Kirk, in sending him letters to the chiefs he would pass on his way, asked him in return, as a favour, to cram into any old book what he could of the highest vegetation of the mountain. Mr. New had never dried a plant in his life, and had no apparatus available for the purpose other than a bundle of old 'Guardians.' Yet he succeeded in obtaining for us specimens of about fifty species, the examination of which yielded results of the very greatest interest and importance.† To mention one result alone, he found on this mountain a plant which is not known to occur elsewhere in Africa than on the Cameroons, 2000 miles distant, and the significance of which I shall have by-and-by to advert to.

* The botany of the Speke and Grant Expedition fills the whole of the twenty-ninth volume of the 'Transactions of the Linnean Society.' I cannot do better than quote, as an encouragement to future travellers, the modest words in which Colonel Grant commences his account of his collections: "It occurred to me that many a pleasant hour might be spent in collecting plants and seeds while traversing the country to be explored. I here confess that I did not then anticipate any botanical importance from such a collection. With this idea (more of pleasant occupation than of scientific result), before embarking at Plymouth I purchased some drying paper and a couple of books for notes, all for a few shillings. When Captain Speke saw this bundle of paper, he thought it far too cumbrous for such a journey, but he readily yielded to my wish to have it. He afterwards saw how the plants were appreciated, when we took them to Kew upon our return."

† J. D. Hooker, "On the Subalpine Vegetation of Kilima Njaro," 'Journal of the Linnean Society,' vol. xiv., pp. 141–146.

To take another instance. Since the end of last century it has been known that the island of Amsterdam, in the South Indian Ocean, was covered with trees; and though the desirability of ascertaining the nature of this arboreous vegetation has often been impressed on the commanders of ships about to visit the Southern Ocean, nearly three-quarters of a century elapsed before the wished-for information came. The late Commodore Goodenough touched at Amsterdam Island in 1873, and brought off a specimen of the only tree in the island (to which the forest described by Labillardière had been reduced), together with a fern in an imperfect state, and an armful of cabbages pulled from the deserted garden of departed whalers. The tree proved to be identical with *Phylica arborea* (Thouars), known previously only from Tristan d'Acunha—a most astonishing fact, seeing that these two oceanic specks of land are separated by 3000 miles.* A last case, which I cannot pass over, is that of perhaps the only natural-history specimen yielded by the Ashanti War. Lieut. de Hoghton brought us a single fruit, which turned out to belong to an undescribed species of *Duboscia*, known to us previously only by specimens gathered on the River Muni by Mr. Gustav Mann.† Invaluable, however, as are such happy scientific windfalls as these, I think I shall succeed in showing you that what is wanted in the present state of botanical science are collections, systematically made, from the interior of countries, the botanical productions of which are still almost wholly matters of conjecture.

I feel, however, that I shall not be stating my case with entire fulness if I omitted to point out that while botanical collections are indispensable for the study of phyto-geography, a herbarium such as we possess at Kew renders great services for other purposes. The botanical determination of a plant is nothing more than the process of affixing to it a name which shall pass current in all countries to which scientific literature has access, and which we can recognise as belonging to the species by virtue of the distinctive characters which it is the business of the botanist to point out. At present, however, from a variety of causes which it is now unnecessary to discuss, the literature of systematic botany, as indeed of all the descriptive sciences, is in a very scattered condition. It is not always easy for even botanists in foreign countries to correctly name their plants, and it requires the resources of a central establishment, such as we possess in Kew, to accomplish this with any certainty; more especially if the

* 'Journal of the Linnean Society,' vol. xiv., p. 475. † Ibid., p. 457.

material to work upon is, as is too often the case, fragmentary. I might occupy a good deal of your time, and perhaps in a not uninteresting manner, if I were to enumerate more than a few of the cases in which the services of the botanist have been of importance from a merely commercial point of view.

The botanical determination of the existence of the indigenous tea-plant in Assam, initiated the commencement of Indian tea-cultivation.* In what promises to be another great branch of Indian industry—the cultivation of Cinchonas, the botanical determination of the valuable species has been all important. None have felt this more than the Dutch, who introduced a worthless species (*Cinchona pahudiana*) at great cost into Java, the cultivation of which they had eventually to abandon. To point to more recent instances which fall within my knowledge, I may mention that after the India Office had gone to great expense in bringing over to this country for introduction into India, the true plant which yields Para India-rubber, we learnt that one bearing the same scientific name (*Hevea*) was already in cultivation in the botanic gardens of the East. On obtaining authentic specimens, we were able to ascertain that, though a rubber-producing plant, it was really quite different from that of Para, and so disappointment and confusion were obviated. To take some minor instances—a substance called Chicle-gum was sent to us from America as likely to be of use in telegraphic engineering. Had it proved of any value—which it did not—in ascertaining the fact that it was produced by a widely cultivated tropical plant (*Achras Sapota*) we should have been able to introduce a new industry into countries where the Sapodilla plum already grows. A grass (*Uniola virgata*), again, was sent to us from the West Indies as a proposed paper-material. Grasses are so much alike in leaf and stem, that but for a fragment of the inflorescence we could not have identified the species. When this was done, residents who are acquainted with the plants of Jamaica would have no difficulty in knowing where to find it, and if it proves worth while, can cultivate it for the purpose. As a final instance, let me take the introduction of a new drug (*Duboisia myoporoides*) which we owe to Baron von Mueller. The natives of Central Australia have long been known to chew a plant which they call Pituri, which invigorates them on long foot journeys, and excites their courage in warfare. Baron von Mueller succeeded in identifying this plant as *Duboisia Hopwoodii*. This led him to

* A. Burrell, "Indian Tea Cultivation," 'Journal of the Society of Arts,' vol. xxv., pp. 206, 207.

test the properties of another species, *Duboisia myoporoides*, which he found to possess, amongst others, that of dilating the pupil, for which purpose it is already in use in ophthalmic surgery.*

Even where travellers are unable or disinclined to collect on a considerable scale, it is remarkable how much useful work they could do by finding out and securing specimens of any plant whose products they found in use amongst the natives—just as Baron von Mueller succeeded at last in doing with the Pituri. When a botanist has possessed himself of a recognisable specimen of a plant, he is able to record for all time the useful properties which native tradition has attributed to it, and which, as native customs and habits become restricted and disappear, run the risk of being for ever buried in oblivion. In the immense collection which we possess at Kew illustrating the useful products of the vegetable kingdom, there are a multitude of specimens—fibres, gums, resins, barks, seeds, &c.—all interesting, and yet to the origin of which we have no clue, and which therefore we should have no idea how or where to find, however anxious we might be to get further supplies of them.

And even of things which find their way into commerce, our ignorance of the source is often remarkable. Till within the last few years, it was supposed, on the best authority, that the well-known kinds of tobacco grown at Lattakia and in Cuba, were the produce of some other species of *Nicotiana* than *N. Tabacum* which really yields them. St. Ignatius's beans, which find their way into the markets of this country as a source of the deadly poison, strychnine, are the seeds of a fruit which is said to be sold in the market at Manila, and there our knowledge stops. The various kinds of Cardamoms, which are found in Eastern trade, are the seeds of plants most imperfectly known, though some species grow in forests under the charge of Government officers. When we approach China we find, as we might expect from the sagacity of that ancient people, that the vegetable products in use amongst them are very numerous, but that the origin of them is very little known amongst Europeans. It required all the energy of Sir W. Hooker to urge his correspondents during several years to trace out the history of the plant whose pith is the material of rice-paper, and which is confined to the island of Formosa.† It was reserved for Lieut.-Col. Prejevalsky, as the crown of his adventurous journey to Lake Koko-nor, to settle finally the controversies as to the source of true or Kiakhta rhubarb, and to study the real plant

* 'Nature,' May 24, 1877.

† 'Journal of Botany,' 1852, pp. 50–54.

producing it (*Rheum palmatum*) on its native soil; being, says Colonel Yule, "the first European who had seen it there since Marco Polo."*

During the course of last year the attention of the Indian Forest Department was attracted by the high price given at Shanghai for coffins made of Nan-mu wood. Of the same wood the Imperial palaces at Pekin are also said to be built, although travellers were quite content to believe they were constructed of teak, just as antiquaries have held, and with as little accuracy, that the oaken roofs of our ancient buildings were made of chestnut. This tree appears to be indigenous to Yunan; and a few leaves collected by Mr. Davenport during the mission to that country, and examined by my acute colleague, Professor Oliver, have rendered it probable that this celebrated timber-tree is at any rate a member of the Laurel family, and possibly allied to *Phœbe pallida*, with whose foliage its own closely agrees.

However, I fear I have too long trespassed on your patience in endeavouring to illustrate by example, as well as precept, the immense services which the "roving Englishman," and still more the disciplined explorer, might render to that practical side of botanical studies, which at Kew we never lose sight of for a moment. All economic plants, whose range is at all contracted, progress steadily towards extinction,† and the first step in attempting to obviate this by bringing them under cultivation is to make quite sure that we have got hold of the precise plant which produces the thing of which we wish to keep up the supply.

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* Prejevalsky's 'Mongolia,' translated by E. Delmar Morgan, vol. i., p. xxxi.

† This is so invariably confirmed by experience that illustrations are hardly needed. A few examples will at any rate sufficiently point the moral. The Akyaw of the Burmese is a resin which is obtained from the wood of trees growing in the Mergui Archipelago when it has begun to decay. It finds its way to China, where it is greatly in demand for incense and other purposes. It has been supposed to be identical with the "aloes" of the Bible. From the Report of the Forest Department in British Burma for 1876–7 (pp. 20–23) it appears that there has been "a great diversity of opinion respecting the number of species of trees which yield the Akyaw"; the native collectors distinguish two kinds of trees, but these at present, from want of flowering specimens, have not been accurately identified botanically. Nevertheless "the margins of the forests have already been cleared, and the extermination of the tree in all readily accessible places is only a question of time." The history of the valuable Rubber-vines (*Landolphia*) of Tropical Africa is precisely parallel. Mr. Sketchly states that the natives, "rather than take any extra trouble, ruthlessly destroy every vine for the sake of obtaining a single supply of the elastic juice. The result is that, vast as is the area over which the rubber-tree is found, the natives, who alone are the producers, have to penetrate deeper and deeper into the forests for each year's supply." The large tea-trees of the Naga Hills—some of which are said to be three feet in girth and eighty feet in height—are rapidly disappearing, being cut down for firewood, or to save trouble in gathering the seed. ('Report of Forest Department in Assam,' 1876-7, pp. 29, 30.)

I must now attempt to point out to you the more abstractedly scientific problems to the solution of which we, whose business it is to work out the materials we receive, stand very much in need of aid; and I can only do this by stating, as briefly as possible, the present results which we have acquired, and the serious gaps in our knowledge will then speak for themselves.

The most superficial study of the vegetation of the world brings almost immediately into prominence its division into three great floras, of which, speaking very roughly indeed, we may say that the tropics are the frontiers. That these are but differentiated portions of one sheet of vegetation, formed by the aggregate twigs of one great genealogical tree, having a single root in the distant past, we infer from the general theory of evolution; and we are no less led to it by the internal evidence afforded by the more detailed study of the floras themselves. But we may be quite sure that these great divisions are very ancient, and at present we have not proceeded very far in clearly apprehending the relation of the several subsidiary areas of vegetation which belong to each.

I. The NORTHERN Flora is characterised by forests of needle-leaved *Coniferæ* and catkin-bearing trees (*Amentaceæ*) shedding their leaves in winter, and by the vast variety of herbaceous plants —*Ranunculaceæ*, *Cruciferæ*, *Leguminosæ*, &c.—which cover the surface of plains and uplands. This great flora spreads over the whole of the extra-tropical lands of the northern hemispheres in the Old and New Worlds.

II. The SOUTHERN Flora is markedly contrasted with the Northern. Instead of occupying large continuous areas, in which the local peculiarities of one district blend insensibly into those of another, it occupies widely-dissevered territories, in which local peculiarities, intensified by long separation, have mostly effaced the possibility of comparing and identifying species and even genera, and compel us to seek for points of contact in the comparison of groups of a higher order. The resemblances consist, in fact, not so much in the existence of one general facies running through the regions, as is the case with the Northern flora, but in the presence of peculiar types such as those belonging to the families *Restiaceæ*, *Proteaceæ*, *Ericaceæ*, and *Mutisiaceæ*.

III. The TROPICAL Flora is characterised by the absence of herbaceous and the predominance of arborescent * types, which rarely

* A striking instance of the poverty of tropical floras in herbaceous types is afforded by the distribution of *Compositæ*, which are most poorly represented in the Brazilian and Malayan forests (see Bentham, 'Journ. Linn. Soc.' xiii., pp. 484, 524, 546). Beccari's collection of 1849 Sarawak plants contained only six *Compositæ*, several mere weeds.

shed their leaves. Polypetalous orders abound (*Anonaceæ*, *Meliaceæ*,* *Leguminosæ*, &c.), and amongst Monocotyledons, Palms,† Plantains (*Scitamineæ*) and gigantic grasses (*Bambusaceæ*) are especially conspicuous.

I. THE NORTHERN FLORA.—This is by far the most widely-extended of existing floras, and palæontological evidence appears to show that its uniformity has been even greater than it is at present, when the complete severance of its New and Old World divisions, and the severe segregation which each underwent during the glacial period, has brought about some considerable divergences. Lesquereux finds the essential types of the present arborescent flora indicated in the North American cretaceous rocks, and more distinct and numerous in the tertiary.‡ Hence he infers that the origin of the existing American flora is American. And as we seem to be justified in admitting the existence of a marked analogy between the Miocene flora of Central Europe and the present vegetation of North America, which is undoubtedly greater than between the same fossil flora and that now existing in Europe, we may accept Lesquereux's conclusion that the American element in the vegetation of Miocene Europe was derivative. In the Old World, in its most characteristic forms, it has now faded away in the West; and, which is due probably to very different causes, it is now also most predominant in the Eastern rather than the Western States of North America. We owe, in fact, to Asa Gray one of the most interesting achievements of the modern study of Geographical Botany, in establishing the remarkable result that the flora of North-east Asia has more affinities with that of North-east than that of North-west America.§ In both what may be called the Miocene facies of the flora is better preserved. Oliver has, however, shown that proceeding westward in the Old World from Japan, through Northern China and the Himalaya, and thence through Persia to the Mediterraneo-Caucasian region, we trace the stragglers of the retreating Miocene host in *Chamærops*, *Platanus*, *Liquidambar*, *Pterocarya*, *Juglans*, &c. ‖ Amongst specific types actually common to North America, Japan, and the Himalayas, may be mentioned *Aralia quinquifolia*, *Phryma leptostachya*, and *Trillium erectum*.

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* "On the Distribution of *Meliaceæ*," see C. De Candolle, 'Trans. Linn. Soc.,' second series, vol. i., pp. 233–236.

† "On the Distribution of Palms," see O. Drude, Petermann's 'Mittheilungen,' 1878, p. 16.

‡ 'Geological Survey of Mentana,' 1871, p. 314

§ 'Memoirs of American Academy,' vol. vi., pp, 377–458 (1859); 'Darwiniana,' pp. 219–224. Grisebach's attempt with little success to explain away Asa Gray's facts is discussed by Bentham, 'Presidential Address to Linnean Society,' 1872, pp. 5–7.

‖ 'Natural History Review,' 1862.

In determining the subsidiary divisions of so vast a flora, extending from far within the Arctic circle to the tropic, we are not surprised to find that physical conditions play an important part in effecting the differentiations which make it possible to draw the boundary-lines. Looking at the northern continents, we are struck with the wide difference in the arrangement of the prominent elevations and corresponding depressions. In the Old World we see great latitudinal barriers in the vast mountain-ridges which run from east to west, and which are flanked in the latter direction by the chain of seas from the Aral to the Straits of Gibraltar. In the New World there are no such barriers, and the mountain-ridges take an almost meridional direction. During the glacial period, when the northern flora was driven down southwards, and still more when it slowly returned from its exile, the course of the migrating streams must have been powerfully controlled by the nature and position of the obstacles placed in their way; and the object of our present studies of this flora—of which the actual component species are now, no doubt, pretty well known—must be to try to unravel the complications of its existing distribution in the light of physical geography.

The secondary floras, which may be distinctly recognised, are the following:—

1. The *Arctic-alpine*, consisting of races of plants belonging originally to the general flora, and recruited by subsequent additions, which have been specialised in low stature and great capacity of endurance to survive long dormant periods sometimes even unbroken in successive years by the transitory activity of the brief summer.

From the interesting collections made by the recent Arctic Expedition, it appears that the Arctic flora extends to the most northern lands at present known. On May 30th, in Ward Hunt's Island, lat. 83° 5′, "vegetation was fairly represented as regards quantity in the poppy, saxifrage, and small tufts of grass."* At the winter quarters of the *Alert*, in lat. 82° 25′, Sir George Nares gives an interesting account of the brief summer aspect of the vegetation. On July 29th, "The purple carpet of saxifrage profusely spread over the ground . . . lasted only for about ten days. It has now given place to the bright yellow ranunculus and *Draba*, with a rich sprinkling of the more delicate tinted poppy and mountain avens, and a small yellow saxifrage."† In 81° 4′, Sir George Nares describes the vegetation on the southern slopes of Bellot's Island as remarkably rich. "Six species of saxifrage were common; and the

* Nares, 'Voyage to the Polar Sea,' vol. i., p. 32. † Ibid., *l. c.*, p. 78.

beautiful *Hesperis*, with its lilac blossoms, attained a height of eight or ten inches; considerable patches were also covered with *Androsace septentrionalis*, and a single species of fern grew abundantly under the shelter of boulder rocks." He concludes, "that a favourable combination of soil, shelter from winds, and full exposure to the sun, have more to do with the development of flowering plants in the polar regions than parallels of latitude."* From a review of the whole collection,† Sir Joseph Hooker deduces some interesting conclusions, which are in complete agreement with his previous examination of the general distribution of Arctic plants.‡ He finds "that the vegetation of this meridian of the polar area is entirely Greenlandic, showing no further relation than does Greenland itself to the floras of the American polar islands to the west of it, and of Spitzbergen to the east of it.§

This northward extension towards the pole of the Greenlandic flora, unmixed with the polar island and Spitzbergen floras on either side, is a remarkable instance of meridional distribution in an area where, from the restricted size and apparent general uniformity of physical conditions, it would scarcely have been anticipated. How little justified we are even under such exceptional conditions in assuming anything like vegetative uniformity under the same latitude is clearly shown by the contrast between Grinnell's Land and Franz Josef's Land, the "brilliant assemblage of gay-coloured flowers, the resort of butterflies and bees," of the former contrasting most strikingly with the rare and isolated patches of the latter.‖ It is of course obvious that within the existing limits of the Arctic flora there can be practically no diffusion and intermixture of its constituents. During the glacial period, however, when the flora proceeded southward, it would be liberated from its narrow bonds, and extend its area, and produce new races and varieties. When it retreated again northwards, the detachments travelling backwards, along great meridional zones in Europe, Asia, and in North America, would have acquired a local colouring, partly due to variation during their migration, and partly to the elimination of some of

* Nares, 'Voyage to the Polar Sea,' *l. c.*, p. 140.

† A list of the species of flowering plants collected by the naturalists of the expedition is given in the appendix to Sir George Nares's book (vol. ii., pp. 310–312). It would certainly have added to the interest of these important gatherings, made over five degrees of latitude, if the localities had been appended to the names of the species. In lat. 82, in the vicinity of Discovery Harbour, a very interesting collection of Miocene fossil plants was made (vol. ii., pp. 333–335). This is the most northern evidence we at present possess of the Arctic extension of the Miocene flora. It included *Taxodium distichum*, the genus being *now* confined to Mexico and the south of the United States.

‡ 'Trans. Linn. Soc.,' vol. xxiii., p. 253.

§ Hooker in Nares, *l. c.*, vol. ii., p. 301.

‖ Ibid., *l. c.*, vol. ii., p. 307.

the constituents and the addition of new ones. The isolated colonies left behind on mountain ranges towards the south would, compared with one another, reflect the same diversities as the sections of the Arctic flora belonging to the same meridians do now in a narrower compass.

2. The *Temperate* or *Intermediate* flora is the name which Bentham has given to the vegetation of the large areas which are occupied by Grisebach's Prairie region of the new world, Steppe region of the old, and Forest region of both.

In the Old World I have already pointed out how completely the old Miocene vegetation has disappeared in Northern Europe and Western Asia. The existing vegetation is probably almost entirely post-glacial and Eastern in origin. The oak (*Quercus Robur*) has left no trace in the tertiary deposits of Europe, and its starting point is to be sought eastwards.* Successive waves of vegetation have rolled towards the west; even now that represented by the oak is in its turn losing, and the more recent one, represented by the beech, is gaining ground.

In the New World we are struck with the remarkable diversity between the floras of the Pacific and Atlantic States. California has no beech, chestnut, hornbeam, birch, lime, locust, hickory, elm or mulberry. And Sir Joseph Hooker has shown in a recent lecture, in more detail than I can refer to here, that the general features of vegetation in North America run parallel to the mountain ridges which, as we have already seen, take a meridional course. He has shown good reason for supposing that when, during the glacial period, the Miocene vegetation was driven downwards into Mexico, the valleys parallel to the Pacific coast were still filled with ice when the tide again began to turn northwards and the whole stream was consequently deflected to the east. When the western valleys were at length unlocked, they could only be supplied with a vegetation of a more Mexican type.

3. The *Mediterraneo-Caucasian* flora contrasts no less vividly with the Intermediate flora than the Arctic-Alpine. Its extreme richness in number of species (it comprises six-sevenths of the European flora), and the extremely restricted areas of many of them, both point to a great antiquity. In fact there is reason to believe that the flora of the Mediterranean basin has been a centre of preservation ever since the Miocene period.† The oleander is

* Asa Gray, 'Darwiniana,' pp. 186–189.

† A conclusion to which Mr. Ball is also led on other grounds. See the introduction to his "Spicilegium Floræ Maroccanæ," 'Journal of the Linnean Society,' vol. xvi., p. 302.

said to be found there in local deposits of an even earlier age,* and the evergreen oak is probably the living representative of a Miocene ancestor.† Under the influence of a colder climate the southern extension of this flora, now limited by the African and Arabian deserts was considerably greater. *Adenocarpus*, a characteristic Mediterranean genus, is represented by an identical species discovered by Mr. New on Kilima Njaro, near the equator, and on the Cameroons mountains, 2000 miles distant on the opposite and western side of the African continent.‡

Eastward, the Mediterranean flora reaches its limit in Scinde, and the temperate flora of Asia is only separated from the tropical by the Himalayas. Some of the peculiar Mediterranean types reappear after a long gap in North Eastern China. Amongst these are *Liquidambar* and *Pistacia*,§ both of which are found in Mexico —*Pistacia* not being known elsewhere in the New World. Mexico, indeed, in some respects, plays in it the part of the Mediterranean region. Further investigation will doubtless detect in it many remains of the old Miocene flora once common to the whole northern hemisphere, which driven down during the glacial period, have never succeeded in retracing their steps. Mr. Hemsley has obligingly pointed out to me two striking cases in *Deutzia* and *Abelia*, two Indo-Chinese genera, unknown elsewhere in the New World.

II. THE SOUTHERN FLORA.—The problems presented by the philosophical study of the southern flora have lost none of the fascinating interest with which the classical essays of Sir Joseph Hooker, published twenty years ago, at once invested them. Biological investigations will always attract us in proportion to their difficulty, and I know none which is more worthy of attention than the distribution of vegetable life in the Southern Hemisphere.

I have already indicated the remarkable points in which the southern and northern floras contrast. A further difference, with which I am much impressed, but about which I desire to speak with diffidence, is the relatively greater antiquity of the former. To the southern hemisphere (although not entirely to the Southern Flora) belong the majority of living species of *Cycadeæ*, a group of plants which flourished in Europe in the oolitic epoch, and as to the extreme antiquity of which morphological, no less than palæontological, evidence bears conclusive testimony. The species

* Martius, 'Mém. de l'Acad. des Sc. de Montpellier,' vol. ix., p. 95.
† Asa Gray, 'Darwiniana,' p. 189.
‡ Hooker, 'Journal of the Linnean Society,' vol. xiv., p. 144.
§ Hance, 'Journal of Botany,' 1873, pp. 169–172.

of *Araucaria* also, which carry their archaic character unmistakably in their habit and aspect in European gardens, have been, as far as we know, extinct in the wild state since the oolitic age north of the equator. Now they are a distinctive feature in Australian and extratropical South American vegetation. Lastly, South Africa possesses in *Welwitschia* a vegetable type whose extraordinary peculiarities make it seem amongst contemporary vegetation much as some strange and extinct animal form would if suddenly endowed with life.

1. The *Australian* flora has the first claim on our notice, as there is no area of vegetation, equal in dimensions, which has been worked out so completely or in so masterly a manner as that of the great island-continent by Mr. Bentham. This enormous undertaking, of which the seventh and concluding volume appeared at the commencement of the present year, is, as far as I know, unique in botanical literature. It enumerates and describes, with all the acuteness brought to the task by the greatest living systematist, the immense stores of Australian species of plants which have been accumulated in European herbaria by the indefatigable labours of a long series of collectors, explorers, and botanists, beginning with the memorable names of Banks, Solander, and Robert Brown, to terminate with that of the distinguished botanist Baron von Mueller, who has been associated with Mr. Bentham in its preparation, and without whose unparalleled energy in collecting and critically studying the vast Australian herbarium, which he has generously transmitted to this country for Mr. Bentham's examination, this monumental labour could never have been brought to its present satisfactory degree of completeness.

In the concluding preface it is interesting to find that Mr. Bentham thinks that a detailed examination only confirms the general conclusions arrived at by Sir Joseph Hooker in his well-known essay prefixed to the 'Flora Tasmania' eighteen years before.* The dominant features of Australian vegetation are familiar to everybody. And we are the more struck with them because even unobservant persons cannot fail to grasp the fact that they are totally unlike the vegetable productions of any other country. Nowhere else do we meet with the dreary-looking gum-trees (*Eucalyptus*), which form three-fourths of the forests, the strange grass gum-trees (*Xanthorrhœa*), blackened, but not killed, by the bush-fires, or the stiff Proteaceous types (*Banksia*, *Hakea*, *Grevillea*, *Dryandra*), the acacias with vertical leaf-like phyllodes, the

* Bentham, 'Flora of Australia,' vol. vii., p. v.

Epacrideæ, and the beautiful genera of *Diosmeæ* which adorn our greenhouses.* Traced more into detail by the professed botanist, the strangeness and isolation of the flora makes itself more and more manifest. As, according to our present views, this could only have been attained by an enormous amount of obliteration and destruction in connecting links, which in trees implies the operation of great changes in physical conditions, determining migration and remigration and the isolation and dying out of types of vegetation about which we shall probably never be able to do more than guess, we are forced to the admission that the Australian flora is one of great antiquity. There is good ground for believing that it has existed much as we now know it all through the Tertiary epoch. Sir Joseph Hooker has remarked that the conclusion that, before some tertiary submergence of a great part of the continent, even in point of specific differences, the flora was not very different from what it now is, "would appear from a fact insisted on by Mr. Jukes, that it was during such a submergence that those volcanoes were active, the lavas of which now cover large tracts of Southern Australia, and which we know to have buried a plant identical with *Banksia ericifolia*, which is still one of the commonest trees in that part of the country." †

Plausible arguments may even be urged for the belief that the existing Australian flora is as old, at least, as the Cretaceous period of Europe. And I do not think that, on weighing all the evidence, the suggestion will be found unworthy of consideration, that the primitive stock of the Australian flora, as well as of the fauna, may have originated in the Northern Hemisphere, if not in Europe ‡ itself. Australia may be regarded, then, as a centre of preservation rather than as a centre of origin for a vegetation of an extremely ancient type (although now doubtless much modified), which in other parts of the world has given way before more modern and more powerful forms. At any rate, whatever direction our speculations take, the Australian flora seems to give little support to those who, like Grisebach, ignore the influence of geological change and explain plant-distribution exclusively from the phe-

* Hooker, 'On the Flora of Australia,' p. cii.

† 'On the Flora of Australia,' p. ci.

‡ This idea had also occurred to Sir Joseph Hooker ('On the Flora of Australia,' p. cii.), who suggests that such a southward migration would explain the existence of South Australian genera on Kini Balou, in Borneo, beneath the equator. He had, however, also in view Unger's identification of Proteaceous plants in the Cretaceous and Miocene rocks of Europe, which I agree with Mr. Bentham ('Presidential Address to the Linnean Society,' 1870, pp. 12–17) in thinking without adequate basis. In fact at *that* period European vegetation was probably of an entirely different type.

nomena of climate. If this alone has made Australian plants what they are, why do we find nothing resembling them in California, in Northern Africa, or North-west India, for the present physical conditions of which they prove to be singularly fitted.

To the Australian region, in a large sense, must be referred the vegetation of a number of adjacent islands. That of New Guinea is scarcely known. The few scanty data, however, we possess from the collection of Beccari, show that the characteristic Malayan forms so splendidly developed in Borneo, such as the *Dipterocarpeæ*, have all but died out, while such markedly Australian types as *Epacrideæ*, make their appearance.* We may conclude therefore that, as was no doubt to be expected, the vegetation of New Guinea will prove to be Australian in essential features when more adequately examined.†

A most important and interesting field of phytographic investigation is to be found in the Pacific Islands east of Australia and New Guinea. A curious parallel to the zoological boundary found by Mr. Wallace to pass between the nearly adjacent islands of Borneo and Celebes (but which for plants must be drawn to the east of the latter island), exists in the marked differences between the vegetation of the chain of islands extending from the Solomon Islands to New Zealand, and that of the archipelago to the east of it. Of all these latter the flora is essentially Oriental, with scarcely an Australian type.‡ Of the former, it is equally characteristically Australian. There are, however, many anomalous details which are in the highest degree perplexing, Thus, while the large majority of New Zealand genera are represented in Australia, and quite a quarter of them nowhere else, the most conspicuous elements in Australian vegetation are wanting in New Zealand altogether. It has no *Eucalyptus*, *Acacia*, *Casuarina* or any of the great Australian genera of *Proteaceæ*. It is inconceivable that New Zealand can ever have possessed this assemblage of types, and have afterwards lost them. We are driven, therefore, to some such conclusion as that a segregation of the Australian flora must have taken place, and that, while the tropical and warm temperate typical Australian types found a centre of preservation in one or more of the large islands into which the continent is known to have been broken up, a remnant of the flora, capable of adapting itself to cooler climatic conditions, blended to the south with the Antarctic

* I have discussed this point in the 'Journal of Botany,' 1878, pp. 98–100.

† The birds, snakes and insects of New Guinea exhibit, like the plants, an infusion of Oriental types. See Wallace, 'Geographical Distribution of Animals,' vol. i., p. 415.

‡ See Hooker, 'On the Flora of Australia,' p. lxxxvi.

flora. The latter so recruited then became the common source from which subsequently, on different meridians, South Australia, New Zealand, and as we shall see, extra-tropical South America, were partly stocked.

A similar problem is presented by the presence in Australia of an element belonging to the Indian flora. Mr. Bentham finds that "a number of genera whose main station is in tropical Asia, extend more or less into tropical and eastern sub-tropical Australia, sometimes in identical, sometimes in more or less differentiated species."* This Indian element Sir Joseph Hooker regards as botanically more foreign to the Australian flora than the Antarctic element already referred to. In fact, the absence of reciprocity of distribution is still more strongly marked than in the case of New Zealand—not one characteristic Australian genus ever having been found in the peninsula of India. This again seems to only admit of explanation by supposing that the source of the Indian colonisation was an island which was first connected with the Asiatic continent, and so stocked with members of the Indian flora, but was dissevered previous to union with perhaps some extension of Australia. In this way, if such an explanation is not rejected as too hypothetical, we may conceive that an island may play the part of a carrier bringing gifts and yet taking away nothing in return.

2. The *South African* flora, as will be abundantly evident from what has preceded, is one of a very highly specialised type. Mr. Bentham remarks that "it is perhaps the richest known in proportion to its extent, and remarkably varied within its narrow limits." † Its affinities with the Australian, which do not extend beyond groups of the highest order, have been already described.

Two remarkable extensions of the South African Flora exist northwards, and are worthy of careful study. In the west of Europe and Northern Africa, there are a peculiar assemblage of plants—shrubby *Leguminosæ*, species of *Erica*, *Lobelia*, and *Gladiolus*—which Mr. Bentham finds "more nearly allied to corresponding Cape species than they are to each other." The other extension is to Eastern Africa. The sub-Alpine vegetation of Kilima Njaro is distinctly South African, and the presence of some species of *Erica* in Natal fits in well with Sir Joseph Hooker's suggestion, that the South African flora has been once continued along the high lands of East Africa, from Natal to Abyssinia. The identity of the South African plants found on the Cameroons with Abyssinian species

* Bentham, 'Flora of Australia,' vol. vii., p. vi. Hooker, 'On the Flora of Australia,' pp. xvi., xli., civ.

† 'Presidential Address to the Linnean Society,' 1869, p. 25.

also suggests that Abyssinia may have been the source from which they were derived, and botanists will eagerly look forward to the time when materials will be available for studying the distribution of plants between these two extreme points of a diameter of the great continent.

3. The *Temperate South-American* flora is continuous northwards with the Andine flora. Many of its characteristic genera extend therefore as Alpines almost to the gulf of Mexico. Westward they are distributed to New Zealand, one-eighth of whose flora belongs to genera represented in and often characteristic of South America, as for example the familiar garden types, *Fuchsia* and *Calceolaria*. Besides these there are some curious if remote points of affinity with South Africa. South America is the head-quarters of a peculiar tribe of *Compositæ*, the *Mutisiaceæ*, and South Africa has more of these than any other Old World region.* Mr. Bentham and Dr. Asa Gray have also laid stress on the points of relationship between the extra-tropical North and South American floras, but taking the recently published 'Botany of California' as a basis of comparison, there are far more southern extensions of genera whose head-quarters are north of the Equator than of southern genera northwards. The most extraordinary cases are those of a few small genera which are represented by single species in Mexico, South America, and South Africa respectively. Amongst these are *Menodora*, and the Scrophularineous genera, *Melasma* and *Alectra*.†

* Bentham, 'Journal of the Linnean Society,' vol. xiii., pp. 501–502, 548.

† See Bentham, 'Presidential Address to the Linnean Society,' 1869, p. 25; and Asa Gray's 'Darwiniana,' pp. 218, 219. In an article on "Distribution," in the 'Encyclopædia Britannica,' I have, perhaps, attributed to the passages just cited more than they were intended to carry, and have included a Mexico-Californian flora amongst the sub-divisions of the great southern flora. I have pointed out above some of the striking deficiencies in the flora of south-western as compared with that of north-eastern extra-tropical North America, but the affinities of the former with that of extra-tropical South America appear to me to break down on detailed examination. The two floras appear to me essentially distinct, but to have sent out extensions across the tropics—doubtless during the glacial period—the migration from the north having in the New World, as in the Old, predominated over that from the south. I have taken from the Botany of California the following cases of the preponderating southern extension:—*Larrea; Prosopis juliflora*, California, Mexico, along Andes to Chili, Buenos Ayres; amongst *Onagraceæ*, *Gayophytum Œnothera*, *Godetia*, *Boisduvalia*, *Mentzelia*; *Cornus*, represented by a single species in Peru; *Grindelia; Psilocarphus; Madia; Bahia; Blennosperma; Microseris; Downingia; Collomia; Gilia; Phacelia; Coldenia; Heliotropium*—the garden Heliotrope is *H. peruvianum; Eritrichium; Mimulus; Orthocarpus; Micromeria*. Of the northern extension the genera are very few:—*Acæna trifida* occurs in Chili and California, where it represents a genus with about thirty species in Chili and Peru; *Baccharis*, a characteristic South American genus, has seven species in California; *Soliva; Perezia; Petunia parviflora* extends to California; *Sphacele; Lippia*. The volume which has been published does not enable me to carry the comparison beyond *Gamopetalæ*. Mr. Bentham's statistics as to *Compositæ* take a wider area than California, but point

4. The *Antarctic-alpine* flora may be appropriately considered after the South American, with which its affinities are now known to be clearer since the examination of the materials collected by the Challenger and Transit-of-Venus Expeditions. Its history must, however, be to a great extent matter of speculation, and upon a somewhat slender basis. Unlike the Arctic flora, its scattered distribution over numerous isolated points of land, remote from great continental areas, from which during migrations like those attending the glacial period in the northern hemisphere, it could have been recruited, at once accounts for its limited number of species and their contracted range in the world. On the whole, it consists of local species of some widely distributed northern genera, such as *Carex*, *Poa*, *Ranunculus*, &c., with Alpine types of strictly south temperate genera characteristic of the separate localities. The following general results are derived from Sir Joseph Hooker's recently published 'Botany of Kerguelen Island.' Starting from Fuegia, the first land met with to the east is the Falkland Island Group; of this the vegetation is exclusively Fuegian. South Georgia succeeds, and the scanty botanical information recorded in Cook's voyage indicates that its plants are of the same type. Marion Island and the Crozets have a flora nearly identical with that of Kerguelen Island, distant 1650 and 1200 miles respectively. Mr. Moseley thinks that the occurrence of *Pringlea* in all three* points to an ancient land connection between them. Kerguelen Island has five species common to Fuegia and six to America, as well as New Zealand. *Lyallia Kerguelensis* is allied to the andine *Pycnophyllum*, while *Acœna* is the Antarctic representative of a genus having its head-quarters in Chili and solitary northern representatives in California and the Sandwich Islands. *Cotula plumosa* is common to Lord Auckland's group and Campbell's Island, and *Uncinia compacta* is found on the mountains of Tasmania and New Zealand. The remaining southern islands have a South African element; in the case of Tristan d'Acunha, Nightingale, and Inaccessible Islands, superimposed on a Fuegian basis; in Amsterdam and St. Paul's, combined with Kerguelen Island species.

III. THE TROPICAL FLORA. — Notwithstanding the considerable

to the same conclusion (see 'Journal of the Linnean Society,' vol. xiii., p. 528). The flora of Central America is most imperfectly known, and the enumeration of the species, as represented in the Kew herbarium, which Mr. Hemsley is preparing for Messrs. Godman and Salvin, will be extremely useful in relation to phyto-geographical questions. The materials, however, from the southern half of this area appear to be most scanty.

* 'Journal of the Linnean Society,' vol. xv., p. 485.

collections in our herbaria, no adequate examination of the flora of any one tropical country has yet been completed; and the areas of tropical vegetation still to be explored are very considerable. The immense "Flora Brasiliensis" projected by Martius is still unfinished. Little is known of the botany of Central America and the Isthmus of Panama and much remains to be done in that of the Northern States of South America, and on the eastern slopes of the Andes; amongst the West Indies, the flora of San Domingo is a sealed book. Turning to the Old World, the collections of Kirk, Grant, Cameron, and Schweinfurth, only serve to show how vast is the work still to be accomplished before any adequate account can be given of the vegetation of tropical Africa. While we may hope in the course of a few years to see the flora of British India gradually completed, little is known at present of the eastern portion of the great botanical region which includes India to the west. As will be shown, our knowledge of the vegetation of China is most slender, while that of the countries lying between Burma and Cochin China is still more so. In the Malayan Archipelago the collections of Beccari have thrown a flood of light upon the vegetation of Borneo, but the islands to the east of it are still practically unexplored.

The difficulties in the way of arriving at any but the widest general conclusions with regard to the origin and distribution of tropical vegetation are at present very great. Comparing that of Asia and America for example, we have the authority of Mr. Bentham for stating that "the resemblance between them is only in some of the races of a higher grade, natural orders and comprehensive genera; the smaller genera and species, and many even of the higher ones, are totally different."* The presence, however, in the tropical regions of the Old and New Worlds of such well marked types as *Guttiferæ*, which do not extend into the temperate flora of either, can only be naturally accounted for by assuming that at some remote period the tropical flora had a common centre of distribution. If the distribution of land and water bore then—as we seem justified in supposing—some resemblance to that now existing, the transverse connection between the different branches of the tropical flora must have taken place in the northern hemisphere, and tropical vegetation must have extended—as there is reason for believing it did in the early part of the tertiary period—to much higher northern latitudes than at present. Mr. Darwin has even suggested that the present tropical flora is the blended and reduced residue of two sub-tropical floras which occupy the

* 'Presidential Address to the Linnean Society,' 1869, p. 24.

place of a more ancient equatorial flora now obliterated and destroyed.*

But though the occurrence of common tropical types throughout the tropical zone implies a common origin for its vegetation, the large amount of differentiation which these types have generally undergone in widely separated areas, show that the common starting-point must be referred to a very distant past. For example, no group of plants is more characteristic of the tropics than palms, and no better one could be selected to test this point. Dr. O. Drude finds that there is no species or genus common to the Old and New Worlds, and that the tribes are almost as distinctly limited, only two out of ten being found in both. The general conclusions drawn by Mr. Bentham from his exhaustive study of *Compositæ* (an order including not far short of 10,000 existing species), points to much the same conclusions.†

Three great divisions of the tropical flora correspond respectively to the three great continents.

1. The *Asiatic* Tropical Flora includes the Indian and great part of the Chinese empires, with the southern part of Japan and the Malayan Archipelago (but probably excluding New Guinea). It occupies also Polynesia to the north and east of the chain of islands which, as already remarked, belong to the flora of Australia.

For the general affinities of the Indian flora reference must be made to Hooker and Thomson's Introduction to the 'Flora Indica.' The materials for its detailed investigation are now ample, and considerable progress has been made in working them out. Only a few points need be touched upon here. There is a marked difference between the vegetation of the greater part of the peninsula of Hindostan and that of the areas to the north and north-east of it. The latter belongs to the type characteristic of the Malayan region, which is also represented on the Malabar coast and in Ceylon. The former has distinct African affinities, which are not merely shown by the eastward extension to India through Southern Arabia and Persia of African desert plants, but by many points of resemblance between the floras of Southern India and tropical Africa, even reaching to such negative agreements as the absence of oaks and pines in both.

Some light is thrown upon these facts of distribution by a consideration of the probable geological history of India in the Tertiary epoch. During the Eocene period Hindostan formed an island which

* 'Origin of Species,' fourth edition, p. 447.
† 'Journal of the Linnean Society,' vol. xiii., p. 391.

was separated from the rest of Asia by a sea which extended westward into Europe. Along the northern shore of this sea the Indo-Malayan flora flourished, extending northward as far as lat. 55°. There seems reason for believing that the oleander is in Europe a surviving type of it, and the genus, with others long extinct in the west probably still holds in Asia much of the ground that it occupied then, though the bottom of the nummulitic sea has long since been elevated into land. In order to explain the presence of Indo-Malayan types in Malabar and Ceylon, we may adopt the explanation which Mr. Wallace has proposed for zoological purposes, "If the shallow northern part of the Bay of Bengal had been elevated during the late Miocene or Pliocene epochs, a few Malayan types may have migrated to the peninsula of India, and have been preserved only in Ceylon and the Nilgherries, where the climate still retains somewhat of its equatorial character." * At the same time the desert plants probably entered the peninsula from the north-west.

A single fact will suffice as an example to illustrate the Asiatic character of the Polynesian flora. Casimir de Candolle finds that all the species of *Meliaceæ* included in it belong, with one exception, to genera represented in one or other of the Indian peninsulas.†

To no part of the map of Asia does the eye of the botanist wander with greater interest than to the vast territory occupied in its south-eastern portion by the Chinese Empire. The characteristic policy of jealousy and exclusion rigorously maintained towards the world outside, and which has so long at once stimulated and baulked our curiosity about the economy and productions of this wonderful country, has left us in profound ignorance as to its indigenous vegetation. The paucity of our data for forming any generalisation about the place of China in any scheme of plant-distribution is almost incredible. Grisebach remarks that the whole of the interior of China, Corea, the island of Formosa, and Southern Mantchuria remain, from a botanical point of view, almost completely unexplored.‡ Dr. Hance, our invaluable correspondent at Whampoa, who never loses a chance of adding to his knowlege of Chinese plants, insists upon this no less strongly. "Whilst M. Maximowicz's excellent and very complete 'Index Floræ Pekinensis' provides a good catalogue of the flora of the Chinese metropolis and

* 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 519.
† 'Transactions of the Linnean Society,' new series, vol. i., p. 235.
‡ Grisebach, 'La Végétation du Globe,' vol. i., pp. 714, 715. See also Bentham, 'Presidential Address to the Linnean Society,' 1862, p. 14.

its vicinity, and Mr. Bentham's classical 'Flora Hongkongensis' has acquainted us with the principal constituents of that of the extreme south-east of the empire, nothing whatever of a scientific character has as yet, to my knowledge, been written on the vegetation of the districts intermediate to these two points, which are separated by 17 degrees of latitude, or of the various ports of trade along the coast or on the Yangtse." *

These being the only two points of detailed attack to which the Chinese flora was accessible, it must be regarded as a happy accident which determined their position. The careful investigation of the flora of Hong Kong before the island had become materially modified by its gradual conversion into a great trading centre, has proved of inestimable value in a scientific point of view. Separated from the mainland by a shallow strait, only half a mile in width, nothing would seem to justify the supposition that its vegetation can ever have been materially different to that of contiguous parts of Southern China. Yet a superficial comparison of its vegetation with that at present existing on the mainland would lead to the belief that it abounded in endemic species found nowhere else, and that its flora was of a wholly exceptional character. But the exigencies of a teeming population have long since all but denuded Southern China of its arboreous vegetation, and with the forests have gone a host of other plants which common experience in every country prove to disappear when the physical conditions change with the disappearance of the trees. Dr. Hance tells us: "A mile or two outside Canton, hundreds of plants of *Liquidambar formosana*, only a foot or two high, are met with, which prove on examination to be merely shoots springing up from old stumps buried beneath the soil, showing that this tree, now all but exterminated, was once common; and so eager is the search for firewood, that any shrub which has attained half an inch in diameter is almost certain to be ruthlessly cut down. This denudation of arboreous vegetation and consequent deprivation of shade and diminution of humidity, entail the disappearance of numbers of herbaceous plants, and will serve to explain why one-seventh of the entire number of species in the Hong Kong flora have not been met with on the adjacent continent, the sparse fishing population of the island, engaging in agriculture so far only as was necessary to supply their own wants, having left the virgin forest inviolate." † There can be no doubt that the numerous small scattered islands along the Chinese coast N. E. of Hong Kong, would yield a rich harvest to any one who

* 'Journal of Botany,' 1874, p. 258. † Ibid., 1870, pp. 274, 275.

would take the trouble to make even small collections in any of them to which circumstances or accident afforded access.

Of late years the obstacles in the way of penetrating and collecting in the interior of the empire seem to have materially diminished; and Kew is indebted to several energetic European residents for collections, though small in extent, of the highest interest and value. In fact I know of no field for botanical exploration where amateurs could at the present time collect with less trouble and with more probability of rendering useful aid to science than in China. Dr. Hance remarks: "Every short excursion from Canton or other cities where foreigners reside, leads to the discovery of three or four new plants." * It is quite remarkable indeed how little advantage has been hitherto taken even of the opportunities that were available. I quote the following case in point from one of Dr. Hance's papers:—"The temple where I slept is only six miles outside the walls of Canton, and is often visited by pic-nic parties; and yet, though the small wood surrounding it has plenty of *Quercus fissa*, Champ., some *Castanopsis chinensis*, mihi, and two trees of *Liquidambar formosana*, mihi, about 80 feet high, none of these species were known a few years ago; and a new *Pygeum*, together with my *P. phœostictum* are to this day undescribed." † These small woods, it is interesting to observe, have served botanically the same function as the scantily peopled islands of the coast. Chinese "temples," Dr. Hance tells us, "are for the most part built in depressions or glens between the converging apices of spurs, in order to defend them from the violence of the wind; and are further sheltered on the sides and at the back by thick woods, the constituents of which, so different from the trees habitually planted by the Chinese for ornament or shade, unequivocally prove them to be the remnants of the once wide-spreading forest, preserved from destruction only by the presence of the sacred edifices which they embosom."‡

I mention these details, interesting however in themselves, more particularly since I feel satisfied that it must be in the power of many Fellows of this great Society to interest friends resident in China in the work of collecting. And if anything were needed in addition to what I have already said to show how useful even small contributions may be, I may point to our obligation to Dr. Shearer for a collection from Kiu Kiang, the novelties in which have been described by Mr. Baker and Mr. Le Marchant Moore,§ and which

* 'Journal of Botany,' 1878, p. 6.
† 'Journal of the Linnean Society,' xi., p. 455.
‡ 'Journal of Botany,' 1870, p. 275. § Ibid., 1875, pp. 199–202, 225–231.

included a new Tulip-tree (*Liriodendron*), hitherto regarded as an exclusively characteristic feature in the North American flora; to Mr. Forbes, of Shanghai, who is devoting himself especially to the task of working out the Chinese flora; to Mr. Ross, who has sent us valuable collections from the neighbourhood of Newchwang; and lastly, to Dr. Hance, to whom I have already referred.

From what has been said, it is easy to agree with Grisebach, that we can only guess at the richness of the Chinese flora. Our present data point to its close relationship with that of Japan, and the presence in it of a strong admixture of Northern Indian and Himalayan types.* This latter relationship would doubtless appear more closely if there were any present means of examining the flora of North-West China and that of the mountainous country north of the Mishmi Hills. The cultivated tea-plant of China is no doubt specifically identical with that found wild in Assam. Still they are distinguishable in general appearance, and I am not aware that the wild progenitor of the Chinese tea-plant, which probably differs as a geographical form from that of Assam, is to be found in our herbaria. But there can be no kind of doubt that it must exist in North-Western China, and its presence is a highly characteristic indication of the continuity of its flora with that of North-Eastern India. Farther south the flora of Yunan, as far as it could be investigated from the collections formed by Dr. J. Anderson, repeats on a lower parallel the eastward extension of the Indian flora. Kurz found that the species were decidedly Khasyan, and for the most part well-known.† The results of the interesting journeys of Lieutenant-Colonel Prejevalsky fall in with this hypothesis of a general eastern extension of the North Indian flora. He found the wooded mountains of Kansu east of the Koko-nor ablaze with red, white, and lilac rhododendra, and collected *Rheum spiciforme*, which is a Himalayan plant.‡ All students of geographical botany will look forward with eager interest to the publication of the full details of Prejevalsky's collections, consisting of 5000 specimens, representing 500 species, of which a fifth are said to be new. No less valuable would be the results of Père David's collections, which doubtless contain examples of the sixteen kinds of rhododendrons found by him on the mountains south-east of the Koko-nor.§

Other elements in the Chinese flora will, no doubt, also, as it becomes better known, make themselves evident. Towards the east it passes imperceptibly into the temperate North Asiatic flora.

* See Hance, 'Journal of Botany,' 1870, pp. 275–276; 1874, p. 258; 1878, p. 8. Le Marchant Moore, *l. c.*, 1875, p. 231.

† 'Journal of Botany,' 1873, p. 193.

‡ 'Mongolia,' vol. ii. pp. 85–87.

§ Prejevalsky, *l. c.*, vol. i., p. xxxii.

In fact, Prejevalsky found almost a Siberian vegetation along the frontier as far as Kansu.* On the other hand, the vegetation of Southern China will no doubt be found to be largely intermingled with Indo-Malayan types. Dr. Hance remarks that the grasses have a close affinity to those of Ceylon.† He has also noted the extension to China of some types belonging to Northern and Eastern Australia.‡

2. The *American* tropical flora is still, as already remarked, too little worked out to allow of even approximate analysis. Mr. Wallace deduces from zoological evidence the isolation of South America through almost the whole of the Tertiary period, union with the northern continent having, however, taken place once at least in Secondary or early Eocene times.§ This agrees on the whole with the botanical facts. Mr. Bentham's comparison of the *Compositæ* of the tropical regions of the Old and New World lead him to the belief that no mere migration of American types will explain the points of agreement, but that this element in the vegetation of both must have had a remote but common source of origin,‖ followed by great local differentiation and extinction. It seems to me that the facts of the case would be met by supposing, as I have already done, that the transverse intercommunication which they imply took place in the northern hemisphere. In this way would be explained also the presence in the American and Asiatic flora of the same genera of such a typically tropical order as *Ternstrœmiaceæ*. Out of thirty-two genera as many as five—viz., *Ternstrœmia*, *Cleyera*, *Saurauja*, *Archytæa*, and *Laplacea*, are represented in the Indo-Malayan and South American floras. *Gordonia* is a Ternstrœmiaceous genus, which in the New World has lagged behind, being represented in North America only with two species, and in the Indo-Malayan flora by about eight.

The eastward extension of the Indian vegetation through Polynesia affords a tempting hypothesis that this may have been the path by which Indo-Malayan types found their way across. The results of Casimir De Candolle's investigation of the distribution of the *Meliaceæ* seem, however, to me to tell all the other way. Not a single American genus or species extends to the west of the Peruvian or Columbian Andes, while none of the Asiatic forms get farther west than the Navigators' Islands. On the other hand, the distinct

* Prejevalsky, *l. c.*, vol. i., pp. 160–163.
† 'Journal of Botany,' 1878, p. 8. ‡ Ibid., 1876, p. 14.
§ 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 532.
‖ 'Journal of the Linnean Society,' vol. xiii., p. 492.

Polynesian and American forms find their connecting links in the Asiatic region, from which they, according to my view, have diverged eastward, north and south of the Equator. The northern contingent has scarcely left a surviving trace north of the tropic, though we may fairly explain in this way the two outlying species *Cedrela sinensis* and *Aglaia odorata*, which are found in the neighbourhood of Pekin.

3. The *African* tropical flora undoubtedly affords indications even in the present fragmentary state of our knowledge about it, of the existence of very difficult problems in the study of its plant-geography. Mr. Bentham's extensive investigations have led him to the belief, more than once expressed, in the great antiquity of the vegetation. "Here, more perhaps than in any other part of the globe, in *Compositæ* as in so many other orders, we may fancy we see the scattered remains of ancient races dwindling down to their last representatives."*

Two elements in the flora at once challenge investigation. Both American and Asiatic types are represented in a way which points to causes more fundamental than the casual intermixture brought about by the various agencies of plant migration, ordinarily adduced to account for the isolated existence of species far away from their head-quarters. We may explain by them the occurrence of identical species on the shores of the opposite continents separated by the Atlantic, such as *Entada* and *Gyrocarpus*, and *Carapa procera* on the West Coast of Africa and in the Guianas. But there appear to be in the interior of the continent American types the presence of which it is difficult to attribute to agencies now acting and which we must therefore refer back to the common origin or transverse connection of the floras now so widely divided. It may perhaps prove to be the case that the American and Asiatic types in Africa will find a common interpretation, and that as Mr. Bentham seems inclined to think, the American element above referred to came from the east rather than from the west.

A few instances may be given which seem not inconsistent with this explanation. Thus *Schmidelia* has its head-quarters in tropical America, but is also represented in tropical Asia, whence it has found its way to Africa on the one hand, and the Malayan Archipelago and Australia on the other. *Mammea* again, with one well-known species in tropical America, reappears in tropical Asia, Madagascar and Africa. *Trichilia*, however, is represented in tropical America and Africa but not in Asia. Identical species

* 'Journal of the Linnean Society,' vol. xiii., p. 492.

are even widely distributed in the tropical regions of the Old World. Thus *Asparagus racemosus* and *Chlorophytum laxum* are common to Africa, Asia, and Australia, while the beautiful *Gloriosa superba* is found in central Africa and also in the Himalayas. Finally the curious Baobab (*Adansonia*) exists as two species, one African and Asiatic, the other Australian.

The affinity of the flora of Madagascar with that of Africa is well marked; but there occur in it undoubted Indo-Malayan types which also connect its flora with that of the Mascarene Islands. *Nepenthes* is a striking example; finding its head-quarters in the Malayan Archipelago, it is represented in Khasia, Ceylon, the Seychelles and Madagascar. *Dipterocarpeæ*, a very characteristic Indo-Malayan family, extends westward to Africa; Ceylon is rich in species belonging to it, and one is also found in the Seychelles. An explanation of this gradual creeping westward of Malayan vegetation has already been partially given, and the connection with Africa which would account for the presence of some African types in Southern India and the extension of Malayan and even American types to Africa, may perhaps be explained by supposing with Mr. Wallace that the scattered islands in the Western Indian Ocean are the remains of a once larger land surface which acted as an intermediate resting-place for the interchange of Asiatic and African plants as well as animals.

I must now attempt to sum up the general conclusions to which I have been led in the brief survey—of which I cannot but confess the extreme imperfection—of the present state of the subject. I find myself driven to the opinion that the northern hemisphere has always played the most important part in the evolution and distribution of new vegetable types, or in other words, that a greater number of plants "have migrated from the north to the south than in a reversed direction." At any rate all the great assemblages of plants which we call floras seem to admit of being traced back at some time in their history to the northern hemisphere.* It is easy on this supposition to account for their possession of common characters which, in their widely scattered southern distribution, is not readily explained on other grounds.

In the Carboniferous period the maximum of vegetation existed apparently in the northern hemisphere, and characteristic plants

* Mr. Wallace regards the northern hemisphere in respect to Mammalia "as the birth-place of the class and probably of all the orders." 'Geographical Distribution of Animals,' vol. ii., p. 544.

of this age are found in Brazil * on the one hand, and Australia † on the other.

In the Oolitic period we have undoubted evidence of the existence in Europe of types such as *Cycadeæ*, *Araucaria*, and *Pandaneæ*, which are now either confined to or dominant in the southern hemisphere. The present distribution of *Cycadeæ* is exactly what might be expected, supposing different branches of the family to have gradually travelled along different continents from north to south. In Australia, Africa, and America the genera are different. Australia has *Macrozamia* and *Bowenia;* Africa has *Encephalartos* and *Stangeria;* America has *Zamia*, *Ceratozamia*, and *Dion*. *Cycas* follows the fortunes of the Indo-Malayan flora, and occurs over an area reaching from Japan and the Himalayas in the north to Queensland and the Comoro Islands in the south. This is the only genus common to two continents—a state of things which would hardly have happened if there had been land connections to the south between them subsequent to the arrival of *Cycadeæ*. Cycads are not plants whose structure lends itself to aerial or oceanic dispersion, and to the complete isolation of the different branches of the family may be attributed the existing differentiation of the genera. The present distribution of *Araucaria* may have been brought about in the same way. The two sections of the genus are both represented in Australia and the adjacent islands, but the species peculiar to South America belong to only one of these, and it may of course be argued that they have been derived from Australia. In any case, however, they are survivors in widely-scattered portions of the world of the ancient Jurassic flora. It is worth while observing that rocks of this age in India have yielded fossil forms closely agreeing with those found in the Lower Oolites of Yorkshire (*Williamsonia* ‡), and the fissile limestone of Stonesfield and Solenhofen (*Araucaria*, *Thuites expansus*).§ Uniformity of vegetation at such great distances indicates a greater uniformity of climate than at present exists, and this would favour the dispersion of the flowering plants, which, at any rate in Europe, made their appearance in the Cretaceous age, side by side with the waning Jurassic flora. The identification of Cretaceous plants with *genera now existing* in South Africa and Australia, appears to me, however, to be doubly

* Plant and Carruthers, 'Geological Magazine,' 1869.

† Clarke, 'Journal of the Geological Society of London,' vol. iv., p. 60.

‡ 'Memoirs of the Geological Survey of India,' ser. ii., 3, p. 19.

§ *l. c.*, ser. xi., 2, pp. 16, 17. *Echinostrobus rhombicus*, Pl. xi., figs. 6–11, seems to me identical with *Athroxtaxites lycopodioides*, another Australian type, which I have discussed in the 'Geological Magazine,' 1872.

doubtful after the criticism of Mr. Bentham, and as anticipating the appearance of forms which it may be assumed with probability were only differentiated in the southern hemisphere.

But it seems to me that to this age we must look for the dispersion of the ancient flora whose remains, as I have already pointed out, are scattered over the southern hemisphere, and which, according to my view, have descended southwards along different meridians, rather than have been distributed from some great southern continent. I am quite aware that this suggestion is attended with considerable difficulties. Mr. Bentham, in studying the *Campanulaceæ*, thinks that the evidence points to a southern origin for one of the tribe (*Lobeliæ*), and a northern for the other (*Campanuleæ*).* The existence of identical genera sections and even *species* of this order in South Africa and Australia leads to the suggestion that they may be specially adapted to avail themselves of means of dispersion, and that they are a more modern element in the two floras than the general substratum, whose points of affinity are only now to be found in groups of a much higher order than genera and species.

In the Eocene period following the Cretaceous, we appear to have evidence that the marked differentiation between temperate and tropical vegetation had been already reached, and the wider extension of the latter into the northern hemisphere in modern times would appear to me to allow of the affinities which exist in the three great tropical floras, excepting those which are the result of intercommunication in later Tertiary times.

As the tropical flora gradually settled down into its own area the Miocene vegetation took possession of the present temperate zone of the northern hemisphere, having its origin chiefly perhaps in the New World. The differentiations then gradually arose which furnished the Mediterranean and Mexican regions with their characteristic floras.

The Glacial period followed in due course, and made enormous changes. The Miocene vegetation was swept out of North-West Europe and South-Western North America, and the forms which the temperate flora assumes under extreme conditions of low temperature were widely distributed even to countries south of the equator. A corresponding, but quite subsidiary, migration northward of southern forms took place at the same time. Mr. Darwin explains the wider extension of northern forms on principles which I am inclined to think applicable, as I have attempted to show,

* 'Journal of the Linnean Society,' vol. xv., p. 9.

to ages long antecedent to the Glacial period. "I suspect," he remarks, "that this preponderant migration from the north to the south is due to the greater extent of land in the north, and to the northern forms having existed in their own homes in greater numbers, and having consequently been advanced through natural selection and competition to a higher stage of perfection or dominating power than the southern forms." *

It only remains to consider how far the results arrived at in the preceding pages agree with the facts of animal distribution. I believe that they will be found to do so better than a mere comparison of the botanical regions which I have indicated with those proposed for animals by Mr. Sclater would lead us to suppose. Animals are far more independent of latitude than plants. Even in the case of insects, which are so closely dependent on the latter, Mr. McLachlan has remarked that the butterflies found by the recent Arctic Expedition north of lat. 78° belong to "genera such as one might expect to meet with on a summer day's walk in England." † It is scarcely necessary to point out that as much could not be said for the vegetation. The range of the tiger, "popularly supposed to be confined to the hot jungles of India," as far north as the Island of Saghalien, in lat. 52°, on the same parallel as the south of England, but with a much more severe climate, is a still more striking case.‡

A division of the world into districts, based on the facts of animal distribution as *now* existing, will, probably, therefore, be less closely related to past geological and geographical changes than one based on plant-distribution. Thus I have shown in the previous pages that botanically the Palæarctic and Nearctic divisions have not much significance, and Mr. M'Lachlan remarks that they cannot "be maintained for insects, except as terms of convenience." § Again, to adopt for botanical purposes the Ethiopian and Neotropical divisions would be to entirely ignore the marked peculiarities of the southern extremities of the respective continents. Nor is it quite clear to me that they do not make matters too simple even from the zoological point of view, since "south temperate Africa," remarks Mr. Wallace, ‖ "still exhibits a remarkable assemblage of peculiar forms of mammalia, birds, and insects."

I need hardly say that it is with extreme diffidence that I hazard

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* 'Origin of Species,' 4th edition, p. 452.
† Nares, 'Voyage to the Polar Sea,' vol. ii. p. 236.
‡ See 'Natural History Review,' 1861, p. 16.
§ 'Journal of the Linnean Society,' "Zoology," vol. xiv., p. 104.
‖ 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 517.

these suggestions. I shall be content if I have made it probable that the last word is far from having been said on the analysis of past geographical change in the light of the distribution of existing forms of life, and that if the study of plants leads more slowly and with less immediately brilliant results to its correct appreciation, it will in the end give us a not less accurate solution of our problems. But such an end is still a very long way off, and it will never be reached without—as I began by saying—the earnest co-operation of those who devote themselves to botanical studies and to geographical exploration.

The CHAIRMAN, in asking the Meeting to return their thanks to the lecturer for his most instructive discourse, said he felt sure that the eloquent appeal that had been made, and the cogent arguments by which it was backed up, could not fail to bear practical fruit. Mr. Thiselton-Dyer had shown them how much a traveller could do, and how little many had done, in the matter of geographical botany. Mr. Wallace had dealt with the present geographical distribution of land and sea, and the way in which it occurred, as evidenced by the animal life now found upon the earth: in the same way Mr. Thiselton-Dyer had recalled their attention to the fact that the evidence afforded by plants was at present exceedingly scanty; but when it was supplemented more fully it would give most valuable data towards determining that problem. It seemed strange that travellers did not more frequently go out prepared with the knowledge of the kind of questions that were sure to be put to them when they returned. For instance, they would be asked, "What does the country afford? What are its commercial capabilities and its economic products?" The economic products had been largely treated of in the lecture, and travellers could not do better than co-operate more closely than they had done with Kew, to obtain from there information as to what was especially wanted to be observed in the country to which they were going, so that they might make their collections with special reference to the enlargement of the valuable collection in the national herbarium. It now simply remained for him to adjourn the Meeting to November the 11th, when he hoped their recently elected President, the Earl of Dufferin, an old member of the Society, would take the Chair.