TRANSACTIONS

OF

THE ROYAL SOCIETY

OF

VICTORIA,

FROM JANUARY TO DECEMBER, 1860, INCLUSIVE.

VOL V.

Edited for the Council of the Society by

JOHN MACADAM, M.D., HON. SEC.

Melbourne:

MASON AND FIRTH, PRINTERS, FLINDERS LANE WEST.

Royal Society of Victoria.

CONTENTS.

PAGES

Inaugural Address of the President, His Excellency Sir HENRY BARKLY, K.C.B., &c., &c. ... ... 1—18

ART. I. The "Three Sections," the "Tangencies," and a "Loci Problem" of Apollonius, and Porismatic Developments, by MARTIN GARDINER, C.E. (formerly Science Scholar, Queen's College, Galway) ... ... 19—89

II. A Communication from the Rev. W. B. CLARKE, of Sydney, to His Excellency Sir HENRY BARKLY, K.C.B., &c., &c., President of the Royal Society of Victoria, on Professor M'COY'S "New Tæniopteris" from the Coal-bearing Rocks of the Cape Patterson District in particular, and on the Evidence bearing on the Question of the Age of Australian Coal Beds in general.—Communicated to the Society by His Excellency THE PRESIDENT 89—95

III. A Commentary on "A Communication made by the Rev. W. B. CLARKE to His Excellency Sir HENRY BARKLY, K.C.B., &c., &c., President of the Royal Society of Victoria, on Professor M'COY'S 'New Tæniopteris,' &c., &c.," by FREDERICK M'COY, Esq., F.G.S., Honorary Fellow of the Cambridge Philosophical Society, Professor of the Natural Sciences in the University of Melbourne, Government Palæontologist, and Director of the National Museum .. .. 96—107

IV. The Conjugal Condition of the People of Victoria, considered in relation to Laws of Divorce, by FRANCIS A. CORBETT, ESQ. .. .. 108—127

V. Remarks on the Physical Geography, Climate, &c., of the Regions lying between the Rivers Lachlan and Darling, by W. LOCKHART MORTON, ESQ. ... ... 128—140

VI. On the Nest and Eggs of the Coach-whip Bird (*Psophodes Crepitans*, Gould), and of the White-fronted Epthianura (*Epthianura Albifrons*, Gould), with some general remarks on the Nidification of Australian Birds, by A. DOBREE, ESQ. ... ... 141—144

VII. On the Application of Galvanic Electricity to Practical Astronomy, by R. J. L. ELLERY, ESQ., Government Astronomer ... ... 145—152

PAGES

ART. VIII. Suggestions for the Introduction of Animals and Agricultural Seeds into Victoria, by W. LOCKHART MORTON, Esq. ... ... 153—157

IX. On a Deposit of Diatomaceæ at South Yarra, by JOHN COATES, Esq., M.R.C.S.L., South Yarra ... 158—164

X. Manners and Customs of the Australian Natives, in particular of the Port Lincoln District, by CHARLES WILHELMI, Esq. ... ... 164—203

XI. Description of a New Species of Plumatella, by P. H. MACGILLIVRAY, Esq., A.M., M.R.C.S. ... ... 203—204

XII. Indigenous Fibrous Plants, by F. A. CORBETT, Esq... 205—208

XIII. Remarks on Professor M'Coy's Commentary, by Rev. W. B. CLARKE, M.A., F.G.S., &c. ... ... 209—214

XIV. Note on Rev. Mr. Clarke's "Remarks," &c., by Professor M'COY ... ... 215—217

XV. On the Multisection of an Angle by means of the Cycloid, by the Hon. D. E. WILKIE, M.D., M.L.C., with a plate ... ... 217—220

PROCEEDINGS.

Minutes of the Meetings of the Society ... ... i.—xxv.

Annual Report for 1860 ... ... xxvii.—xxx.

Balance Sheet for 1860 ... ... xxxi.—xxxii.

Reports of Committees .. .. xxxiii.—xliv.

List of Institutions, Learned Societies, &c., receiving copies of the Transactions of the Royal Society of Victoria for 1860 xlv.—xlvii.

List of Members ... ... li.—lxii.

APPENDICES, containing—
1. Instructions to Members of Exploring Expedition, List of Stores, &c. ... ... lxv.—lxxxiv.
2. Reprints of the Contents of former Volumes of the "Transactions," &c. ... ... lxxxvii.—c.

Minutes, &c., of Committee on Prize Essays ... ... end of volume

Laws of the Institute ... ... ditto

TRANSACTIONS

OF THE

Royal Society of Victoria.

Inaugural Address of the President, His Excellency SIR HENRY BARKLY, K.C.B., *&c., &c.*

[Delivered to the Members of the Royal Society, at the Anniversary Meeting held on the 10th April, 1860.]

GENTLEMEN OF THE ROYAL SOCIETY OF VICTORIA,

I AM conscious that my unanimous election to the office on which I to-night enter, was in nowise owing to the scientific qualifications you supposed me to possess, but to your desire, as Members of the late Philosophical Institute, to evince a grateful sense of Her Majesty's recent condescension, by thus making Her Representative your first President under the new style you have been permitted to assume.

In this view I felt I had no right to decline the proffered compliment, nor to shrink from the duties its acceptance imposed, however unequal I knew myself to be to their efficient discharge.

"Parcus *scientiarum* cultor et infrequens,"

if I may be allowed so to paraphrase the confession of Horace, it is indeed with the greatest diffidence that I rise to deliver the Inaugural Address expected from me on this occasion, and to treat of scientific questions in the presence of many so much more conversant with their details than I can pretend to be.

Most especially am I sensible of my unfitness to succeed one who has achieved so high a reputation in the scientific world as my predecessor in the Presidential Chair—Ferdinand Mueller—a man whose enthusiasm as a botanist is only surpassed by his industry as a writer, evidenced, despite the official demands on his time, by the publication, during his presidency, of several most useful works, of which I need only instance his "Monographs of the Tropical Eucalypti, of the Australian Acacias, and of the Genus Eremophila;" his "Enumeration of the Plants collected on the exploring expeditions of Gregory and of Babbage;" his invaluable "Fragmenta Phytographiæ Australiæ," containing already the diagnoses of no less than 600 new or undescribed Australian plants; and above all his first sheets of the "Flora of Victoria," a work which, when completed, will redound equally to the credit of the author, and of the Colony at whose expense it has been given to the world.

As through his zeal and perseverance, moreover, the Philosophical Institute has, during the past year, obtained a "local habitation," as well as a change of name, and may now, therefore, be considered an established institution of the land, the present seems a fitting opportunity for me, when thus addressing you, to examine how far it has hitherto accomplished the objects for which it was founded, and to consider by the light of past experience how its operations may in future be most beneficially conducted.

These objects were declared in 1855 (when two infant projects of a similar nature were amalgamated into the present Society), "to embrace the whole field of science, with special reference to the development of the natural resources of the country," the mode of effecting them having at the same time been defined to be "by original researches conducted by members, and original papers read and discussed at meetings."

I find that in accordance with the latter intention, not far short of one hundred Papers on points connected with Zoology, Botany, Geology, Astronomy, Meteorology, Engineering, and other branches of science both exact and inexact, have been, during the five years of its existence, read and discussed; and when I mention, not invidiously but for the sake of illustration, the names of Professors Wilson, McCoy, Hearn, and Neumayer; of Doctors Mueller and Becker; of Messrs. Selwyn and Brough Smyth, as among the contributors, I need hardly add that much has been thereby done for the advancement of scientific truth.

I would not ignore the fact that the Society has been occasionally criticised by the local press for the trivial nature of some of the topics brought forward, no less than for the asperity which has at times characterised its discussions. Such criticism need occasion little concern. If well founded, it can scarcely fail to lead to improvement. If unfair, it will in the long run fall harmless.

I am old enough to remember the attacks of the *Times* on the early proceedings of the British Association for the Advancement of Science; but witty and vivacious as were its sallies, they aided probably rather than retarded the subsequent triumphs of that noble scientific Congress.

We are in fact all of us too prone to despise such pursuits as lead to no visible or immediate good to society; but, as has been well remarked, "no serious study is without serious value to the human race," and a very little reflection will serve to show that the observation of facts cannot possibly be too minute or too accurate when we are engaged in investigating the mysterious and all but inscrutable laws of Nature.

Whilst I feel justified, however, in asserting that fair progress has been made towards realising one of the chief objects for which the Society has been instituted—namely, to elicit original communications on scientific subjects—I am, at the same time, free to confess that, looking to the many eminent names enrolled among its members, more, far more, of interest and importance might have been expected to be contained in the three volumes of its Transactions which have as yet seen the light.

My idea is, that the Society's Transactions ought to present a faithful and enduring record of the position and progress of scientific research in this country, and should set forth the most advanced views that its *savans* entertain on the great scientific questions of the day, more especially those affecting the development of our material resources. From some of these gentlemen, however, mere passing and fugitive contributions have been obtained; from others none at all; and so far from the Transactions reflecting the actual state of science in Victoria—of which there is, in my opinion, every reason to be proud—a stranger desirous of judging for himself on this point, would be obliged to gather scattered intimations of the labors of our scientific men from the reports of scientific bodies in Europe, from returns laid before the Legislature, or from even less accessible sources of information.

To devise a remedy for this inadaquate representation of the state of science in our pages, may not be easy, but it will at any rate prove salutary to trace its causes.

There is in Victoria, I need hardly remind you, no class of noblemen and gentlemen, as at home, devoting ample fortunes to the cultivation of such scientific pursuits as please them, and possessing abundant leisure to communicate their discoveries to one another.

It is a melancholy fact, though one almost incidental to the paucity of our population and the newness of our society, that neither literary nor scientific teaching will, except in connection with posts of public emolument, enable even the most talented to earn a livelihood in this country. I need not cite instances; the experience of everybody will supply not a few. Hence it so happens that our leading scientific men have nearly all of them professional duties of more or less urgency to perform, and but little time at their disposal for the composition of papers not absolutely required by the State at their hands.

So far from blaming them for this, we are bound to feel the deepest obligation to them for transferring their labors to our shores. There is scarcely one of them who would not have obtained higher honors if not larger emoluments in the Old World, and who does not therefore remain to explore the wide field opened at the Antipodes from pure love of science.

It is natural that under such circumstances gentlemen should, when devoting their spare hours to describe the result of their observations, seek to influence as large a body of scientific readers as possible, and that they should, therefore, seldom address themselves to this Society, where the number of members who have turned their attention to any particular branch of knowledge is necessarily extremely limited. Hitherto, in fact, this paucity of members has constituted the great obstacle to the introduction of a proper system of sectional division into our rules, and I fear no arrangement of the sort can work well until the number of cultivators of science is greatly augmented among us.

At the last meeting of the British Association, at Aberdeen, upwards of two thousand members were present, furnishing material for full attendance, and an intelligent auditory in every section.

Is it too much to anticipate that those throughout the Australian Colonies who take an interest in the advancement of science will, ere long, congregate in like manner in one or other of their Capital Cities every year?

We have intercolonial cricket matches for the development of the physical strength of our youth; champion races to test the fleetness of our horses. Why should we not have annual gatherings for the interchange of intellectual ideas? Into such an arena it would be worth the while of our scientific men to descend. The Geologists might there satisfactorily discuss the theory of the distribution of gold in its matrix; the Palæontologists determine whether our coal fields were really of the Palæozoic or Mesozoic era, or whether secondary formations have any place on the Australian Continent or not. But until we can hold out an inducement in this way, we can hardly hope for such disquisitions on the different species of Ammonites and Belemnites as we had the pleasure of listening to from Professor McCoy on the occasion of Dr. Hochstetter's recent lecture; nor be surprised that Mr. Selwyn should prefer to make known his theories through the journals of the Geological Society of Great Britain.

There is indeed another way in which this Society, whilst more directly than heretofore fulfilling its avowed object of developing the natural resources of the country, might entitle itself to the gratitude, and perhaps enlist the services of the heads of our scientific departments, and that is, by enforcing from time to time their applications for pecuniary aid upon the Government and the Parliament.

I might, from the peculiarity of my public position, hesitate to refer more specifically to such a matter, had I not the high example of Prince Albert, who pointed this out to the British Association at Aberdeen, as one of the functions it was eminently fitted to discharge.

I entirely concur with His Royal Highness in thinking that it is well for every country to possess a body capable of justly appreciating the wants of science, and of speaking with authority whenever the national interests demand the expenditure of public money for scientific purposes.

I am aware that this Society has, on some particular occasions, done so, but I think it might safely carry the principle further; and when it is clear, for example, that the printing of the maps of the Geological Survey is delayed for want of funds: that the collection of minerals and fossils made to illustrate it lie useless, because neither space nor money is provided for their proper classification: that two or three hundred pounds would suffice for the publication of Meteorological and Astronomical Observations of the highest value made at the Flagstaff-hill Observatory: I hold it to be the duty of this Society to call public attention to the fact, and not to leave the officers concerned to supplicate for the requisite funds as if they had some private or personal interest to serve in obtaining them.

I am confident that if such desiderata were fairly made known on competent authority, there would be no disinclination on the part of the Ministry to propose the vote necessary for their immediate attainment; and no one looking at the annual Estimates, and seeing the scale on which many of our scientific establishments are provided for, can accuse the Legislature of a niggardly disposition in such matters. Were it otherwise, with the political constitution under which we live, it is not on either that the blame would fall. Lord Bacon, indeed, lays down the doctrine, that whatever the form of Government may be, "the state of knowledge is ever a democracy, and that prevaileth which is most agreeable to the senses and conceits of the people."

If there be then no just appreciation of the labors of scientific men; if there exist unreasonable impatience that the practical results of their investigations are not more rapidly realised: the fault is chargeable on the entire community.

I would not willingly imply that this is the case among us here. Every credit is due, I must repeat, to the Legislature for the liberality it has in times past displayed in scientific matters. It has cause, I have already recorded my belief, to be proud of the results achieved. For my own part, when I peruse the encomiums passed in presence of learned societies at home, by so illustrious an authority as Sir Roderick Murchison, upon the labors of our Government Geologist and Palæontologist; or when I find so celebrated an astronomer as Mr. Hinds congratulating the scientific world, through the columns of the *Times*, "That the essential instruments exist at Melbourne, in the hands of experienced Astronomers, for observing the transit of the newly discovered intra-mercurial planet over the sun's disc;" I feel, I confess, prouder of being the Governor of a colony which has attained this advanced stage of civilisation, than if I had a stately palace to dwell in, or barbaric hordes to bend the knee at my nod.

If I am anxious, as I have hinted, to see still further moderate expenditure for scientific purposes; if I long to know that the Southern Heavens are nightly swept with an eighteen-inch lens, instead of by our present comparatively powerless telescopes; it is because I am convinced that such expenditure would in many respects be the truest economy, and that in others the fame which would accrue to the colony would far more than compensate for the immediate outlay.

Our present position in regard to scientific researches strikes me as not very dissimilar to that of some quartz-crushing Company on our gold fields, possessing stacks of auriferous stone ready to yield untold treasure, together with a first-rate battery of stampers, but begrudging the fuel requisite for working the steam-engine by which that battery is to be driven.

This Colony has gone to great expense in engaging the services of men of first-rate ability: it has provided each with certain apparatus suited to his vocation, or given him the aid of a costly staff. Having done this, will it be content to rest in ignorance of what is being accomplished, or delay, for the sake of a few extra thousands, the successful completion of their allotted tasks?

I have enlarged, gentlemen, at the risk of wearying you, upon this portion of my subject, because I am convinced that the Royal Society may do much to remedy such a state of things. It must, however, first of all, begin at the beginning, and acquire more of the confidence of the people than it at present commands. It must make science popular. Not in the false sense of that word. Not by patronising the exhibition of pretty tricks and ingenious experiments (though let me, in passing, observe I should be glad to hear lectures on scientific subjects, delivered by qualified lecturers, in our new Hall). Not by promoting the publication of cheap manuals and trashy guide books to science, in which facts are generalised until their individual significance is lost, and the student is persuaded that he can run before he really knows how to walk alone. Not by such means would I have you popularise the objects we have in view, but by teaching your fellow-colonists to believe in the earnestness of your purpose and the sincerity of your endeavours to promote their welfare; by inducing implicit reliance in the accuracy of your assertions, and inculcating the real value and utility of scientific truth.

I know that difficulties await any society of this kind in such a course. Even among the educated classes there are many who deride the notion of a Philosophical Institute, and though not ignorant of the derivative sense of the words, nor unwilling to boast themselves "friends of reason," or possessors of "knowledge," would only apply the name of "philosophers," or "men of science," to its members by way of taunt. That taunt is out of date, and futile. The revelations of the telescope on the one hand, and of the microscope on the other, so far from tending to exalt the pride of human reason, oppress man rather with a sense of utter insignificance. We have no longer, as in Shakspere's day,

> "Our philosophical persons to make modern
> And familiar things supernatural and causeless."

Such dogmatic half-knowledge, such pretension to superior wisdom, have long since vanished before the more general diffusion of education, and the humility inspired by a wider acquaintance with the boundless realms open to scientific research; and we find in their stead that our scientific men are anxious and painstaking inquirers after truth, careful recorders of the facts their own special course of study may reveal.

Another class of doubters as to the utility of the Royal Society's operations will be found in those who style themselves "par excellence" practical men.

Very little consideration should serve to show these, however, how enormously they benefit by the progress of scientific discovery, how ungratefully they too often appropriate its results with scarcely an acknowledgment.

Let any one who denies this read a pamphlet lately circulated, setting forth the claims of the Reverend Mr. Clarke, of New South Wales, in connection with the opening up of the mineral riches of Australia, wherein is clearly shown how valuable was this gentleman's geological skill in directing the first miners aright; how little even of the poor guerdon of thanks he has received from those who rushed afterwards to profit by his lessons.

Or to cite a less familiar instance. Look at one of the greatest boons conferred on all in these Colonies—the shortening of the voyage between them and the Mother Country. Is this due, as might naturally be inferred, to the practical navigator? Was it effected by chance or rule of thumb? On the contrary, the credit belongs almost solely to Lieutenant Maury, of the United States Observatory at Washington, by means of whose Wind and Current Charts, in which the laborious records of innumerable voyages are compiled, the average passage to Australia was almost immediately reduced from 124 to 97 days. I might allude, if time allowed, to the Electric Telegraph, and more especially to the Submarine Cable, inventions which could never have extended their incalculable blessings to our very shores, had the Science of Electricity not been brought to its present advanced state by the labors and experiments of unremembered and unrewarded *savans;* but I proceed to a third class of objectors to the study of Natural Philosophy, more difficult to deal with still, because their objections are founded on a vague though conscientious apprehension that it leads to scepticism in matters of religious belief.

This scruple is not new. It once extended even to the study of the Bible itself. Bacon found occasion to write—"Let no man, upon a weak conceit of sobriety, or an ill-applied moderation, think to maintain that a man can search too far, or be too well studied in the Book of God's Words, or in the Book of God's Works; but rather let him endeavor at endless progress and proficience in both." Yet, though silenced two centuries ago, it has of late, in consequence of the unexpected revelations of modern science, partially revived, and, if not often openly urged, creates strong prejudice against the speculations of Geology, Astronomy, and other inductive pursuits, in the minds of many sincere Christians.

To such I would with all respect submit—that any attempt to limit the scope of human inquiry must of necessity break down, whilst the mere desire to restrict it savors of want of faith in the truth of Divine Revelation.

To reconcile God's Works with God's Words may, it is possible, for ever transcend the faculties of mere humanity, but the believer may surely rest satisfied that what our present finite capacities cannot fathom, will one day be made clear, to all who have sought aright, in the mansions of eternity.

Convinced, in the words of the laureate, "that God and Nature are not then at strife," let all echo the noble strain into which he bursts forth,—

> "Who loves not knowledge? Who shall rail
> Against her beauty? May she mix
> With men and prosper! Who shall fix
> Her pillars? Let her work prevail!"

But I must descend to less grand and exalted themes. To elevate the position of our Society to the extent I have indicated; to render it at the same time the depository of the opinions of the learned few, and the mouthpiece of the scientific wants of the unlearned many, are tasks for gradual accomplishment. I have to allude to-night to one or two matters which I should like to see occupy your special attention during my presidential term.

The first is the consideration of a scheme which has recently been proposed to the Government at home by my enlightened compeer Sir William Denison, for the publication of the Natural History, using the term in its widest significance, of the British possessions throughout the world, at the joint expense of the Mother Country and the Colonies, the latter contributing the descriptive materials and scientific data, the former being at the expense of engraving the illustrations and editing the work.

A more comprehensive or imperial design cannot easily be imagined, and I am happy to state it has received the cordial approval of the Royal Society of Great Britain, to whom it was referred for report by the late Secretary of State for the Colonial Department. Should it be determined to carry it into execution, the co-operation of this Society will no doubt be invoked, and from the able manner in which some of its members have recently reported, at the instance of the Royal Society of Arts, on the productions of the Colony, I feel confident I may reckon on its aid to accelerate the scientific portion of the undertaking.

In the meanwhile, it is worthy of being considered whether, in any event, certain principles of uniformity might not be introduced into all official publications in this and the adjacent colonies, as has, I know, been attempted by the Registrar-General in regard to their statistics. A great deal of unnecessary trouble and expense, as well as of needless repetition, might thus be spared in the production of any great National Work hereafter.

There is a second subject of scientific interest which will I hope occupy a good deal of your attention during the ensuing twelvemonth—namely, the superintendence of preparations for the exploration of the interior.

I rejoice that this Colony is at length about to take its share in this important National duty. Our very presence here to night may be said to be attributable to the love of science and of maritime discovery which the Anglo-Saxon race has always displayed; for you will remember that it was to observe the transit of Venus over the Sun that Captain Cook was despatched on his first voyage to the Southern Ocean, and but for his subsequent exploration of the east coast of Australia, this continent might never have been colonised by the British nation.

It seems but right, then, that this, the wealthiest and most civilised of the communities which have hence sprung into existence, should make some effort to advance the cause to which it owes its origin. Nor will that effort, I am persuaded, prove fruitless. We can gain, it is true, no extension of territory by the discoveries we may make, yet no inconsiderable commercial advantages must ultimately accrue to the possessors of the only great haven on the south coast, from the progress of internal settlement, and from opening up a practicable route to the northern shores of this vast continent; whilst a clearer insight into the nature and extent of the central desert cannot fail to elucidate phenomena now not easily explicable, and to complete our stores of information as to the Meteorology and Mineralogy, the Fauna and the Flora, of this most exceptional and extraordinary portion of the globe.

To this Society belongs the honor of first directing attention to the importance of such an expedition; it has subsequently—stimulated by the munificence of the anonymous donor of £1,000—raised a sum of nearly £3,000 towards this object, and has by its representations induced successive administrations to obtain from Parliament funds for the purchase of camels, as well as a further liberal grant of £6,000 to supplement the private subscription.

The Society must, therefore, feel the deepest anxiety for the successful issue of an undertaking to which it thus stands committed, and the Government has, in my opinion, acted wisely in resolving to leave its guidance and control to the committee which has been appointed for the purpose, taking care, of course, that nothing is done without its knowledge, and that proper checks are imposed on the issue and disbursement of the money voted.

The committee has prudently decided that nothing shall be attempted during the approaching winter, which would have been too far spent ere the exploring party could have reached its starting point; but I trust that every pains will be taken in the spring to organise and equip an expedition worthy of this colony, and that by the commencement of the ensuing summer it will be on its way, under a leader of approved ability, to the depôt selected upon Cooper's Creek as the basis of its operations, so as to be ready to take advantage of the first rains that may fall, to prosecute its researches.

The precise direction of these must necessarily be left a good deal to the discretion of the leader to be chosen. Were not something more than a mere bush ride across the continent aimed at, it might be the easiest course to proceed at once to the westward of Lake Torrens, where that daring veteran Stuart, and my no less gallant friend the Governor of South Australia, have already penetrated country which seems to promise a passage to the north. My own opinion has, however, always been in favor of directing the earlier efforts of the expedition to ascertaining the exact eastern limits of the Great Desert, with a view to crossing as directly as possible to the Gulf of Carpentaria, or to Arnheim's Land, the great promontory by which the western shore of that gulf is formed.

These, gentlemen, are the special questions on which I am chiefly desirous that your immediate attention should be bestowed.

You will not, I feel sure, suffer them to interfere with the zealous discharge of your ordinary duties as members of the Royal Society, but will, on the contrary, devote yourselves with redoubled ardor to the task of rendering our monthly meetings profitable and agreeable. A noble field lies before us. There is ample room for all!

Let every one set earnestly to work in his own sphere for the advancement of science; he who never did so before taking up some branch in which more accurate knowledge is still desirable. Let those who find aught worthy of being communicated favor us with papers, to be discussed with moderation of language, and in entire oblivion of bygone bickerings. Let this be done, and we shall hardly fail to achieve results of importance; for, in the words of an eloquent writer on natural history in the *Cornhill Magazine*, "from the illumination of many minds on many points, truth must finally emerge." Association for scientific research is, in fact, no longer matter of choice, but of necessity. The collection and classification of facts is the essential element of modern progress, and it cannot be attained without division of labor and widespread publicity. In earlier stages of the world's history the brain of a single man, of an Aristotle or a Pliny, sufficed to comprehend all that was yet discovered regarding Nature, but such knowledge is now too vast to be grasped in sufficient clearness of detail by any individual intellect. Even the giant mind of Humboldt quailed before the task of giving a physical description of the universe, and confessed the completion of his "Cosmos," according to his original conceptions, to be impracticable.

True genius is indeed ever humble. The great Newton described himself towards the end of his career as having only gathered a few pebbles on the shores of a boundless ocean. Who in our day shall venture to boast of doing more than sift some grains of the sand which brims that ocean's shores? May we united pursue the path of scientific inquiry, in a like spirit of humility, and with an eye to truth alone.

"Let knowledge grow from more to more,
Yet more of reverence in us dwell."

May we, like them, whilst fearlessly scrutinising Nature's laws, cease not for a moment to respect the teachings of inspiration, nor forget to look from Nature up to Nature's God.

Long as I have already trespassed on your time, I cannot adequately give utterance to the feelings which I entertain on this head, without, in conclusion, adopting, in its integrity, the impressive language of one of the greatest orators and divines the New World has yet produced, Dr. Channing:—

"I look with admiration on the intellectual force which combines and masters scattered facts, and by analysis and comparison ascends to the general laws of the material universe. But the philosopher who does not see in the force within him something nobler than the outward nature which he analyses—who, in tracing mechanical and chemical agencies, is unconscious of a higher action in his own soul—who is not led by all finite powers to the Omnipotent, and who does not catch, in the order and beauty of the universe, some glimpses of spiritual perfection—stops at the very threshold of the temple of truth."

ART. I.—*The "Three Sections," the "Tangencies," and a "Loci Problem" of Apollonius, and Porismatic Developments.* By MARTIN GARDINER, C. E. (formerly Science Scholar, Queen's College, Galway).

[Read before the Royal Society, June 4, 1860.]

PRELIMINARY OBSERVATIONS.

IN the Transactions for 1859 I promised solutions to the celebrated problems of the Greek and French schools, and the present paper is the first instalment towards the fulfilment of that promise.

I commence with the problems of Apollonius, known as his "Three Sections," and "Tangencies," and the principal problem of his treatise on Loci; but I propose also the continuation of the development of interesting "Porisms."

The problems of the Three Sections are famous from the number of geometers who have assayed their solutions.

Willebrord Snel (the first person who measured the length of an arc of the meridian by means of a geodetic survey), who was born at Oudewater, in Holland, in the year 1590, was the first geometer of eminence to restore the Section of Ratio. His solution was published at Leyden, in 1608. Early in the eighteenth century, Dr. Halley discovered an Arabic manuscript in the Bodleian Library containing distinct investigations to the numerous subdivisions of the Section of Ratio, a Latin edition of which he published at Oxford in the year 1706; but there is no evidence as to whether this relic is a transcript from the original of Apollonius, or merely a string of solutions to its various cases by some other geometer; it covers 138 pages. Since then the principal solution is that by Reuben Burrow, which was published about the year 1780 in his "Apollonius." An application of the problem may be seen in David Gregory's Astronomy.

The Section of Space received an original solution from Dr. Halley, which is similar to that given in Leslie's Geometrical Analysis. Other solutions may be found scattered through mathematical periodicals; but as they are all similar and incomplete, they deserve no particular notice.

Indeed, an unaccountable neglect has been shown to this problem by the geometers who attempted the other "Sections;" and this is the more strange as the Section of Space is by far the most useful of the three.

The Determinate Section was solved by Willebrord Snel, and since then by Dr. Robert Simson, William Wales, and Petro Giannini. Snel's and Wales' solutions were republished at London in 1772, by the Rev. John Lawson, and Giannini's at Parma in 1773. Dr. Simson's solution was published in his Opera Reliqua in 1776, at the private expense of Earl Stanhope, and covers over 150 pages.

However, though the lost writings of Apollonius occupied the attention of Newton, Halley, Simson, Burrow, Huygens, D'Omerique, Lalouerc, and a host of other distinguished geometers, it is a most remarkable fact that none of them perceived the *liaison* of "The Three Sections." Indeed, it was only through the instrumentality of the *Homographic Theory*, as systematised by M. Chasles, Professor of Geometry to the Faculty of Sciences of Paris, that this intimate connection was exposed, and analogous solutions for the first time given. Chasles' solutions—extracted from his correspondence with the late Professor Davies, of the Royal Military Academy—dated 1848, were published in the third volume of the *Mathematician*, and again in his recent work entitled Traité de Géométrie Supérieure.

These latter solutions are more in detail than those in the Mathematician, and the following accompanying observations of the author, who has been justly styled the Newton of Geometry, are worthy of special attention. He says :—

"Amongst the numerous questions to which the homographic theory can be most easily applied, are those which formed the subject of the three works of Apollonius, entitled the Section of Ratio, the Section of Space, and the Determinate Section. Each of these questions exacted a great number of propositions. Pappus relates that there were 181 in the Section of Ratio, 124 in the Section of Space, and 83 in the Determinate Section. These arose from the fact that the solution to the general question was never given directly, as the ancient geometers proceeded to first establish the most simple cases, and then went step by step to the more general, so that the solution of each case always depended on those which preceded. Moreover, each problem gave rise to as many different questions as there were varieties in the different relative parts of the figure.

In the two last centuries these problems have occupied the attention of many eminent geometers, who endeavoured to restore the works of Apollonius; but, although they tried to reduce the solution of each to as few propositions as possible, it is yet the same long and tortuous method they have all followed. For instance, J. Leslie gives four propositions to the Section of Ratio, six to the Section of Space, and eight to the Determinate Section, whilst, by my method, one solution suffices for the three questions, considered in their most general forms."

Now, I have already recorded my opinion concerning the peculiar method of investigation of the ancient geometers and their modern imitators, namely, that it is attributable to the want of precision and generality in the indicated operations, and involved theorems; but I will further observe, in this place, that the homographic theory must receive some developments in *limits* to the constants of the equations, implicating the *double points* of divisions on the same straight line, before it becomes thoroughly effective in its applications. And from the absence of such developments, Chasles' solutions are necessarily defective.

Take for instance his solution to the Section of Ratio, which is as follows*:—

"Draw AE parallel to NN, to cut MM in E; draw AG parallel to MM to cut NN in G; find I in MM such that PI : RG :: m : n; bisect IE in O; in NN find H such that PO : RH :: m : n; draw HA to cut MM in F; from O as centre and radius = $(\text{OF}\cdot\text{OE})^{\frac{1}{2}}$ describe a circle; through either point C in which this circle cuts MM, draw CA to cut NN in D: then will CAD be an answerable line." And his only remarks in respect to the limits of the problem are—"And if the segments OF and OE be not on the same side of O, the two solutions will be imaginary."

Here it is evident that when the given straight lines MM, NN, are parallel, the method is not intelligibly applicable. And it is but right to observe that this is the only case in which the principal construction given in Leslie's Geometrical Analysis (introducing the improvement of indicating opposite directions by opposite signs) cannot be applied. However, the general method of finding the *double points* of homographic divisions which is given in the Géométrie Supérieure, would, if introduced, overcome this imperfection. But there is a much more serious defect which cannot be rectified by the "theory," such as it now exists, namely, the non-establish-

---

* See the enunciation I give to this problem.

ment of the precise limiting values for the ratio $\frac{m}{n}$. Surely, it is not evident that there are two limiting positions for F, such as f and f', and that according as the ratio $\frac{m}{n}$ lies outside the limits $\frac{Pf}{Rh}$ and $\frac{Pf'}{Rh'}$ (h and h' being the points in which fA and f'A cut NN), or is equal to one of them, or is comprehended between them, so will the corresponding points C be real and distinct, real and coincident, or imaginary.

And similar remarks apply to his solutions to the Section of Space and to the Determinate Section; for the homographic theory will not establish the *limits,* nor even hint as to their nature or number.

My solutions are equally general with those given by Chasles, and—as will be seen in the Generating Problem—one wording applies to the three questions in their most general forms. Besides, they possess the distinguishing characteristic of being intelligibly applicable to all the particular cases; and the simple considerations, by means of which the limits are established, will be found applicable to the determinations of limits in numerous other important questions.

The next in order of the works of Apollonius, after the Determinate Section, was the "Tangencies."

The enunciation of the problem, and some of the "Lemmas" used in its solution, which were preserved in the Mathematical Collection of Pappus, enabled Dr. Robert Simson, of Glasgow, to reproduce one case (that of two circles and a point) though not under its original form,—as may be seen in the Appendix to his Opera Reliqua; but a more elegant solution to the same was previously given by Vieta, in his Apollonius Gallus. And since Dr. Simson's, an entirely different solution has been given by Monsieur Auguste Cauchy, in the "Correspondence de l'Ecole Polytechnique."

However, neither Simson, Vieta, nor Cauchy succeeded in giving a direct solution to the general question.

Newton virtually solved the general question in his Principiæ, where it entered into some astronomical determinations; and, indeed, it is the only direct geometrical solution by a British geometer which applies to the various cases, when we suppose the circles to have any value from zero to infinity.

But the most complete and elegant solution hitherto given to the "Tangencies," is that of M. Gergonne, in the *Annales de Mathematique,* which (according to M. Chasles) is an improvement on a solution by M. Gaultier, in the *Journal de l'Ecole Polytechnique.*

In this paper I give ten direct geometrical solutions to the general question.

The first of these is, I consider, the simplest ever given Its applications to the case in which two of the circles are finite, and the other circle infinitely small, is an improvement on Victa's solution; and to the case where two of the given circles are infinitely small, and the third finite, it is similar to what is given by Brianchon* in the Journal de l'Ecole Polytechnique.

The second solution is also applicable to all the cases of the problem; and the idea of the auxiliary circle can be applied in other questions, so as to render the solutions more general.

The application of the third solution to the case, in which two of the given circles are finite, and the third infinitely small, leads to M. Cauchy's method for this case, &c.

The other solutions are applicable to all the leading cases of the problem, but fail to indicate graphical constructions for some of the minor ones, owing to the peculiarities inherent in the involved theorems, or in the methods of contemplating or expounding them. The tenth is most probably a reproduction of Apollonius' solution.

The "Loci Problem," which I have undertaken, is in a more general form than was accorded to it by Apollonius. It comprehends almost the entire substance of the Second Book, as restored by Dr. Simson.

The solution is direct and general; besides, it shows that when the *ratio* is unrestricted in sign, the locus is not (as usually intimated) *a circle,* but two real circles, a real circle and a point, or a real circle and an imaginary one, according to relative states of the data.

Particular cases only of this problem were solved by Dr. Simson, all of which have been republished in Leslie's Geometrical Analysis. His methods are inapplicable to the general question, as they depend on the reality of a point in the straight line passing through the given points, which may become imaginary, even when the locus is real.

A method of constructing the locus, having many points approaching to mine, is given in the Geometry of the Library of Useful Knowledge; but there, too, the process depending on points which may be imaginary when the locus

---

* Professor Davies has erroneously confounded Brianchon's with Pappus' solution.—(See vol. 3, page 227, Mathematician.)

is real, is applicable only in particular states of the data. In the Notes will be found a genuine *ancient* porism, from which the problem originated.

I might also mention that Francis Van Schooten, Professor of Mathematics at Leyden, published a restoration of some of the particular cases of this problem, in 1657; and that a like task was performed in an algebraic form by Fermat, Councillor to the Parliament of Toulouse, in his Opera Varia Mathematica, published in the year 1679.

It is scarcely necessary to remark, that in the present improved state of Algebraic Geometry, it would be an easy matter to solve the general case of this problem; but, to arrive at a construction of the Locus, such as I give, would be impossible without introducing other geometrical considerations than those to be found in ordinary Algebraic Elements; besides, the complete discussion would present difficulties which none but experienced analysts could overcome.

The "Porisms" in the present paper, with those in the *Transactions* for 1859, belong to the most numerous and useful system in the whole range of elementary theorems. Some few of them—as is evident from Professor Davies' contributions to the Mathematician—have been already noticed by Mr. Mark Noble, and by Professors Playfair and Wallace; but their number is so few, that when they occur I will make no scruple of reproducing them amongst the classes to which they belong. I have already given proof of their efficiency in the solution of difficult problems.

They are most probably but restitutions of a part of the lost treatise of Euclid, known as his Second Elements—composed when his geometrical knowledge was fully matured, and which, there is strong reason to suspect, contained all the principles developed in the elementary writings of Gergonne, Poncelet and Chasles.

Having said thus much relating to the substance of my paper, I think it right, before closing these preliminary remarks, to explain the nature of the improved ideas and theorems on which the *spirit* of my investigations is mainly dependent.

To do this, I may at once state that all the great masters of Logic have observed that there are two points which must be rigorously attended to in correct systems of reasoning.

First:—That the propositions employed as premises are unambiguous, and correctly understood.

Second:—That the steps (the auxiliary operations and theorems) by means of which the conclusion is drawn from those premises, are true, unambiguous, and correctly understood.

This being borne in mind, it is evident that if from a given point in a given indefinite straight line, we were told to cut off a part equal in length to a given finite straight line, we should naturally ask in which direction from the point we are to take the part; as the problem would be ambiguous if either direction should not be answerable to the end in view. And if the solution of some other problem depended on this operation (as just defined), and that one only of the parts which can be cut off is applicable, then it is evident there would exist an ambiguity in the solution.

The method of indicating opposite directions on the same straight line in distinct terms—such as positive and negative directions, or right and left directions, obviates this difficulty; but though long since adopted in Trigonometry and Algebraic Geometry, it is only in the modern French pure geometry, that it has been consistently introduced.

Again, if in any general investigation or construction it were necessary to draw a straight line through a particular point, making an angle of a given magnitude with another straight line, then, as two such lines can be drawn through the point, and that but one of them may be answerable, it is clear there should be a precise method of indicating each of these lines.

Further, if on any straight line, for instance, a particularised one of the last two, it were necessary to cut off a segment from a point therein whose length should have some peculiar relation to other magnitudes and positions, and that but one segment from the point would be answerable; then, too, it is obvious we should have a method of particularising directions in one straight line in respect to the directions in others.

Yet it is only in my previous papers such methods are either advocated or applied.

And without those improvements in the manner of indicating angles, it is not only the elementary geometry of the straight line and circle that suffers, but also the conic sections and higher departments; for there, too, geometers have failed to expose the general truths comprehended in the theory. One instance of this is supplied by the following well-known theorem:—"When the base AB of a triangle is given in position and magnitude, and that the difference of the angles CAB, CBA at the base is constant, then will the locus of the vertex C be a hyperbola."

For, as the locus of the vertex is not a hyperbola under these conditions, but part of one, it follows that, in all inquiries in which the theorem is used, the results must be defective in generality.

The complete theorem which should replace it is as follows:—

If *aa* and *bb* are fixed straight lines through fixed points A and B, should *cc* and *dd* be any other pair of straight lines through A and B, making the angle *cc* right to *aa* equal to the angle *bb* right to *dd*, then will the locus of the intersection of *cc* and *dd* be a rectangular hyperbola through the fixed points A and B.

Indeed, a due consideration of the requirements of a complete logic, or of the laws of nature, will show that the improvements are necessary to the explicit enunciations of implied operations, and confer precision and generality on most important theorems; and are therefore, in so far as these are understood, a correct step in the advancement of pure science.

Finally, I think it right to remark that, in indicating opposite formations of magnitudes, I have purposely avoided the terms *positive* and *negative*, as so many meanings are given to these words by metaphysicians and others. Besides, the introduction of *right* and *left* renders the language more elegant, and often affords important advantages in allowing us to decide, according to circumstances, whether right or left should be indicated by plus or minus.

MARTIN GARDINER, C.E.

DEFINITIONS.

1. If a straight line, which we may conceive produced to infinity in its primitive directions, be supposed to become rigid, and one point of it to be permanently fixed, the rigid line being otherwise capable of movement in any plane in which it may lie, then it is evident that there are but TWO ways of revolving the line in this plane; one being by means of a "*right*" rotation, and the same as that in which the hands of a watch move if the dial-plate be towards us, in the plane; and the other being by means of the contrary, or "*left*" rotation.

2. If AA and BB be two straight lines, and I their point of intersection, then the "*angle IA right to B,*" means the angle formed at I by a rigid line having I as a fixed pivot, and

revolving from a position in AA by a right rotation until its first arrival into the position BB, the revolving line being supposed produced indefinitely on both sides of the pivot. And a similar meaning applies to the term "*angle IA left to B.*"

3. If AA and BB be two straight lines, and I their point of intersection, then "*angle IA right round to IB*" means the angle formed at I by a straight line having one of its extremities in this point, revolved by right rotation from the actual direction IA until it arrives in the actual direction IB. And a similar meaning applies to the term "*angle IA left round to IB.*"

4. If AA and BB be two straight lines, and I their point of intersection, the angle "*right AB*" means the angle IA right round to IB, and the angle "*left AB*" means the angle IA left round to IB.

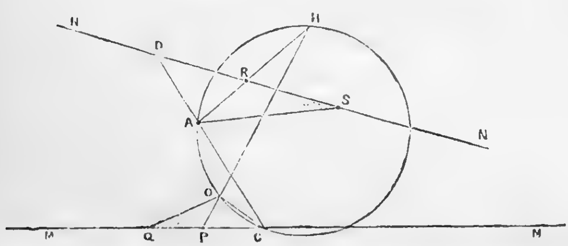
5. The angle (AB) means either one or the other of these last two, indifferently.

NOTE.

It is necessary to restrict the meaning of the term "angle (AB)," given in Chasles' Géométrie Supérieure, to that which has been just defined; for otherwise, his enunciated properties of the homographic pencils will not hold good as to sign.

See my paper entitled "Improvements in Fundamental Ideas and Elementary Theorems of Geometry," in the *Transactions* for 1859.

SECTION OF RATIO.



Given the points P *and* R *in the given straight lines* MM *and* NN; *through a given point* A *to draw a straight line* CAD *to cut the given lines in* C *and* D, *so that the segments*

PC *and* RD *shall be to each other in the given ratio of* m *to* n, ($\frac{m}{n}$ *being of given magnitude, and of known sign in respect to directions on* MM *and* NN).

ANALYSIS.

Suppose on MM and NN we take PQ and RS, so that PQ : RS :: PC : RD :: m : n, and that we draw PO and QO making the angles PO right to Q, and QO right to P respectively equal to the angles RA right to S, and SA right to R. Then it is evident that the triangle POC is similar to RAD, and that the angle OC right to P is equal to the angle AD right to R. Hence, H being the point of intersection of PO and RA, it follows that a circle can pass through AOC and H; but A, O, and H are known points: therefore the point C, in which the circle AHO cuts MM, is known, and therefore also the line CAD.

COMPOSITION.

On MM and NN take segments PQ and RS, having to each other the given ratio of m : n; draw PO and QO, making the angles PO right to M, and QO right to M equal respectively to the angles RA right to N, and SA right to N; through A, O, and the intersection H of PO and AR, describe a circle; through either point C, in which this circle AHO cuts MM, draw CA to cut NN in D: then will CAD be an answerable line.

For draw OC. The angle AH or AR right to C or D is equal angle OH or OP right to C, and therefore since the angle PO right to Q or C is equal angle RA right to S or D, it is evident that the triangles POC and RAD are similar, and that PC : RD :: PO : RA :: PQ : RS :: m : n.

DISCUSSION.

It is evident that when $\frac{m}{n}$ is restricted as to sign, there is but one point O, one circle OAH, and two answerable points C (real or unreal).

If $\frac{m}{n}$ be unrestricted in sign, then, obviously, there are two points O, two corresponding circles AOH, and, therefore, four answerable points C. Moreover, as the points O must be on opposite sides of MM, it is evident two of these points C must be always real.

Limiting Values for the Ratio $\frac{m}{n}$.

When A and H are on opposite sides of MM, the corresponding points C are always real; but when A and H are on the same side of MM, the reality of the points C is dependent on the position of O, or, which amounts to the same thing, on the value of $\frac{m}{n}$. Again, since PO : RA : : PQ : RS, it is evident that if O′ and O′ be the points in which the two circles through, A and H touching MM again cut PH, then will $\frac{PO'}{RA}$ and $\frac{PO'}{RA}$ be the limiting values of $\frac{m}{n}$. Moreover, it is evident that, according as any value of $\frac{m}{n}$ is comprehended between these limits, or equal to one of them, or not comprehended between them, so will the corresponding points C be imaginary, or real and coincident, or real and distinct.

Porismatic Relations of the Data.

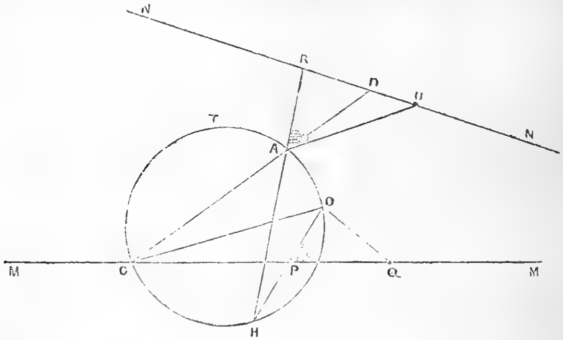
It is evident the problem is indeterminate only when the circle AOH is indeterminate. When O coincides with A, and that PO cuts AH, then H also coincides with A, and the circle AOH is infinitely small; but when O coincides with A, and that PO and RA form one straight line, then it is obvious that any circle touching this straight line in A is an answerable circle AHO: therefore in this case there are innumerable answerable points C and lines CAD. The problem under these last conditions (viz., when we have MM parallel to NN, and PRA a straight line, and the ratio $\frac{m}{n}$ equal to $\frac{PA}{RA}$) is said to be "porismatic"—any straight line CAD through A being an answerable line.

Remarks.

1. When MM and NN are parallels, it is evident PO and RA are parallels and that H is at infinity (when O and A are not coincident), and the circle AOH infinitely great. In this case the straight line AO, lying in the infinite circumference, will give one point C in its intersection with MM: the other point C is evidently at infinity on MM.

2. In all cases QO and SA intersect in the circumference of the circle AOH.

THE SECTION OF SPACE.



Given the points Q *and* U *in the given straight lines* MM *and* NN; *through a given point* A *to draw a straight line* CAD *cutting* MM *and* NN *in* C *and* D, *so that* QC.UD *shall be equal to* m.n *(where* m.n *is a given magnitude of known sign in respect to the directions on* MM *and* NN*).*

ANALYSIS.

Suppose that in the given lines we take the segments QP and UR such that QP.UR = QC.UD = *m.n*, and that we draw PO and QO making the angles PO right to M, and QO right to M, respectively equal to AR right to U, and UR right to A. Then the similar triangles POQ, ARU, give QO.UA = QP.UR, and therefore QO.UA = QC.UD; and ∴ as the angle QC right to O is equal the angle UA right to D, the triangles COQ and ADU are similar, and the angle CO right to Q is equal AD right to U; but PO right to Q is equal AR right to U; therefore it follows that angle AR right to D or C is equal OP right to C. Hence, if H be the point in which RA and PO intersect, a circle can pass through AOH and C: but the points AOH are known; therefore the point C in which the circle AOH cuts MM is known, and hence CAD.

COMPOSITION.

In the given lines MM and NN take any two segments QP and UR, such that QP.UR = *m.n*; draw PO and QO, making the angles PO right to Q, and QO right to P equal respectively to AR right to U, and UR right to A; through A, O, and the intersection H of RA and PO, describe a circle; through either point C in which this circle cuts MM draw CA to cut NN in D: then will CAD be an answerable line.

For draw CO.

The angle OH or OP right to C is = AH or AR right to C or D; and the angle PO right to Q = AR right to U; therefore the angle CO right to Q is equal AD right to U; hence the triangles ADU, COQ are similar, and QC.UD = QO.UA. But the similar triangles PQO, AUR give QO.UA = QP.UR; therefore QC.UD = QP.UR = *m.n*.

DISCUSSION.

When *m.n* is restricted in sign (as in the enunciation), there is evidently but one answerable point O, and therefore but one circle AOH, and two points C, real or unreal, according as the circle AOH cuts MM in real or imaginary points,

If *m.n* be unrestricted as to sign, then there are evidently two answerable points O, and therefore two circles AOH, and four points C, and lines CAD: moreover, it is evident that the points O are on opposite sides of MM, and therefore that two of the points C must be always real.

Limiting Values for m.n.

It is evident the points C can be imaginary only when A, O, and H are on the same side of MM. We know one point A in the circle AOHC, but, in order to arrive in a simple manner at the limiting positions for the circle AOH, it would be well if we could find another point in the circumference. We can find such a point. For, if T be the point in which QO again cuts the circle, the angle AH right to T = OH right to T, and is therefore = RA or RH right to N; and hence AT is parallel to NN, and the point T in which it cuts QO is known.

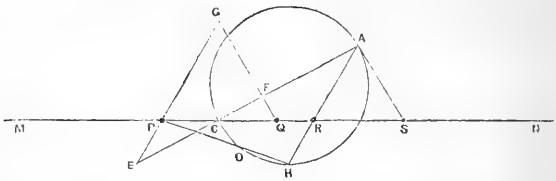
Now it is evident that by putting O′ and O′ for the points in which the circles through A and T, touching MM, cut QO, then will UA.QO′ and UA.QO′ be the required limits. Moreover, it is evident that according as any value of *m.n* is comprehended between these limits, or equal to one of them, or not comprehended between them, so will the corresponding points C be imaginary, or real and coincident, or real and distinct.

Porismatic Relations of the Data.

It is evident the problem becomes indeterminate only when the circle AOH becomes indeterminate. Now the circle

AOH evidently becomes indeterminate when O and A coincide, and that QOAT is parallel to NN. In this state of the data all points in MM are answerable points C, and the problem is said to be "porismatic." It is evident that UA is parallel to MM when QOA is to NN, and that $m.n$ (in this porismatic case) is equal QA.UA.

THE DETERMINATE SECTION.



Given two pair of points P,S, *and* Q,R, *in a straight line* MN; *to find a point* C *in the line such that* PC . SC : QC . RC : l : k . *(in which the sign of* $\frac{l}{k}$ *is known, as well as its magnitude).*

ANALYSIS.

Suppose we assume a point A, and that we draw PG and QG making the angles PG right to Q, and QG right to P respectively equal to RA right to S, and SA right to R; and that E and F are the points in which AC cuts QG and PG.

The triangles CPE, CQF, are similar to CRA, CSA, and we evidently have PE . SA : QF . RA : : PC . SC : QC . RC : : l : k; and therefore PE has to QF the known ratio of RA.l to SA.k. Hence (see Porism 4 in *Transactions* for 1859), the circle EFG passes through a known point O in the circumference of circle PGQ, which is such that PO : QO : : PE : QF.

Again, the angle EF or EC right to O = GF or GQ right to O = PQ or PC right to O; therefore a circle can pass through EPC and O; and hence, as AR is parallel to PE, if H be the point of intersection of PO and AR, it follows that a circle can pass through OHA and C; but O, H, and A are known points; therefore the circle OHA is known, and also the point C in which it cuts MN.

COMPOSITION.

Assume a point A (not in the given line); draw PG and QG making the angles PG and QG right to M equal respectively to the angles RA and SA right to N; describe the circle PGQ, and in it find O (on the same or opposite sides of PQ with G according as $\frac{PG}{QG}$ and $\frac{l.RA}{k.SA}$ have like or unlike signs) such that PO : QO : : l.RA : k.SA; draw OP to cut AR in H; describe the circle OAH: either point C in which it cuts MN is an answerable point.

Let E and F be the points in which GP and GQ cut AC.

It is evident PE is parallel RA, and QF to SA, and therefore that PE.SA : QF.RA : : PC.SC : QC.RC. Again, the angle EP right to C being equal AR or AH right to C, it is equal OH or OP right to C; therefore a circle can pass through OCPE, and the angle EC right to O = PC or PQ right to O = GQ right to O; hence, a circle can pass through GFOE, and therefore (see Porism 4, *Transactions* for 1859), PE : QF : : PO : QO : : l.RA : k.SA, and therefore PE.SA : QF.RA : : l : k, and consequently PC.SC : QC.RC : : l : k.

DISCUSSION.

It is evident the point of intersection I of OQ and SA is in the circumference OHA (for the angle IQ or IO right to A = QO right to G = PO right to G, and $\therefore$ = HO right to A).

When $\frac{l}{k}$ is (as is supposed in the enunciation) confined to a particular sign, there is but one point O, one circle AHO, and therefore two (and but two) answerable points P—both real or both imaginary.

But if $\frac{l}{k}$ were unrestricted in sign, it is evident there would be two points O, and therefore two circles OHA, and four points C. Moreover, since the points O must be on different sides of MN, two of these points C must be always real.

Limiting Values for the Ratio $\frac{l}{k}$.

When the segments PS and QR lie partly on each other, the points H and I lie on opposite sides of MN, and therefore the corresponding point C must be always real.

When one of the segments PS and QR lies entirely on the other, it is evident the points A and G are on the same side of MN, and therefore it is only when the ratio $\frac{l}{k}$ is positive, that O, H and A can be on the same side of MN; in other words, the points C are real for all real negative values of $\frac{l}{k}$; but for positive values of $\frac{l}{k}$ the points C are real only when the circle OHA cuts MN in real points. Hence, it is necessary to define the positive limiting values of $\frac{l}{k}$ so as to be enabled to know, *a priori*, when the corresponding points C are real, &c. This is done by drawing the two straight lines PO′H′ to cut the circle PGQ and line AR in O′ and H′ such that the two circles AO′H′ shall touch MN (these circles can be easily described, since the point X, in which AG cuts the circle PGQ, is common to all circles AHO. For the angle XG right to O = PG right to O = HA right to O = XA right to O); for then the limits are $\frac{RA.PO'}{SA.QO'}$ and $\frac{RA.PO'}{SA.QO'}$; and these limits are evidently such that according as any value of $\frac{l}{k}$ lies outside them, or is equal to one of them, or is comprehended between them, so will the corresponding points C be real and distinct, real and coincident, or imaginary.

When the segments PS and QR have no part in common, it is evident A and G are on opposite sides of MN, and that it is only when the given ratio is negative that the points OHIA can be on the same side of MN, and ∴ only that the points C can be imaginary. Hence, in this case, it is necessary to define the negative limiting values of $\frac{m}{n}$. These limiting values $\frac{RA.Po'}{SA.Qo'}$, $\frac{RA.Po'}{SA.Qo'}$, are obviously found in the same manner as in last case, and like remarks as to their nature apply.

When Q coincides with S, it is evident the points C are always real, and that one of them is coincident with QS.

When P coincides with R, it is evident the points C are real, and one of them in PR.

When R and S are coincident, and P and Q are distinct, then AR and AS are coincident, and G is at infinity, and ∴ O is in the straight line PQ; moreover, H coincides with RS; ∴ the points C are real, and one of them coincident with R.

When P and Q are coincident, and R and S distinct; then G coincides with P and O; but although the triangle POQ is infinitely small, it is known in species, and therefore POH is known in position, and hence the circle OHA. The points C are real, and one of them coincident with PQ.

Porismatic Relations of the Data.

If R and S be coincident, and that we have P and Q also coincident, then as we may have conceived PQ and RS to have had any peculiar relation, such as a constant ratio, &c., during their diminution, it is evident we may suppose G anywhere whatever in the line PQG. And it is clear that for all values of $\frac{l}{k}$ other than unity, the point O must coincide with PQ, and one point C be coincident with PQO, and the other point C with RSH. But for the value of $\frac{l}{k}$ = unity, the point O may be anywhere in the circle GQP (which touches MM in PQ), and ∴ a point C may be anywhere in MM—the state of the data being "porismatic." And it is evident that when P coincides with R and S with Q, and that $\frac{l}{k}$ = unity, then, also, will the problem be "porismatic."

Peculiar Case.

If in MN we suppose SR and RU equals respectively to l and k; then we have PC.SC : QC.RC : : SR : RU.

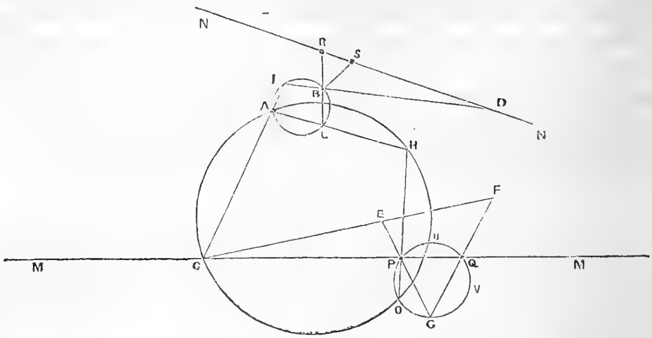
Now, if we suppose R and U to remain fixed, and S to become greater and greater in distance from the fixed points, until it vanishes at infinity, then for points C at a finite distance, we shall have SR = SC, and hence

$$PC.RU = QC.RC.$$

This case of the problem can be expressed as follows:—"*Given three points,* P, Q, R, *in a straight line, to find another* C *in the same, such that* K *being a line of given length (and known sign in respect to the directions on* MN*), we shall have* PC.K = QC.RC."

The solution may evidently be worded thus:—In MN make RU = K; draw RA (not in MN) equal RU; draw PO and QO, making the angles PO right to Q, and QO right to P equal respectively to AR right to U, and UR right to A; produce PO to cut RA in H; describe the circle OHA, and it will cut MN in the required points C, C.

GENERATING PROBLEM TO THE THREE SECTIONS.



Given the points P Q *on a straight line* MM, *and the points* R S *on a straight line* NN; *through two given points* A B *to draw two straight lines* AI, BI, *making the angle* IA *right to* B *of a given angular magnitude* θ *right, and such that* C *and* D *being the points in which* AI *and* BI *cut* MM *and* NN, *we shall have* PC.SD : QC.RD : : l : k; ($\frac{l}{k}$ *being of given magnitude and known sign in respect to the directions on* MM *and* NN).

ANALYSIS.

The circle AIB is evidently known. Suppose we draw a straight line CEF, making the angle CE or CF right to P or Q equal the angle DB right to R or S, and that through P and Q we draw PE and QF to cut it, so that the angle PE right to C = RB right to D, and the angle QF right to C = SB right to D. Then the triangles CPE, CQF are similar to the triangles DRB, DSB; moreover it is evident that from these triangles we have the relation PE.SB : QF.RB : : PC.SD : QC.RD : : l : k.

Let G be the point of intersection of PE and QF.

From the last proportion we have PE to QF in the known ratio of l.RB to k.SB; and therefore (see Porism 4th, in *Transactions* of 1859) the circles EGF, CQF, CPE pass through a point O in the circumference of the circle PGQ, which is such that PO : QO : : l.RB : k.SB; and hence, as PG and QG are known, the point O in the circle PQG is known.

Again, the angle OC right to P = EC right to P = BD right to R; and therefore if L be the other point in which RB cuts the circle AIB, and H that in which OP cuts AL, we have the angle OC right to P or H = BD or BI right to R or L = AI or AC right to L or H; hence a circle can pass through O, H, A, and C; but O, H, and A are known points; therefore the point C in which the circle OHA cuts MM is known, and therefore the point I in which CA cuts the circle AIB, and also the point D in which IB cuts NN.

COMPOSITION.

Through A and B describe the circle AIB, such that I being any point in its circumference, the angle IA right to B = θ right; draw PG and QG, making the angle PG right to M = RB right to N, and the angle QG right to M = SB right to N; describe the circle PGQ, and in it (on the same or opposite side of PQ with G, according as $\frac{PG}{QG}$ and $\frac{l.RB}{k.SB}$ have like or unlike signs) find O such that PO : QO :: l.RB : k.SB; draw RB to cut the circle AIB in L; draw OP to cut AL in H; describe the circle OHA; through either point C in which the circle OHA cuts MM draw CA to cut the circle ABI in I; draw BI to cut NN in D: then will AI and BI be as required.

For through the other point E in which the circle OCP cuts GP, draw CE to cut QG in F.

The angle EC right to P is = OC right to P or H = AC or AI right to H or L = BI or BD right to L or R; therefore, since the angle PC right to E = RD right to B, the triangles PCE, RDB are similar, and CP or CQ right to E or F is equal DR or DS right to B.

And since the angle QG or QF right to P or C is equal angle SB right to R or D, therefore the triangles CQF, DSB are similar. Now from these two pair of triangles we evidently have PE.SB : QF.RB :: PC.SD : QC.RD; but (see Porism in *Transactions* for 1859) we have PE : QF :: PO : QO :: l.RB : k.SB, and therefore PE.SB : QF.RB :: l : k; hence PC.SD : QC.RD :: l : k.

DISCUSSION.

Since there are two points of intersection C, there are two solutions to the problem, both real or both imaginary, according as these points are real or imaginary.

If the ratio $\frac{l}{k}$ be unrestricted as to sign, then it is evident there are two answerable points O, and therefore two circles OHA, and four points C. Moreover, the points O being necessarily on opposite sides of PQ, it follows that two of these four points C must be always real.

Limiting Values for θ Right. *

There are evidently limits to θ right only when A and O are on the same side of MM.

Now the point O is found independent of the magnitude of θ; and it is evident that by describing the two circles through A and O which touch MM, and putting H′ and H′ for the points in which OP cuts them again, and I′ and I′ for the points in which AH′ and AH′ cut RB, then will the angles I′A right to B and I′A right to B be the limiting values for the angles θ right. And if X be the point in which AO cuts I′I′, it is evident that according as $\frac{OH'}{OH'}$ and $\frac{XI'}{XI'}$ have like or unlike signs, so will any straight line through A cutting I′I′ and H′H′ in L and H give $\frac{LI'}{LI'}$ and $\frac{HH'}{HH'}$ of like or unlike sign. Hence it follows that when $\frac{OH'}{OH'}$ and $\frac{XI'}{XI'}$ have like signs, the limiting values *include between them* all values (and no others) of the angle θ right, for which AI and BI are imaginary; and when $\frac{OH'}{OH'}$ and $\frac{XI'}{XI'}$ have unlike signs, the limiting values *have outside them* all values (and no others) of angle θ right, for which AI and BI are imaginary. And when θ right is equal either of the limiting values, the lines AI are coincident and real.

Limiting Values for the Ratio $\frac{l}{k}$.

When the points C may be imaginary, the point O must evidently fall on the same side of PQ with the points A and H. And it is evident we arrive at the limiting values of $\frac{l}{k}$, or $\frac{PO.SB}{QO.RB}$, or (which is equivalent) of $\frac{PO}{QO}$, by finding the points o' and o' in the circle PGQ, so that h' and h' being the points in which Po' and Po' cut AL, the circles A$h'o'$ and A$h'o'$ touch MM.

Moreover, it is evident that the two ratios $\frac{SB.Po'}{RB.Qo'}$ and $\frac{SB.Po'}{RB.Qo'}$ are the required limits, and that they have the same sign, and that according as any value of $\frac{l}{k}$ (having like sign) is of a

* Geometers who do not adopt my improved methods of indicating angles, will find it impossible to define the *limits* of the angular magnitude θ.

magnitude comprehended between them, or equal to one of them, or not comprehended between them, so accordingly will the circle AOH corresponding cut MM in two imaginary points, in two real and coincident points, or two real and distinct points C.

Porismatic Relations of Data.

1. It is evident the problem becomes indeterminate when the circle OAH becomes indeterminate, &c. Now, if the circle PQG passes through A, and that the point O coincides with A, then H on AL will also coincide with A; if, AL does not coincide with OP; and, as the chord OH on OP is equal zero, the circle AHO must be infinitely small. But if AL and OP coincide, then, although AH and OH are "infinitely smalls," they lie both on AL, and therefore it is evident that any circle touching AL in A is an answerable circle AHO. Therefore in this last state of the data the points C are innumerable, and the problem is "porismatic," as well as if we conceived O to move to A having OP parallel AL, and thus causing H to be indeterminate when O coincides with A.

2. If R coincides with S, and that we suppose Q to approach P until it comes to coincide with it, then G is at infinity, and the straight line MM lies in the infinite circumference PQG. And for all values of $\frac{l}{k}$ other than $\frac{1}{1}$ the point O coincides with PQ, and one point C is coincident with PQ, and the other point C with the point in which AL cuts MM. But when $\frac{l}{k} = \frac{1}{1}$, then as the point O, and the point C coincident with O, may be anywhere in MM, the problem is said to be "porismatic."

Remarks concerning Particular Cases.

1. Since PC.SD : QC.RD :: l : k, or, which is the same thing, since

$$PC.(RD - RS) : (PC - PQ).RD :: l : k, \text{ therefore,}$$
when $l = k$, we have
$$PC.RS = PQ.RD$$
$$\text{or } PC : RD :: PQ \quad RS$$

Hence we derive a method of solving the problem—"*Given the points* P, R *in the given straight lines* MM, NN; *through two given points* A *and* B *to draw* AI *and* BI *making the angle* IA *right to* B *of a given magnitude θ right, and such that*

C *and* D *being the points in which* AI *and* BI *cut* MM *and* NN, *we shall have* PC *to* RD *in a given ratio of* m *to* n."

It is evident that the points G and O are coincident, and ∴ the solution of this enunciated problem can be worded as follows:—

Take Q and S on MM and NN, so that PQ : RS : : m : n; through A and B describe the circle AIB, which is such that I being any point in it, we have the angle IA right to B = θ right; through P and Q draw PG and QG, making the angles PG and QG right to M, equals respectively to the angles RB and SB right to N, through L where RB again cuts circle ABI, draw AL to cut PG in H; describe the circle AHG; through either point C in which it cuts MM draw CA to cut circle AIB again in I; draw IB to cut NN in D; then will PC : RD : : PQ : RS : : m : n.

2. If we suppose not only $l = k$, but also $\theta =$ zero, and B coincident with A; then it is evident the problem becomes the "*Section of Ratio*" of Apollonius. Moreover, it is evident the preceding solution to the Apollonian problem flows directly from the present more general problem, for in this particular state of the data we evidently have G coincident with O, and B, L, and I coincident with A, and ARH in straight line, &c.

3. Since PC.SD : QC.RD : : l : k, if we suppose in NN SR and RU always equal l and k, we have PC.SD : QC.RD : : SR : RU.

Now, if we suppose R and U to remain fixed, and that S becomes infinitely distant, then for a point D at a finite distance, we have SR = SD, and therefore PC.RU = QC.RD.

Hence (QC—QP). RU = QC.RD, and (RU—RD) QC = QP.RU, ∴ DU.QC = QP.RU.

Or, UD.QC = QP.UR = a known magnitude.

Hence, we derive a method of solving the problem. "*Given the points* U *and* Q *in given straight lines* NN *and* MM; *through two given points* A *and* B *to draw two straight lines* AI *and* BI *making the angle* IA *right to* B *equal a given angular magnitude θ right, and such that* C *and* D *being the respective points in which* AI *and* BI *cut* MM *and* NN, *we shall have* UD.QC = $m.n$." Where $m.n$ is given in sign, and the directions on the given lines particularised.

It is evident that in this case G coincides with P, and that circle GPQ touches PG at this double point, and ∴ that the triangle QOP is similar to URB, &c.

Hence, the solution of this enunciated problem may be made as follows:—In MM and NN take P and R such that QP.UR $= m.n$; describe the circle AIB such that I being any point in it, the angle IA right to B $= \theta$ right; through P draw a line PG making the angle PG right to M $=$ RB right to N, and describe the circle QOP through Q which touches this line at P; find the point O in this circle such that PO : QO : : RB : RU; through the point L in which RB again cuts the circle AIB, draw AL to cut PO in H; describe the circle AOH; through either point C in which this circle cuts MM, draw CA to cut the circle AIB again in I; draw BI to cut MN in D. Then will AI and BI be answerable lines.

Moreover, it is evident that the angles PO and QO right to M are respectively equals to the angles BR and UR right to U and B, and that we can, therefore, determine PO and QO without drawing PG or describing the circle QPOG.

4. If in addition to the conditions of this third case, we suppose the angle $\theta =$ zero, and B coincident with A; then, it is evident, the problem becomes the "*Section of Space*" of Apollonius. Here again it is evident RAH is a straight line, and that the solution which I have given to this Apollonian problem has been derived from the present more general problem.

5. We have PC.SD : QC.RD : : l : k, when the angle θ has any finite magnitude; and it is evident that when $\theta =$ zero, and that MM coincides with NN, we have PC.SC : QC.RC : : l : k, which is the "*Determinate Section*" of Apollonius. It is further evident that the solution just given to this Apollonian problem has been derived from the present more general one.

REMARKS.

If K be the other point in which SB cuts the circle AIB; then it is obvious AK and QO intersect in a point T in the circle AHO.

If U be the other point of intersection of the circle OGPQ with any circle AOH, and that PV be drawn parallel to AL to cut circle OGPQ in V, then will VUA be in one straight line. Therefore, as the point U is known independent of the ratio, the limiting circles $Ah'o'U$ passing through A and U can be hence easily described.

It is also evident QV is parallel to AK, &c.

Again it may be remarked that if we could solve the generating problem by a different method, we could thence derive other analogous solutions to the 'the Three Problems of Section.'

However, instead of giving another solution to the problem, in which it is required to have PC.SD : QC.RD : : l : k. I will now solve the more extended generating problem in which it is required to have

PC.SD + $p.s$: QC.RD + $q.r$: : l : k, where the magnitudes and signs of the rectangles $p.s$, and $q.r$ are given.

ANALYSIS.

(The figure to be supplied by the reader.)

Suppose we draw PG, QG, making the angle PG and QG right to M, respectively equals to SN and RN right to B. Then the point G is given.

If we draw CE and CF meeting PG and QG in E and F, so that the angles EC and FC right to P and Q shall be each equal to angle DB right to R or S. Then it is evident the triangles QCF, PCE, are similar to the triangles RBD, SBD, and that a circle can pass through CFEG. Moreover, it is evident PC.SD and QC.RD are respectively equal to PE.SB and QF.RB, and therefore we have PE.SB + $p.s$: QF.RB + $q.r$: : l : k.

And if in PE and QF we take the points J and T, such that JP.SB and TQ.RB are equals respectively to $p.s$ and $q.r$; then it is evident the points J and T are known, and that JE.SB : TF.RB : : l : k. Now, from the porisms in *Transactions* for 1859, we know that the circle EFG will cut the known circle JTG in a point O such that JO.SB : TO.RB : : l : k; and therefore O is a known point in circle JTG.

Again, let V be the point in which CA cuts circle CEFG, and U that in which GV cuts circle JTG, and H that in which UA again cuts circle JTGU.

We have angle HO right to U or A = GO right to U or V = CO right to V or A, and therefore a circle can pass through COH and A; but the angle VG right to C being equal EG right to C it is equal DN right to B, and ∴ if W be the point in which GV cuts NN, a circle can pass through VIDW, and the angle WV right to D or N is equal the angle IV or IA right to D or B, and thererefore GW is known in position. Moreover, the point U where GW cuts circle

JTG is known, and the other point H in which UA cuts circle JTGU, and $\therefore$ the point C in which the circle HAO cuts MM, and hence CAI and BID.

The *composition,* &c., may be easily made. However, in order to familiarise the methods of arriving at the limits of angular magnitudes in other questions, I will indicate the nature of the limits of θ right.

Limiting Values for θ Right.

As the points O and A are known independently of θ, $\therefore$ it is evident that by describing the two circles through O and A which touch MM, and putting H′ and H′ for the points in which they again cut circle JTG, and U′ and U′ for those in which AH′ and AH′ again cut this same circle, and W′ and W′ for the points in which GU′ and GU′ cut NN, then will the angles W′G right to N and W′G right to N be the limiting values of θ right. And, if h' and w' be the points in which GA cuts the circle JTG and line NN, it is evident that G may be regarded as a position of U corresponding to w'.

Moreover, it is evident that if w' lies between W′ and W′, and that h' *is not* inside or outside *both* circles through A and O touching MM, then will the circle OAh' cut MM in imaginary points; and the limiting values for θ right are evidently such *as to include between them* all values of θ right (and no others) for which the lines AI and BI are imaginary. But if w' lies between W′ and W′, and that h' is inside or outside both circles through A and O touching MM, then will the limiting values of θ right be such *as to have outside them* all values of θ right (and no others) for which the lines AI and BI are imaginary.

And it is further evident, that if w' lies outside W′W′ and that h *is not* inside or outside both circles through A and O touching MM, then will the limiting values of θ right be such *as to have outside them* all values of θ right (and no others) for which AI and BI are imaginary; but if w' lies outside W′W′, and that h' is inside or outside both circles through A and O touching MM, then will the limiting values of θ right be such *as to include between them* all values of θ right (and no others) for which AI and BI are imaginary.

When θ right is equal either limit, the lines AI are coincident and real.

Moreover, it is evident that when A and O are not on the same side of MM there are no real limits to angle θ right, &c.

NOTES.

1. It is evident that the *porisms* in the *Transactions* for 1859 can, with many others, be derived from the porismatic states of the data of this or the first Generating Problem of the Three Sections.

2. And very probably, the Greek geometers derived from this and other kindred problems, by means of projections, &c., part of their '*porismatic knowledge*' which is now known as the '*anharmonic properties of pencils and divisions.*'

3. In the investigations of the limits of the angles θ right in problems 1 and 2 of my paper in the *Transactions* for 1859, it would be well to omit all the words from 'And it is moreover evident,' &c., and substitute the following:—And when the circles iBC circumscribe the portion of circle ACH which *is not* within or outside both the circles BAi, the limiting values include between them all values of θ right, and no others, for which CO and BO are imaginary; but when the circles iBC circumscribe the portion of circle ACH which *is* within or outside both circles BiA, then the limiting values have outside them all values of θ right, and no others, for which CO and BO are imaginary. At the limits the lines CO are real and coincident.

THE TANGENCIES.

FIRST SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, C.

ANALYSIS.

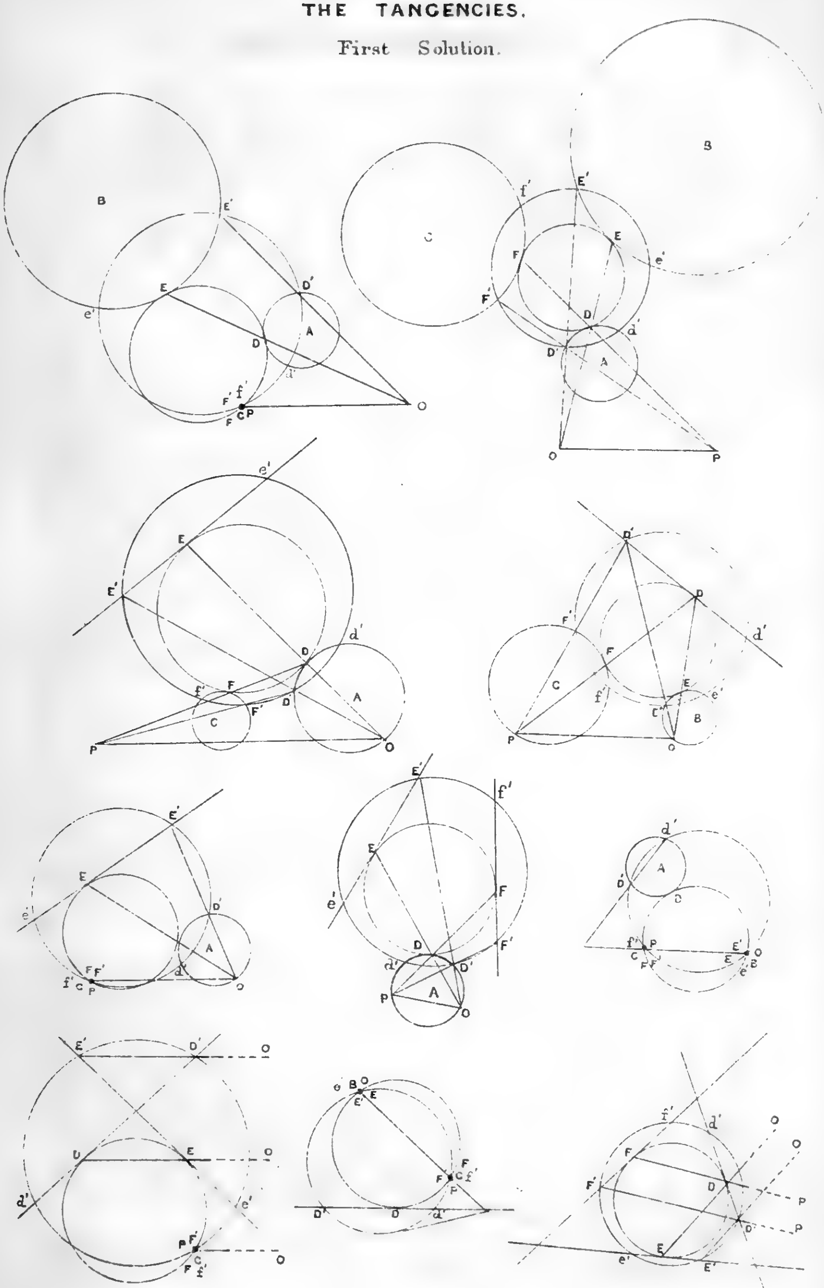
Let D, E, F, be the respective points of contact of the required circle with the circles A, B, C. Then DE passes through O a known centre of similitude of circles A, B; and DF passes through P, a known centre of similitude of the circles A, C.

Now if D′ be any assumed point in circumference A, and that E′, F′, are the dissimilar points in which OD′ and PD′ cut circumferences B and C; then PD′.PF′ = PD.PF, and OD′.OE′ = OD.OE; and it follows that the circles D′E′F′, DEF, have PO as radical axis.

Let d', e', and f', be the other points in which the known circle D′E′F′ cuts the circles A, B, C. It is evident the

THE TANGENCIES.

First Solution.



straight line $D'd'$ and the common tangent to the circles A and DEF at D, cut each other in PO the radical axis of the circles DEF and $D'E'F'$. And for like reasons it is also evident that the intersection of $E'e'$ and the tangent to circle B at E, and also the intersection of $F'f'$ and tangent to circle C at F, are in PO.

But the intersections of the straight lines $D'd'$, $E'e'$, and $F'f'$ with PO are known; ∴ the tangents from these points to the respective circles A, B, C, are known; hence, the points of contact D, E, F, being known, the circle DEF is known.

—— Or, having found either point of contact the others can be easily determined. Thus for instance when D is found, then E and F are the dissimilar points in which OD and PD cut the circles B and C.

COMPOSITION.

Find O a centre of similitude of circles A and B; find P a centre of similitude of circles A and C; through D' any assumed point in circumference of circle A, draw OD' and PD' to cut the circumferences of B and C in the points E' and F' dissimilar to D' on circumference A; describe the circle $D'E'F'$ and draw $D'd'$, $E'e'$, $F'f'$, its respective chords of intersection with the circles A, B, C, to cut the straight line PO in *a*, *b*, *c*.; draw *a*D tangent to the circle A; draw OD and PD to cut the circles B and C in the points E and F dissimilar to point D on circle A; describe the circle DEF. Then will DEF be a required circle.

For $OD.OE$ being $= OD'.OE'$, and $PD.PF = PD'.PF'$, it follows that OP is the radical axis of the circles DEF and $D'E'F'$, and therefore that *a*D is tangent to the circle DEF as well as to circle A at the point D: and hence the circle DEF touches circle A at D.

And since ODE passes through the point of contact D of the circles DEF and A, and that O is a centre of similitude of circles A and B, and that the points D and E on circles A and B are dissimilar, ∴ the circle DEF touches the circle B in E. And for similar reasons the circle DEF touches circle C in F.

NOTES.

It is well to observe that we can find the points D and F from E (E being the point of contact of a tangent from *b* to circle B) by drawing OE to cut the circle A in the point D dissimilar to the point E on circle B, and then PD to cut the circle C in F the point dissimilar to D on circle A. And in like manner we may find D and E from F the point of contact of the tangent from c to circle C.

Moreover, it is evident that we can find D even when the circle A is infinitely great, for the tangents from a to circles A and D′E′F′ are equal.

As there are two points O, and two points P, there are four lines PO and ∴ evidently four answerable points a; and hence, as there are two tangents from each point a to the circle A, it follows that there are in all eight answerable circles DEF, real or imaginary in pairs.

Now DD, EE, and FF, are the polar chords of the circles A, B, and C in respect to the points a, b, c in PO. Let Q be the centre of similitude of the circles B and C through which EF passes. Then OPQ is straight. And as DD must pass through a' the pole of OPQ in respect to circle A, and that EE must pass through b' the pole of OPQ in respect to circle B, and that FF must pass through c' the pole of OPQ in respect to circle C; hence it follows, because ODE, PDF and QFE are straight lines, that DD, EE and FF must meet in the radical centre R of the given circles A, B, C. And this indicates the method of solution given by Gergonne.

It is also easy to see that DD passes through A′ the extremity of the diameter AA′ of the known circle D′Ad'; and EE evidently passes through B′ the extremity of the diameter BB′ of circle BE′e'; and FF passes through C′ the extremity of the diameter CC′ of the circle CF′f'.—Hence other methods of solution.

We may also remark, that as there are four points a, and that the four *polars* of these points in respect to the circle A pass through the radical centre R of the three given circles, it follows that the four points a are situated in the polar of R in respect to the circle A.

And, similarly, the four points b are on the polar of R in respect to the circle B, and the four points c are on the polar of R in respect to circle C.

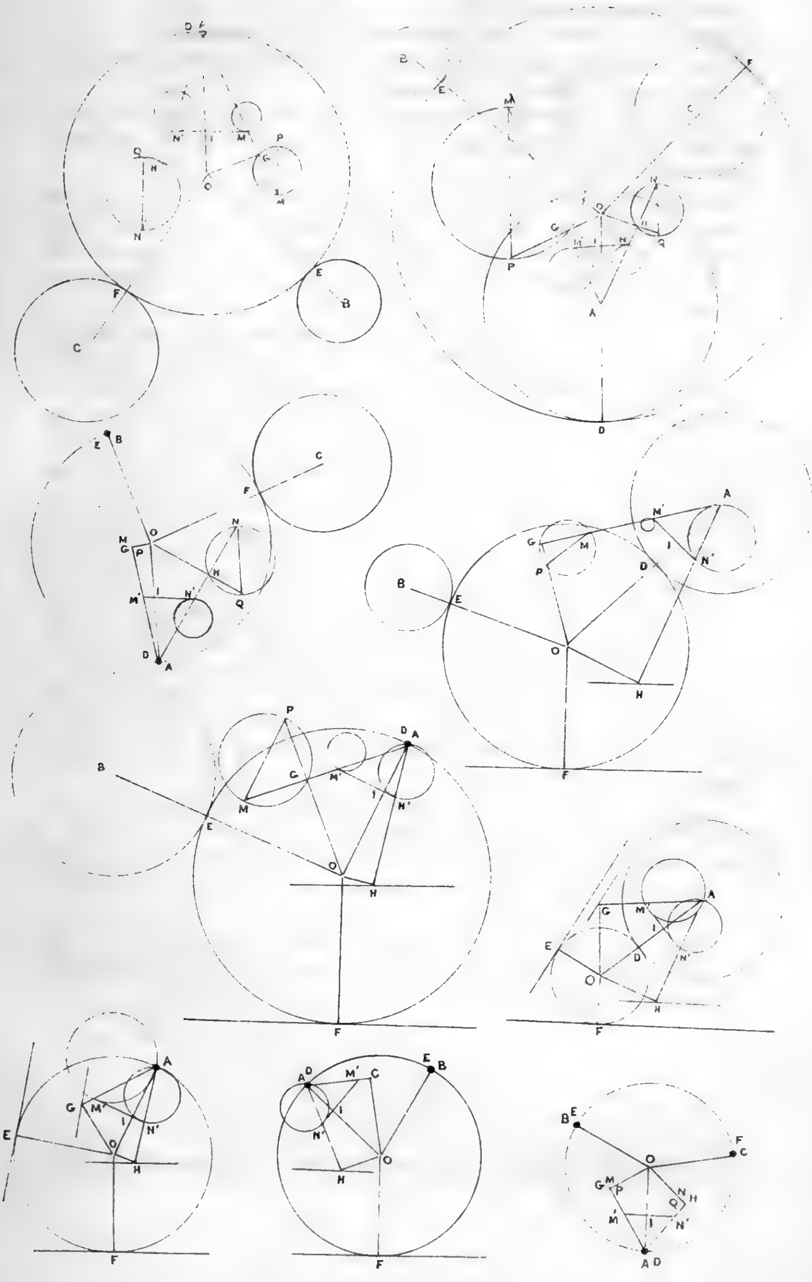
SECOND SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, C.

THE TANGENCIES

Second Solution.



ANALYSIS.

Let O be the centre of the required circle, and let D, E, F be its points of contact with the given circles A, B, C. Then OAD, OBE, OCF are straight lines.

Since OD = OE, if OG bisects the angle OD *right round* to OE, and that AG is perpendicular from A on OG, then is the locus of G a known circle having its centre in the middle point of AB, and such that its diameter MP intercepted by AG and OG is parallel to AO. Similarly, since OD = OF, it follows that if OH bisects the angle OD *right round* to OF, and that AH is perpendicular from A on OH, then will the locus of H be a known circle having its centre equally distant from A and C, and such that the diameter NQ intercepted between AH and OH shall be parallel to AO.

And if we assume any auxiliary circle having A as centre, and that AH.AN′ is equal to the square of its radius, then the locus of N′ is a known circle N′H′Q′ such that H′ being the other point in which AH cuts it, the segments cut off by the chords NH and N′H′ are similar. And, for like reasons, if on AG we take the point M′ such that AG.AM′ = the square of the radius of the auxiliary circle, then will the locus of M′ be a circle having with MGP the point A as a centre of similitude, and such that if G′ be the other point in which AG cuts it, the segments cut off from it and circle PGM by the chords MG and M′G′ are similar.

Let I be the point in which AO cuts M′N′.

Since the angles G and H are right, and that AG.AM′ = AH.AN′ = square of radius of auxiliary circle, it follows that M′N′ is perpendicular to AO, and that AO.AI is equal the square of radius of auxiliary circle.

Again, the angle M′N′ right to A being equal to the angle OA right to G = PM right to G, it is ∴ = P′M′ right to G′, and ∴ M′N′ touches circle M′G′P′ in M′. Similarly, since angle N′A right to M′ = OH right to A = QH right to N, it is ∴ equal Q′H′ right to N′, and ∴ M′N′ touches the circle N′H′Q′ at N′.

Hence as M′N′ is a common tangent to two known circles it is itself known, and ∴ the centre O which is the pole of M′N′ in respect to the auxiliary circle, is known, and ∴ also the circle DEF.

And since the radius of the circle PGM can be taken equal to the half sum or half difference of the radii of circles A, B, and that the radius of circle NHQ can be taken equal either the half sum or half difference of the circles A, C, and that to each of the resulting pairs of circles there are two answerable tangents, ∴ it is evident there are four pair of answerable centres O, and ∴ eight solutions to the question which are real or unreal in pairs.

The *composition* may be easily made. And it may be as well to remark that when we suppose the circle C infinitely great, then will the circle NHQ also be infinitely great; and its infinite circumference bisects all straight lines drawn from the point A to the infinite circumference of circle C, &c., &c.

It may be right to observe that by introducing an auxiliary circle into the Fourth Solution in a similar manner to that in this solution, we can make it intelligibly applicable to the minor cases which now escape it; but though this might be an advantage as regards the greater generality obtained, it would not indicate such neat solutions to the leading cases.

THIRD SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, C.

ANALYSIS.

Let D, E and F be its points of contact with the given circles A, B and C.

Then DE, DF and EF pass through the respective points O, P and Q, centres of similitude of the given circles which are in one straight line.

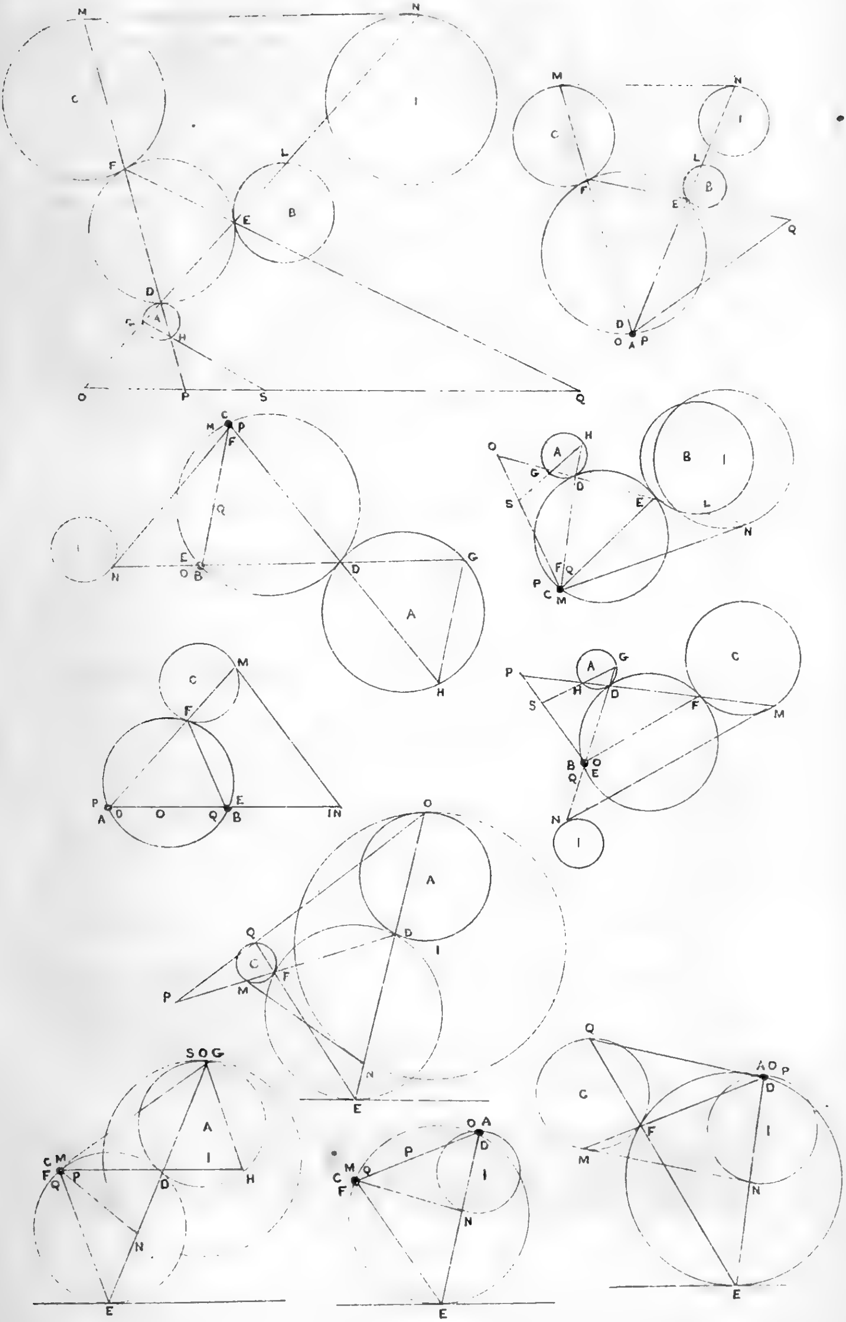
Let G and L be the other points in which DE cuts the circles A and B; and let H and M be those in which DF cuts the circles A and C; and let S be the point in which GH cuts the axis of similitude OPQ. Then OS has to OQ the known ratio which OG has to OE, and ∴ the point S is known.

Now the ratio of OG.DH to PH.DG, which is the same as that of OS to PS, is known; and the ratio of PD.PH to OD.OG is also known; ∴ the ratio compounded of these ratios or that of PD.DH to OD.DG is known: and hence as DH : DG : : DF : DE, it follows that the ratio of PD.DF to OD.DE is known.

Or—which amounts to the same—the ratio of OE.FD to PF.ED being the same as that of OQ to PQ is known; and the ratio of PF.PD to OE.OD is (the same with that of

THE TANGENCIES

Third Solution.



PF.PM. rad B to OE.OL. rad C) known; hence the ratio of PD.DF to OD.DE is known.

Let N be the point in which a tangent to the circle C at M cuts the straight line ODE.

It is evident DE.DN = DF.DM, and that DE.DN has to OD.DE a ratio compounded of the known ratios of PD.DF to OD.DE, and of DM to PD.

Or—which amounts to the same—it is evident DE.DN has to OD.DE a ratio compounded of the known ratios of OQ to PQ, of PD.PF to OD.OE, and of DM to PD, which may evidently be expressed as the ratio compounded of the ratios of OQ to PQ and of PF.DM to OD.OE.

Hence it follows that the point N must be in the circumference of a known circle NXX having with circle A the point O as centre of similitude.

Moreover, if K be the other point in which DE cuts circle NXX we have the angle XK right to N = angle FE right to D, and ∴ = angle ND right to M; and hence MN is tangent to the circle NXX at N.

Now MN being a common tangent to two known circles, it is itself known; and ∴ the other point F in which the straight line PM cuts circle C is known, as also the point D in which it cuts the circle A similarly to the point M on circle C; and the point E in which ON cuts the circle B similarly to point N on circle NXX is known: and ∴ the required circle DEF is known.

COMPOSITION.

Find O, a centre of similitude of A and B; find P a centre of similitude of A and C; and Q a centre of similitude of B and C in the line OP; and find the point S in OPQ such that OS : OQ : : rad A : rad B.

Through O draw a straight line OD′E′ to cut the circles A and B in dissimilar points D′ and E′; draw PD′ to cut circle C in the point F′ which is dissimilar to D′ on circle A, and to cut it again in M′; find the point N′ in OD′E′ such that D′N′.D′E′ shall have to O′D′.D′E′ the ratio compounded of the ratios of D′M′ to PD′ of OS to PS and of PD.PH to OD.OG, —or which amounts to the same—such that D′N′.D′E′ shall have to OD′.D′E′ a ratio compounded of the ratios of OQ to PQ and of PF′.D′M′ to OD′.OE′; draw N′ I parallel D′A to cut OAB in I; with I as centre and radius IN′ describe a circle; draw MN a common tangent to the circles C and I;

through the point of contact M, on circle C, draw PM to cut the circle C again in F, and to cut the circle A in D similarly to the point M on circle C; draw ON to cut circle B in E similarly to the point N on circle I; describe the circle DEF. Then is DEF a required circle.

NOTES.

This method of solution holds intelligibly good in all cases in which neither of the circles A or C is *infinitely great.* When the circles A and B are *infinitely smalls* the centre of similitude O may have any position whatever in the line AB, as the ratio of their radii may be of any magnitude; and similar remarks apply to the centre of similitude Q when the circles B and C are infinitely smalls. By fixing the ratio of these infinitely small circles, we fix the positions of the centres of similitude; and it is evident we may suppose one of them infinitely small in respect to the other, so as to have the centre of similitude coincident with this other in respect to finite distances. And similar remarks apply as to the ratios of infinitely great radii.

This solution furnishes three methods to the case in which two of the given circles are finite and the third infinitely small. And that one in which we have A the infinitely small circle is in substance the same as what is given by Monsieur Auguste Cauchy.

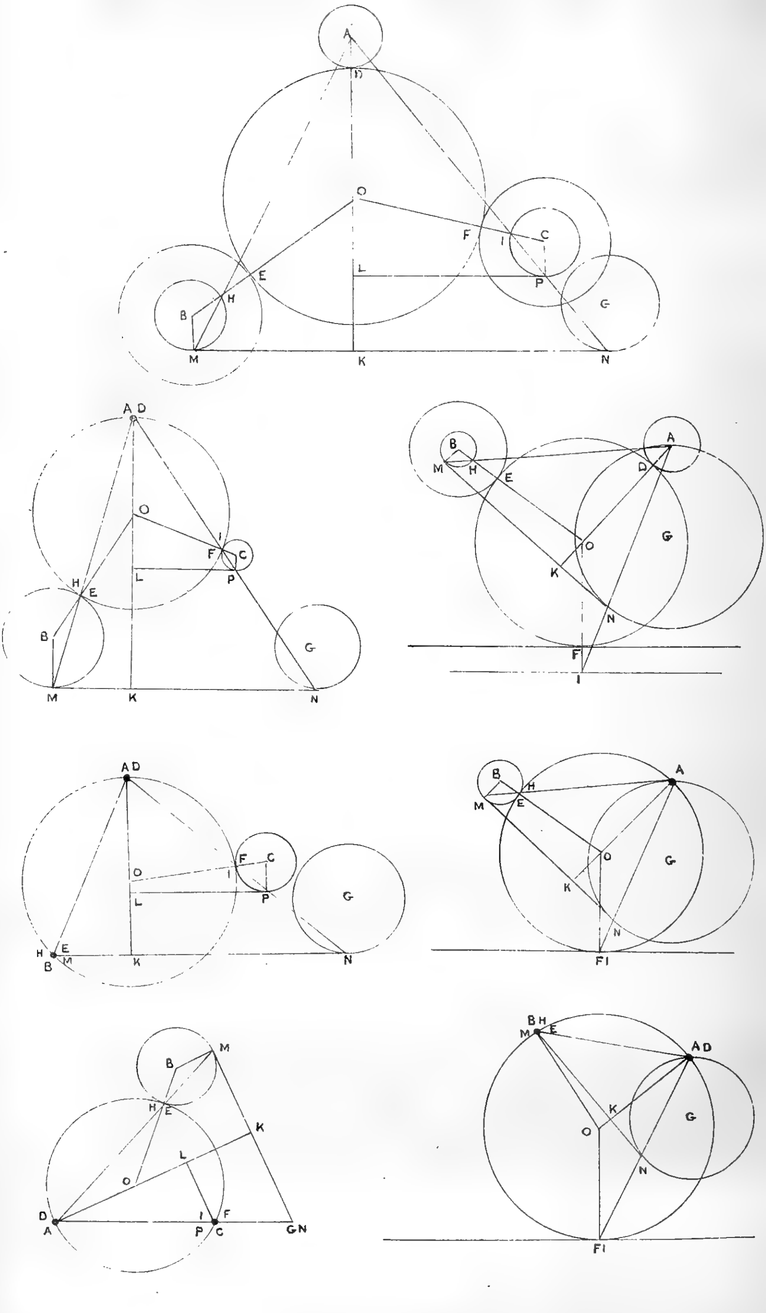
We are furnished with two methods for the case in which two of the circles are infinitely smalls, and the third finite:—one of which (when A and B are the infinitely smalls), is in substance the same as what is given by *Pappus* as the solution to this case from the *Work* of Apollonius.

However, here as elsewhere, when I speak of a general solution being inapplicable to any case or cases, it is to be considered inapplicable only in a graphical point of view, for a general solution holds mentally good in all cases, even when quantities may be infinitely great or small; and the mind's conviction in such cases is established by its knowledge concerning properties of finite quantities and its own power of legitimately applying the principle of '*continuity*' derived, in degree, from this knowledge.

It is also to be observed that owing to our imperfect knowledge of infinitesimal geometry, or to the nature even of this geometry, it may often happen that we cannot intelligibly arrive at some necessary theorem from one point of view, so

THE TANGENCIES

Fourth Solution



as to employ the steps in a graphic construction; and that, for this reason, it will be compulsory to vary the steps, as is well exemplified in the 3rd solution to the Tangencies.

FOURTH SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, C.

ANALYSIS.

Let O be the centre of the required circle, and let D, E, F be its points of contact with the given circles A, B, C.

In OB take OH = OA, and then EH is = DA; and it is evident the circle having B as centre and BH as radius is known. Moreover, if M be the other point in which AH cuts this circle, and K that in which a tangent to it at M cuts AO, then, since BM and AO are parallels, it follows that MK is perpendicular to AO. It is also evident that AO.AK = $\frac{1}{2}$ AH.AM, and is $\therefore$ of known magnitude.

Similarly, if in OC we take OI = OA, and that from the other point P in which AI cuts the known circle having C as center and CI as radius, we draw a tangent to cut AO in L, then will this tangent be perpendicular to AO, and will AO.AL = $\frac{1}{2}$ the known magnitude AI.AP.

Now if N be the point in which MK cuts AIP, then as AN.AI has to AP.AI the same ratio which AN has to AP or which AK has to AL or which AK.AO has to AL.AO, it follows that AN.AI = twice AK.AO = AM.AH, and $\therefore$ that the locus of N is a known circle G having with circle C the point A as centre of similitude.

And since PL is tangent to C at P, it is evident KN is tangent to circle G at N; $\therefore$, since MKN is common tangent to the two known circles BM and GN, it is itself known; and AK perpendicular to it is known, as also the point O such that AO.AK = $\frac{1}{2}$ the known magnitude AH.AM. Hence the circle DEF is known.

COMPOSITION.

Draw any radius BE′ of the given circle B; draw any radius CF′ of the given circle C; in BE′ and CF′ make E′H′ and F′I′ each equal to the radius of the given circle A; with B and C as centres and BN′ and CI′ as radii describe circles;

draw AH′ and AI′ to cut these circles again in M′ and P′; find N′ in AI′ such that AN′.AI′ = AH′.AM′; draw N′G parallel P′C to cut AC in G; with G as centre and GN′ as radius describe a circle; then, according as $\frac{E'H'}{F'I'}$ has like or unlike sign with $\frac{F'B}{F'C}$, draw MN a common tangent *direct* or *inverse* to the circles BM′ and GN′; draw AK perpendicular to MN and in it find the point O such that AO.AK = $\frac{1}{2}$ AH.AM (this can evidently be done by producing AK until KA′ = AK; and then describing the circle A′M′H′ to cut AK again in O.)

The point O is a centre of a required circle, &c.

NOTES.

Here, too, as in the last solution, it may be remarked that the general solution gives more than one method when applied to many of the particular cases.

From this solution also we arrive at that given by Cauchy for *two circles and a point* (by supposing the circle A infinitely small), and we arrive at that of Pappus given in Leslie's Geometrical Analysis for the case of *two points and a circle* (by supposing the circles A and C infinitely small).

Moreover, we see what has not been remarked by the authors of these solutions to the particular cases, viz.:—that the perpendicular from the point A on the tangent MN passes through the centre O of the required circle.

FIFTH SOLUTION.

To describe a circle to touch three given circles A, B, and C.

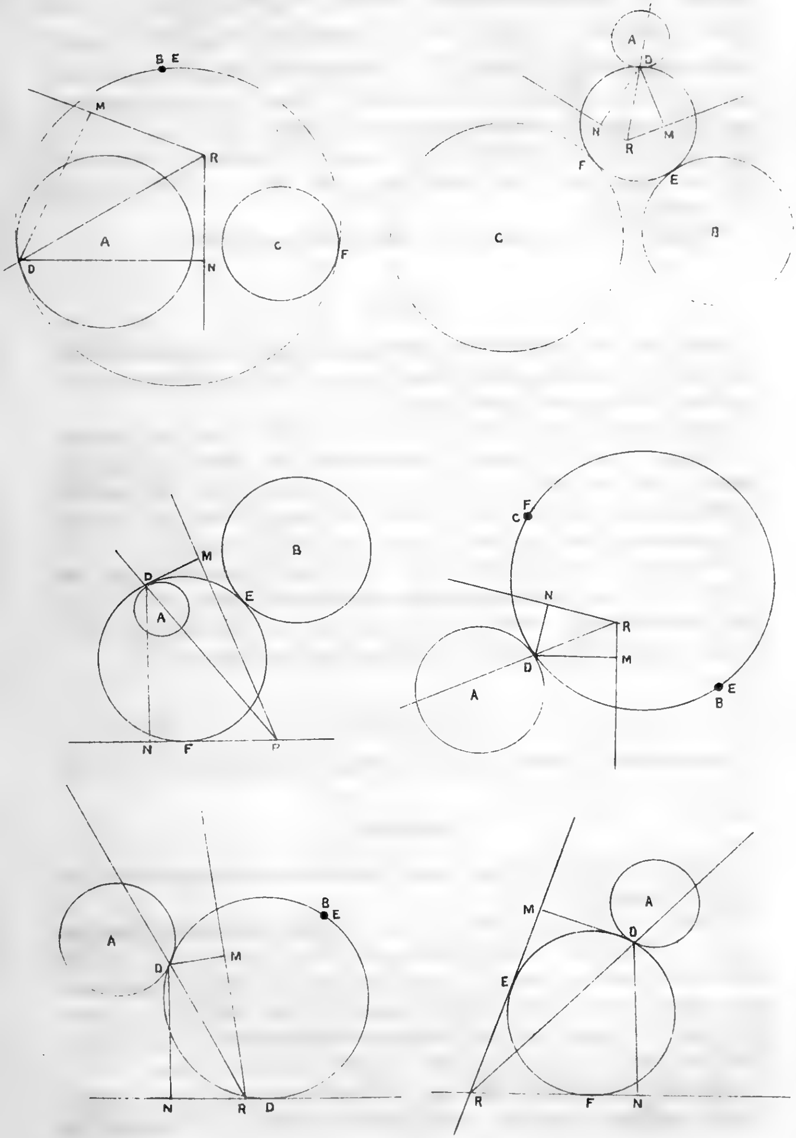
ANALYSIS.

Let D, E, F, be the points of contact of the required circle with A, B, and C.

Now (as will appear from some of the porismatic developments), if DN be a perpendicular from D on the radical axis of the circles A and C, and that DM is a perpendicular on the radical axis of the circles A and B, then will DN.AC have to DM.AB one of the four ratios comprehended in that which $(AC)^2—(\text{rad A} \pm \text{rad C})^2$ has to $AB^2—(\text{rad A} \pm \text{rad B})^2$.

Hence it is evident DN has to DM a known ratio; and ∴ as the radical axes RN and RM are known, it follows that

THE TANGENCIES
Fifth Solution



the straight line RD is known in position; and ∴ the point D where it cuts circle A is known.

Similarly, by drawing perpendiculars from E on the radical axis RM and on the radical axis to the circles B and C, it can be shown that RE through R is known in position, and ∴ E is known.

And in like manner we can find the point F on circle C. Or the circle DEF can be easily found from any of the points D, E, F, of contact, since the lines joining these points pass through known centres of similitude, &c.

The *composition* may be easily made.

NOTES.

The ratio which DN has to DM, is as has been indicated,

$$\frac{DN}{DM} = \frac{AB\left\{(AC^2-(\text{rad A} \mp \text{rad C})^2\right\}}{AC\left\{(AB^2-(\text{rad A} \mp \text{rad B})^2\right\}}$$

And, in order to show that this holds good for all values of the radii C and B from zero to infinity inclusive, let c and b be the points in which AC and AB cut the circles C and B, and let a be that in which either of these lines cuts circle A.

We have $AC = Ac + cC$, rad $A = Aa$, rad $C = Cc$, rad $B = Bb$; and ∴ we can put the ratio under the form

$$\frac{DN}{DM} = \frac{AB\left\{(Ac^2 + 2\,Ac.cC - Aa^2 \pm 2\,Aa.cC\right\}}{AC\left\{(Ab^2 + 2\,Ab.bB - Aa^2 \pm 2\,Aa.bB)\right\}}$$

which evidently holds good for all values of the radii B and C.

The above method of solution requires one circle (as A) to be finite. When circles C and B are infinitely smalls

$$\frac{DN}{DM} = \frac{AB}{AC}\cdot\frac{Ac^2-Aa^2}{Ab^2-Aa^2} = \frac{AB}{AC}\cdot\frac{AC^2-Aa^2}{AB^2-Aa^2}$$

When circles C and B are infinitely greats

$$\frac{DN}{DM} = \frac{Ac \pm Aa}{Ab \pm Aa}.$$

When c is infinitely great and $b =$ zero

$$\frac{DN}{DM} = \frac{2.AB\,(Ac \pm Aa)}{AB^2 - Aa^2}$$

When $c =$ zero, and b infinitely great

$$\frac{DN}{DM} = \frac{AC^2-Aa^2}{2.AC\,(Ab \pm Aa)}.$$

From Gergonne's solution, and the theorem on which the above solution depends, it is evident we have expressions for the ratios of the perpendiculars from the poles of the axes of similitude on the radical axes, &c., &c.

SIXTH SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B and C.

ANALYSIS.

Let D, E, and F be the points of contact of the required circle with the three given circles A, B, and C.

Then DE, DF and EF pass through O, P and Q centres of similitude of the given circles; and OPQ is an axis of similitude.

Let G and H be the other points in which ED and FD cut the circle A, and S that in which HG (which is parallel EFQ) cuts POQ.

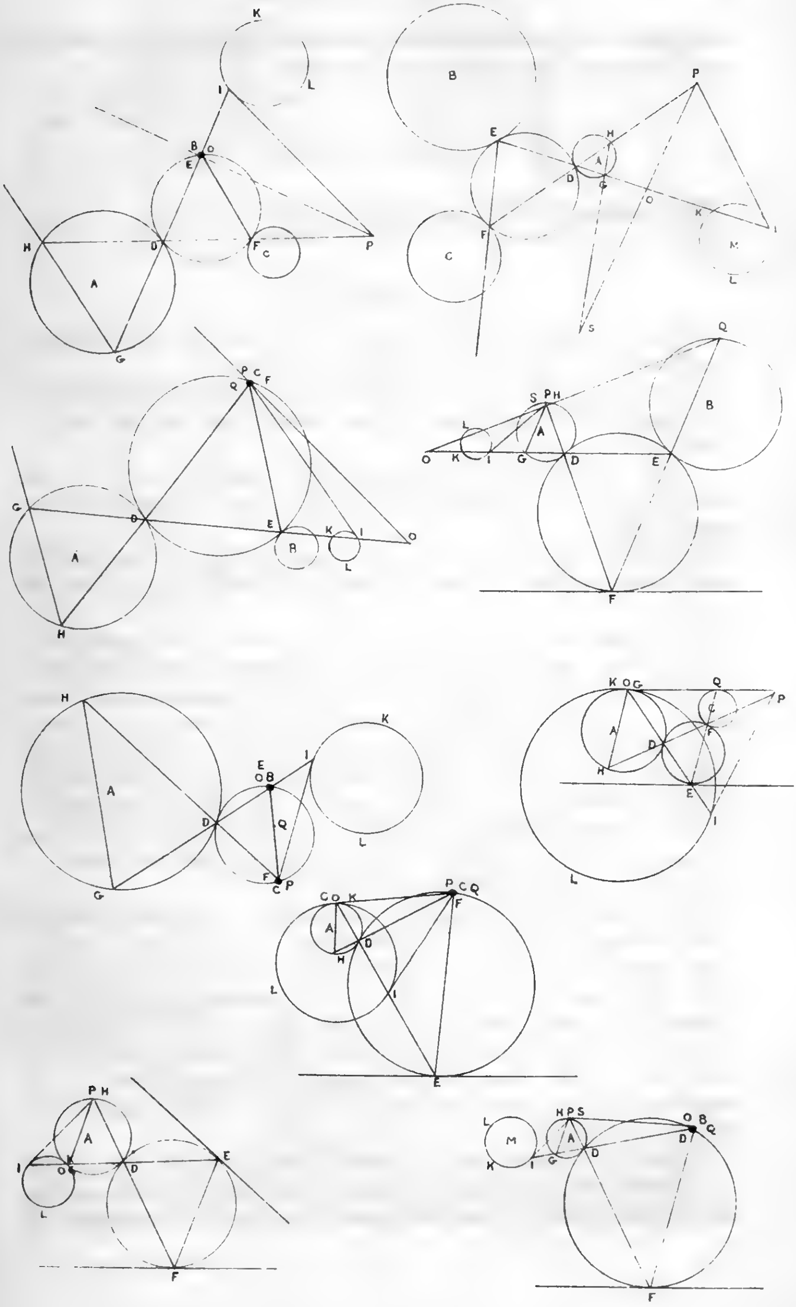
Then OS has to OQ the known ratio which OG has to OE, and which radius A has to radius B, and ∴ S is a known point.

Now the ratio OG.DH to PH.DG, being the same with that of OS to PS, is known; and the ratio of PD.PH to to OD.OG is also known; ∴ the ratio compounded of these ratios, or that of PD.DH to OD.DG is known: or—which amounts to the same—the ratio of OE.FD to PF.ED being the same with that of OQ to PQ is known; and the ratio of PF.PD to OE.OD is known; and ∴ the ratio compounded of these ratios, or that of PD.DF to OD.DE is known; and ∴, as DF : DE : : DH : DG, it follows that the ratio of PD.DH to OD.DG is known.

Let I be the other point in which a circle through P, H and G would cut OGD. Then PD.DH = ID.DG; and ∴ ID has to OD the known ratio which PD.DH has to OD.DG, and the point I must be in the circumference of a known circle ILL having with circle A the point O as a centre of similitude. Moreover, if K be the other point in which DO cuts this circle, then as the angle LK right to I is = HG right to D, it is = ID right to P; and ∴ PI is a tangent to the circle IKL at I.

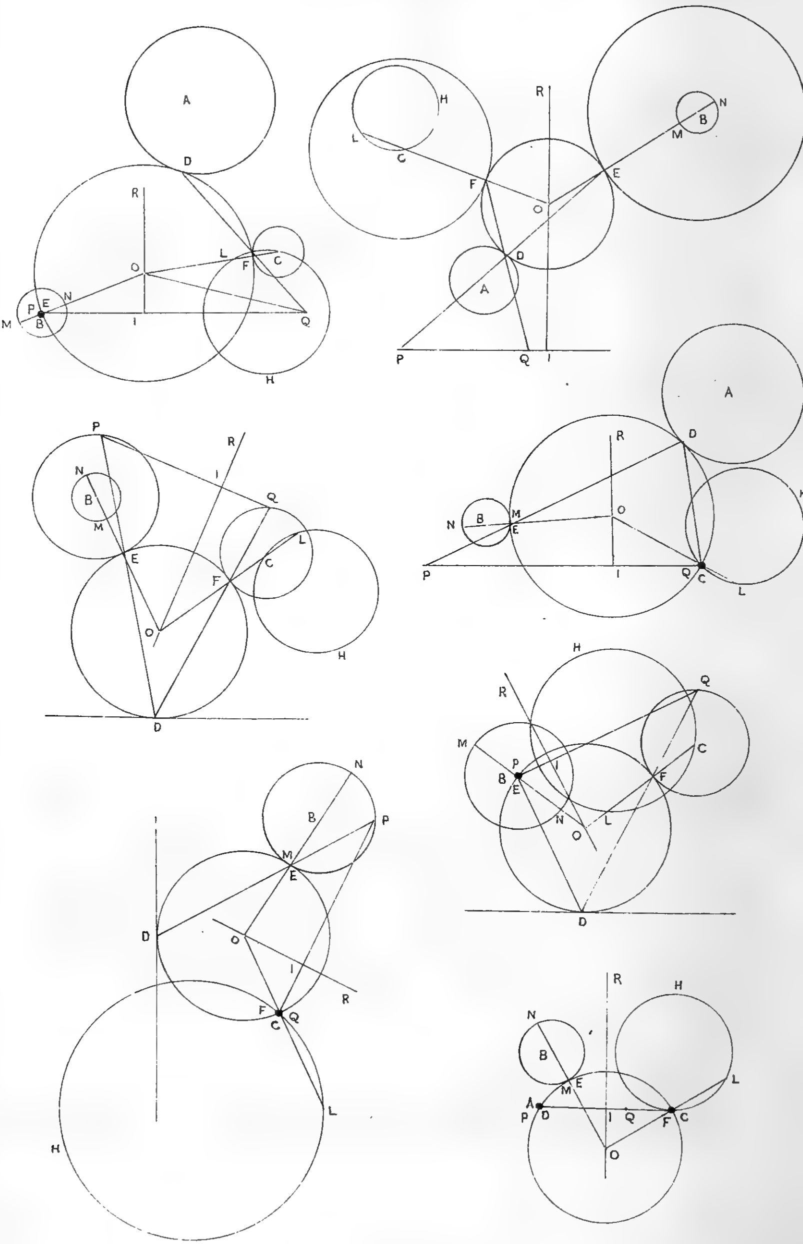
Now PI is known, and ∴ also IO and the point D on circle A similar to I on circle ILK, as also the point E on B dissimilar to D on A; and the point F on circle C in which PD

THE TANGENCIES
Sixth Solution



THE TANGENCIES

Seventh Solution



cuts it dissimilarly to D on circle A is known. Hence the circle DEF is known.

COMPOSITION.

Find O a centre of similitude of the circles A and B; find P a centre of similitude of the circles A and C; find Q the centre of similitude of the circles B and C which is in line with O and P; and find the point S in POQ such that PQ : PS : : rad C : rad A.

Take any point D′ on the circumference of circle A, and draw OD′ and PD′ to cut the circles B and C in the points E′ and F′ dissimilar to D′ on circle A; then on OD′E′ find the point I′ such that I′D′ shall have to OD′ the ratio compounded of the ratios of OS to PS, and of PD.PH to OD.OG: or—which is the same—find I′ such that I′D′ shall have to OD′ the ratio compounded of the ratios of OQ to PQ and of PF.PD to OE.OD.

Draw I′M parallel to AD′ to cut AO in M; from M as centre and with MI′ as radius describe a circle, to which draw PI a tangent; draw IO to cut circle A in D similarly to I on circle M, and to cut circle B in E dissimilarly to D on A; draw PD to cut circle C in F dissimilarly to circle A in D; describe the circle DEF. Then is DEF a required circle.

NOTES.

This solution holds for all the cases in which the circle A is finite, &c.

If we were to draw DR tangent to the circle A at D to cut PO in R; then as DR is parallel to PI, and that RP has to RO the known ratio which ID has to OD, it follows that the point R on PO is known; and ∴ the tangent RD to circle A is known; and hence, &c.—another method of solution.

Or we might solve the problem in a similar manner to that of the third solution from the knowledge that DF.DM has to DE.DL the known ratio of AC^2 —(rad A $\mp$ rad C)^2 to AB^2—(rad A $\mp$ rad B)^2 where M and L are the other points in which PD and OD cut the circles C and B.

SEVENTH SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, C.

ANALYSIS.

Let O be the centre of the required circle, and D, E, F the points in which it touches the given circles A, B, C.

Then ED passes through P a centre of similitude of the circles B and A; and FD passes through Q a centre of similitude of the circles C and A.

And since the rectangles PD.PE, QD.QF are of known magnitudes, and that they are respectively equal to $PO^2 - OD^2$ and $QO^2 - OD^2$, $\therefore$ $PO^2 - QO^2$ is of known magnitude and sign, and the locus of O is a known straight line OI perpendicular to PQ, and such that $PI^2 - QI^2 = PO^2 - QO^2$.

Now if in OB we have OM = OC, then EM = the radius of circle B; and BM is of known magnitude; and the circle having B as centre and BM as radius is known.

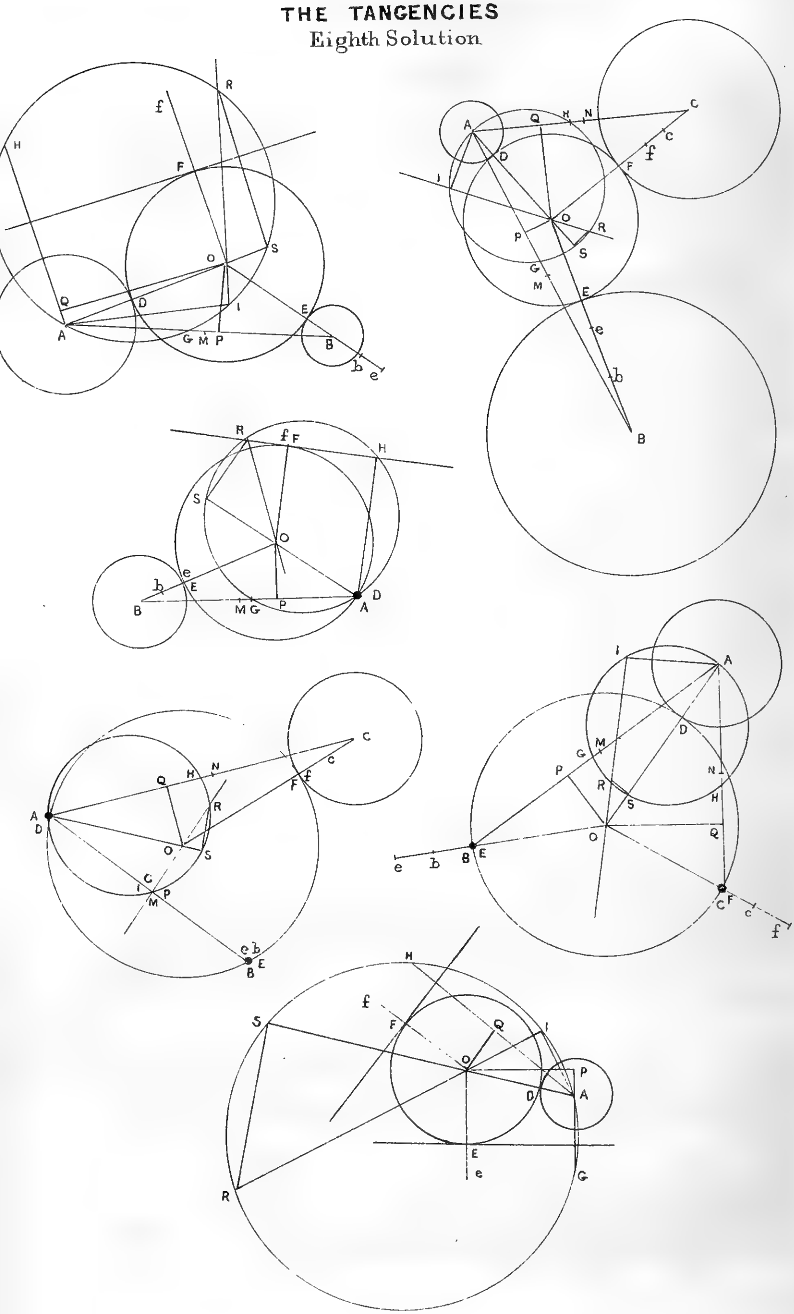
Let N be the other point in which OM cuts this last mentioned circle; and suppose the circle CHL passing through the point C and having with the circle MN the line IO as radical axis.

Then L being the other point in which OC cuts the circle CLH, we have OC.OL = OM.ON; hence as OC = OM, it follows that CL is equal the diameter MN, and $\therefore$ of known magnitude. But the circle CHL is known; $\therefore$ CL is known in position, and hence the point O in which it cuts IO, and therefore the circle DEF is known.

COMPOSITION.

Find P a centre of similitude of the given circles A and B; find Q a centre of similitude of the given circles A and C; draw a straight line PD′E′ cutting circles A, B, in dissimilar points D′ and E′; draw a straight line $Qd'f'$ cutting the given circles A, C, in dissimilar points d' and f'; find the point I in the line PQ such that $PI^2 - QI^2 = PD'.PE' - Qd'.Qf'$, and through I draw a straight line IR perpendicular to PQ: draw any radius Be' of the circle B, and from e' in the proper direction on $e'B$ make $e'm'$ = the radius of circle C; with B as centre and Bm' as radius describe a circle, and produce $e'm'$ to cut it in n'; through the point C describe the circle CHL which with circle $Bm'n'$ has IR as radical axis, and in it inflect the chord CL = to the diameter $m'n'$, and let O be the point of intersection of CL with IR: then will O be a centre of a required circle.

THE TANGENCIES
Eighth Solution



NOTES.

Since there are two points P and two points Q, there are four lines IR, and as there are four corresponding circles CL and two chords CL in each, it is obvious there are eight answerable circles O real or unreal, in pairs, according as the circles LCM are greater and less than the corresponding circles $m'n'$.

It is evident that when the circles A and C are infinitely small, and B finite, then may the point Q have any position whatever in the straight line through A and B (because the infinitely small circles may have any ratio whatever just according as we suppose two circles to have any finite constant ratio during their diminution to the infinitely small state.)

This solution does not readily apply to the case in which two of the given circles are supposed infinitely great, or replaced by straight lines; but the following is an *analysis* of a solution which will embrace all the cases in which we suppose the circle A of finite magnitude.

Since the rectangles PD.PE and QD.QF are known in signs and magnitudes, it follows (from one of a class of porisms to be included in subsequent *developments*) that we know the two points o', o', of real or imaginary intersection of all circles having their centres in PQ and respective radii equal the tangents from them to circle DEF. And since the circle A and straight line PQ are known, we know the two points a', a', of real or imaginary intersection of all circles having their centres in PQ and respective radii equal to the tangents from them to circle A. And it is evident we know the circle through the four points $o'o'a'a'$, and that its centre R is in PQ; moreover it is evident the circumference of this circle R passes through D; and ∴ D on circle A is known, and hence AD and the point O in which it cuts the straight line through $o'o'$; and ∴ the circle DEF is known

EIGHTH SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, C.

ANALYSIS.

Let O be the required centre, and let D, E, and F be the points of contact with the given circles A, B, and C.

Since the rectangle under the half sum and half difference of the sides of a triangle is equal to the rectangle under the half sum and half difference of the segments of the base made by a perpendicular from the vertex; $\therefore$ it is evident, that if OP be perpendicular to AB, and M be middle point of AB, and that in OB we have Oe = OA, and b the middle of eB, then will Ob.Bb = AM.MP; and hence Ob has to PM the same known ratio which AM has to bB.

Now if in AB we find the point G such that eb is to GM in the known ratio of Ob to PM, then will Oe or its equal AO have to PG the same known ratio.

For like reasons it is evident that if OQ be perpendicular to AC, and N the middle point of AC, and that we assume Of in OC and = to OA, and that c is middle of fC, and that we find H in AC such that fc shall have to HN the known ratio of AN to Cc, then will AO have to QH this same known ratio.

Now the points G and H are known, and the ratio of PG to QH is known (because AO has known ratios to PG and QH): hence the point I in which the circle AHG cuts the circle QAP is known; and since the angles P and Q are right, it follows that the straight line IO perpendicular to AI is known, as also the point R in which it again cuts the circle AGH.

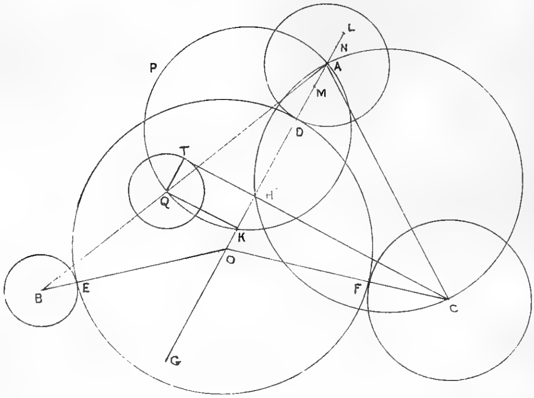
Again, GR being perpendicular to AG, it is parallel to PO; and PG has to OR a known ratio; therefore AO has to OR a known ratio.

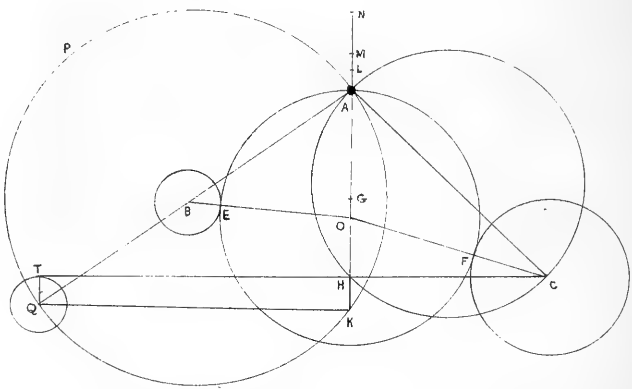
If S be the point in which AO again cuts the circle AGH, it follows, from similar triangles, that AI has to RS the known ratio which AO has to OR, and $\therefore$ the chord RS is of known magnitude, and $\therefore$ also it is known in position; and AS is known, and also the point O where it cuts IR, and $\therefore$ the required circle is known.

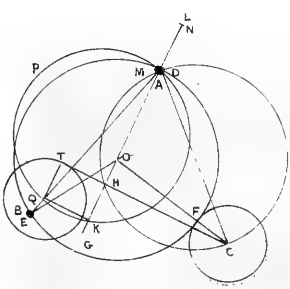
COMPOSITION.

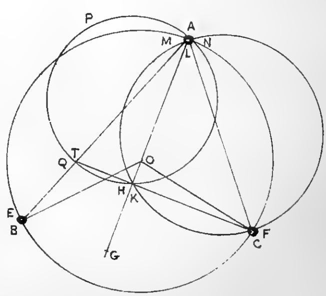
Through the centres B and C draw BE′ and CF′ any two radii of the circles B and C; from E′ in either direction on EB make E′e' = radius of circle A; from F′ in either direction on F′C make F′f' = radius of circle A; bisect e'B in b', Cf' in c', AB in M, and AC in N; find G in AB such that $e'b'$: GM : : AM : $e'b'$; and in AC find the point H such that $f'c'$: HN : : AN : $f'c'$; assume any straight line x and find lines y and z such that $x : y :: \text{AM} : e'b'$, and $x : z$

THE TANGENCIES
Ninth Solution









: : AN : : $f'c'$; on AB and AC make Gp and Hq equals to y and z, and describe the circles AGH, Apq; through the point of intersection I of these two circles draw IR perpendicular to AI to cut the circle AGH again in R; find the point i in IR so that AI : Ii : : AM : $e'b'$, and draw ii' parallel to AG to cut AI in i'; with R as centre and radius equal ii' describe a circle, and from either point S in which it cuts the circle AGH draw AS to cut IR in O.

Then will O be the centre of a required circle.

NOTES.

This method of solution holds good in all cases in which circle A is not supposed infinite, or—which amounts to the same thing—it holds good in all cases but those in which we suppose the three given circles replaced by straight lines.

If we suppose circle C infinite, then it is evident AC is parallel to OC and perpendicular to tangible portion of the infinite circumference; moreover since the ratio of AN to fc is then one of equality, so will that of AO to QH be one of equality, and ∴ QH will be = Of, and the point H in the perpendicular from A on the known portion of the infinite circumference is known as it is at a distance = radius of circle A therefrom.

It may also be observed that the line IOR is identical with the line IOR of the seventh solution.

NINTH SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, C.

ANALYSIS.

Let O be the centre of the required circle, and let D, E, F be its points of contact with the given circles A, B, C.

If in OA we suppose OM taken equal OB and so that OB and OM have like directions in respect to the directions OE and OD, then DM = EB, and it is evident AM is of known magnitude.

And since OB is equal OM and that $2.OA.OM = OA^2 + OM^2 - AM^2$.

∴ $2.OA.OM = OA^2 + OB^2 - AM^2$ both in sign and magnitude. But if G be the point in which the circle having

BA as diameter cuts AO, we have $2.OA.GO = - OA^2 - OB^2 + AB^2$. And from these two we get, by adding equal quantities, the relation $2OA.GM = AB^2 - AM^2$.

Similarly if in OA we suppose ON equal to OC and the like direction in respect to direction OD which the direction OC has to OF, then will $DN = FC$, and will AN be of known magnitude. And it is evident that if H be the point in which the circle having CA as diameter cuts AO, we have in like manner the relation $2OA.HN = CA^2 - AN^2$.

But the ratio of the known quantities $AB^2 - AM^2$ and $CA^2 - AN^2$ is known: $\therefore$ it follows that the ratio of GM to HN which is the same with it is known.

Now if in MN we suppose NL so taken that MA has to NL the known ratio which GM has to HN; then GA has to HL the same ratio.

Hence if in AO we suppose $KA = HL$ and in like direction to it, then GA has to KA a known ratio, and $\therefore$ the point K must be in the circumference of a known circle AKP passing through A and having its diameter AQ in AB.

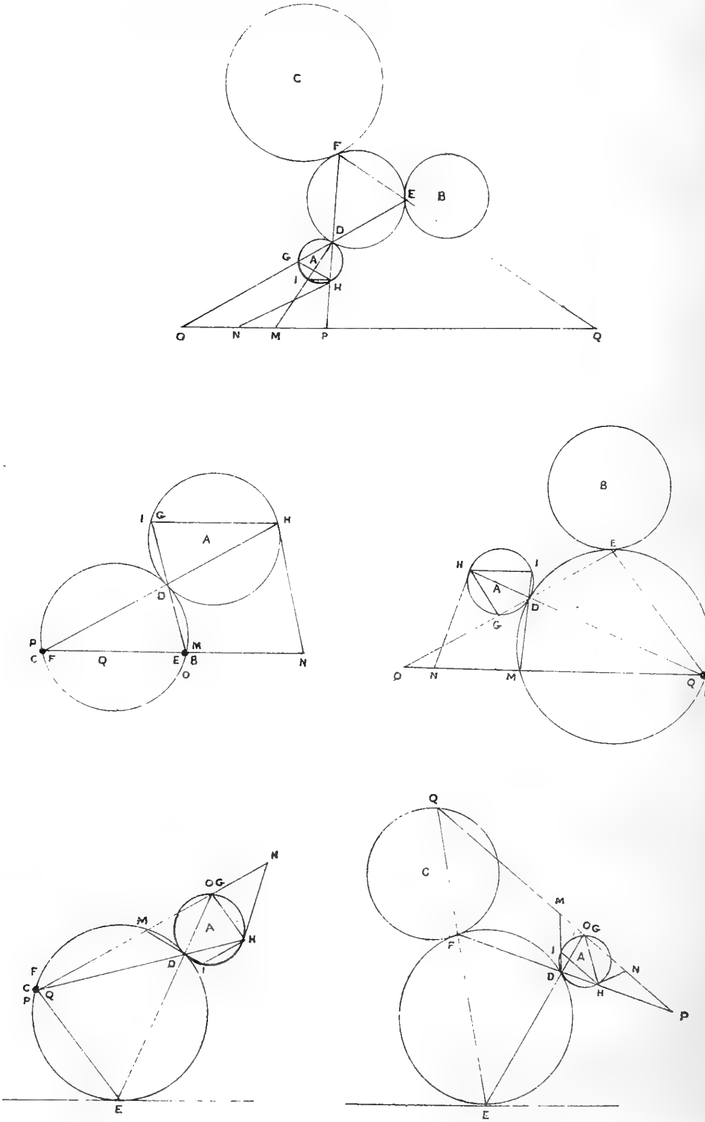
Again since $KA = HL$, we have $KH =$ the known magnitude AL. And the angles CHK, QKH, being right, it follows that QT the perpendicular from Q on CH is equal to KH, and that CT is tangent to the circle having Q as centre and QT as radius; but this circle is known; therefore the tangent CT is known, as also the other point H in which it cuts the circle on AC as diameter; and therefore AHO is known in position.

And, since AHO is known in position, the point N is known; and $\therefore$ as $OC = ON$, the point O is known, and hence the circle DEF.

COMPOSITION.

Through the centre A draw any radius AD'; in $D'A$ take $D'M' =$ radius B, and $D'N' =$ radius C; in $M'N'A$ find the point L' such that $M'A$ shall have to $N'L$ the ratio which $AB^2 - AM'^2$ has to $CA^2 - AN'^2$ (taking signs into account); in AB take AQ so that $AB : AQ :: M'A : N'L$ (taking note of signs); on AC and AQ as diameters describe circles; with Q as centre and a radius equal to AL' describe a circle, and draw CT a tangent to it from C; through the other point H in which CT cuts the circle on AC as diameter, draw the straight line AH to cut the circle on AQ as diameter in K; make $HL = KA$ (and in the same direction); make in the

THE TANGENCIES
APOLLONIUS' ORIGINAL SOLUTION.



same line AN = AN′ so that $\frac{AL}{AN}$ and $\frac{AL'}{AN'}$ have like signs; find O in AL so that OC = ON; then from the point O as centre and the point D, when NO cuts circle A (so that ND = N′D′) as distance, describe a circle : this circle will be as required.

NOTES.

This method of solution is not intelligibly applicable to those states of the data in which any of the given circles is supposed infinitely great, or replaced by a straight line; but for the other cases it is thoroughly complete and deserves attention.

Indeed, I may remark that there are many very good solutions applying only to the cases in which none of the given circles A, B, C, is infinite, or when two are infinite. Yet it must not be lost mind of, by those who would succeed, that the solutions to general questions are often arrived at from considering them under some particular states of the data, and divining what modifications are necessary so as to make the solutions which may be arrived at applicable to the more general cases.

It may also be remarked that a theorem evolved in the above solution is directly applicable in a solution to the principal case of the '*Inclinations*' of Apollonius.

APOLLONIUS' ORIGINAL SOLUTION.

(See Plate.)

To describe a circle to touch three given circles A, B, and C.

ANALYSIS.

Let D, E, and F be the points of contact of the required circle with the given circles A, B, and C.

Then, DE passes through O a centre of similitude of the circles A and B; DF passes through P a centre of similitude of the circles A and C; and EF passes through Q a centre of similitude of the circles B and C; and the points O, P, and Q are in a straight line.

Let G and H be the other points in which DE and DF cut the circle A.

Through H draw a parallel to OPQ; and through the other point I in which it cuts the circle A, draw DI to cut OPQ in M.

Since HI and HG are parallel to FEQ and QPO, the angle QO right to E = angle HI right to G and is ∴ = angle DI right to G or DM right to O or E; and ∴ a circle can pass through MDEQ.

But O being a centre of similitude to the circles A and B, the magnitude of OD.OE is known; and ∴ since OM.OQ = OD.OE, the point M is known.

Let N be the point in which a tangent to circle A at H cuts POQ.

The angle NH right to P is = HN right to I and ∴ = DH or DP right to I or M. Hence a circle can pass through DH, M, and N. And since PM.PN is = the known magnitude PH.PD, it follows that the point N is known.

Now N being a known point, the tangent NH to circle A is known; and the point F in which PH cuts the circle C similarly to H on circle A is known; as also the other point D in which it cuts circle A. And the point E on circle B, in in which OD cuts it dissimilarly to D on circle A, is known: and hence the circle DEF is known.

Or, we might determine D by drawing a tangent at D to cut OPQ, &c., because circle MDP touches A at D.

COMPOSITION.

Find O a centre of similitude of the circles A and B; find P a centre of similitude of the circles A and C; and find Q the centre of similitude of the circles B and C which is in line with O and P.

Through O draw a straight line to cut the circles A and B in dissimilar points, D′ and E′; describe the circle QE′D′; through P draw a line to cut the circle A in points H′, D′; through H′, D′, and the other point M in which the circle QE′D′ cuts the line OPQ, describe a circle; through the other point N, in which the circle D′H′M cuts the line QPO, draw NH a tangent to the circle A; draw PH to cut the circle A again in D, and to cut the circle C in F dissimilar to D on A; draw OD to cut circle B in E dissimilar to D on circle A; describe the circle DEF.

Then is DEF a required circle.

NOTES.

This method of solution is intelligibly applicable in a direct manner only when the circle A is finite, and C neither an infinitely great circle, nor infinitely great in respect to the circle B. The reason of such restriction arises from the peculiar nature of infinitesimal geometry causing the indicated operations to be graphically impracticable though mentally possible.

However as regards the five principal cases of the problem; viz., when the circles A, B, C are finite—when A and B are finite and C infinitely small—when A is finite and B and C infinitely small—when A and C are finite and B infinitely great—and when A is finite, C infinitely small and B infinitely great, this solution is remarkably elegant, and depends on very simple well known elementary truths.

That it is in substance the same as the one given by Apollonius, may be easily gathered from Pappus' commentaries on the writings of the celebrated Greek geometers.

He observed that the Apollonian solution to the Tangencies was of such a nature as to indicate a method of inscribing a triangle in a given circle, whose sides would pass through three given points in a straight line. And then, evidently, in order to prepare for a construction to the general problem of inscribing, in a given circle, a polygon, whose sides should pass through given points, he gives the indicated method of solution to the particular case just mentioned, both when the three fixed points are at finite distances from each other, and when one of them is at an infinite distance.

Now, in the solution just given in the text, nothing would be more apt to suggest itself than the fact that GH, a parallel to FEQ, cuts OPQ in a point S, such that OS has to OQ the known ratio which OG has to OE, or which rad. A has to rad. B; and that we could ∴ solve the problem:—"Being given three points O, P, S, in a straight line; to inscribe a triangle DGH in a given circle so that its sides will pass through these points."

And the method which the present solution indicates is exactly the same as is given in Pappus' Mathematical Collections, as well when the three points are at finite distances as when one of them is at an infinite distance.

These coincidences in peculiarities are, I consider, sufficient to justify me in believing that I have reproduced the solution of the celebrated Greek geometer. And I feel the better pleased at this as it clears up a long disputed point concerning the claims of the rival '*restorations*' given by Vieta and Simson to the case of the problem in which one of the circles as C is infinitely small.

It will be seen that Vieta's solution, in the most improved form, is the same as that of Apollonius.

And here, before closing my notes on this celebrated problem, I may observe that Dr. Robert Simson, like many others, certainly misunderstood the object of propositions 116, 117 and 118 of Book VII. of Pappus' Mathematical Collections; and that through this he was led to imagine he restored or reproduced the proposition to which they were intended as subsidiary.

However, as Dr. Simson's remarks are interesting in a historical point, I will give them as translated from the Appendix to his *Opera Reliqua,* by Professor Davies. They are as follows:—

"In the Seventh Book of the Mathematical Collections of Pappus Alexandrinus (every admirer of the ancient geometrical analysis ought to rejoice that this work has been preserved to our times), among the lemmas which that most eminent writer has handed down, there exists a problem for one of the tangencies of Apollonius, namely, in Prob. 117, B. VII; in which it is required, when a circle being given by position and three points in a straight line, to inflect from two of the points two lines meeting in the circumference, so as to make the two points in which they intersect the circle and the third given point in the same straight line. It is not difficult to investigate the rest of the lemmas which are subsidiary to the problems on the tangencies; and some of these Vieta has used in his *Apollonius Gallus;* but to what problem the aforesaid lemma could be subsidiary, neither Vieta nor any other geometer has attempted to conjecture.

"Often, indeed, have I resolved the subject in my mind, but I have never succeeded in arriving at any satisfactory conclusion, except that the lemma, by no uncertain marks, appeared to be necessary for the following problem:—Two circles and a point being given by position, it is required to describe a third circle which shall touch the given circles and pass through the given point. In what manner, however, the lemma might be subsidiary to this problem I did by no means perceive. I have directed my attention to the solutions of Vieta and others, hoping that by chance I might hit upon the analysis requiring this lemma, but in vain; until this day, after various trials, I discovered the true analysis of Apollonius, to which, indeed, both this Prob. 117 of Pappus, as well as Props. 116 and 118 are manifestly subsidiary.—February 9, 1734."

How such an able geometer could look so long in vain for a solution to the tangencies which might implicate the 117th proposition of Pappus' 7th Book, I am at a loss to understand; though it evidently accounts for his implied opinion that the general problem of *the three circles* was originally referred to the particular case of *two circles and a point*.

Indeed, I may mention that the solution which I give as that of Apollonius was the first one which suggested itself to me for the general question of the three circles; though not exactly in the form in which I now present it: for after arriving at the point in the analysis in which M is shown to be found, I proceeded as follows:—

Since HI is parallel to PM, a circle through M, P and D touches the circle A in D; and ∴, since P and M are known, this touching circle MDP is known; and hence ODE, PDF, and circle DEF are known.

I may further note, that we may give another method of solution implicating Pappus' lemma, by supposing K the point in which DK parallel to OPQ cuts circle DEF, and V that in which FK cuts OPQ.

For as the angle FE right to K = DE right to K, it is= OE right to V and ∴ QV.QO being = QE.QF, the point V is known.

And if T be the point in which the tangent at D cuts OPQ; then since the angle FK right to D = DK right to T, it is= TP right to D, and ∴, PT.PV being = PD.PF, the point T is known. Hence the tangent TD to circle A is known, and ∴ ODE, PDF and circle DEF are known.

It is evident this method holds graphically good only when A is finite and C neither infinitely small, nor infinitely small in respect to the circle B. It applies to the case in which A is finite and B and C infinitely greats; but does not to that in which A is finite and B and C infinitely smalls.

Similar solutions to the two just indicated are obvious from the *"Involution" Theory* as unfolded in the Géométrie Supérieure:—

1. Let D, E, F be the points of contact with the given circles, and OPQ the known centres of similitude, in a straight line, through which DE, DF and EF pass. If G and H be the other points in which DE and DF cut the circle A, then GH is parallel to EF, and OG : OE : : rad A : rad B; and hence S the point in which GH cuts OQ is known.

Now, if we suppose T the point in which a tangent to the circle A at D cuts OQ; then, since we may regard GHDD as an inscribed quadrilateral in circle A having the side DD infinitely small, it follows that the straight line OPST is cut in "*involution*" by the circle A and the pairs of opposite sides of the quadrilateral; but the circle A is known, as also the points O, P and S; therefore the point T can be found as follows (see Chasles' *Géométrie Supérieure*, page 150):—Assume any point U on the circumference A, and describe the circle OPU; through U, S, and the other point V in which the circles A and OPU intersect, describe a circle UVS: then will this circle UVS give the point T in its other intersection with OPS. Hence we know the tangent TD to circle A, &c.

2. We can find the tangent NH in a similar manner. Thus:—Through W any point in the circumference A describe the circle PWS; through O, W, and the point X in which this circle cuts the circle A describe a circle: then will this circle give N in its other intersection with the line SPO. Hence the tangent NH, &c.

3. Or, since the required circle DEF evidently cuts OPQ in known points, real or imaginary, it is obvious that if through any point D′ we draw two straight lines OD′ and PD′, and on them take D′E′ and D′F′ such that $OD'.OE' = OD.OE$, and $PD'.PF' = PD.PF$, then will the circles D′E′F′ and DEF have OPQ as radical axis; and we can find the tangent DT as follows:—Describe the circle OPD′, and through Q, D′, and the other point K of intersection of the circles OPD′ and D′E′F′ describe a circle: then will the other point in which the circle D′KQ cuts OPQ be the required point T from which to draw the tangent TD to the circle A.

Montucla gives a very curious history of this problem. He says:—"Vieta, in a dispute with Adrian Romanus, proposed this problem. The solution given by Romanus, though obvious, was very indifferent, viz., by determining the centre of the required circle by the point of intersection of two hyperbolas. Vieta solved it very elegantly in his *Apollonius Gallus*, printed at Paris in 1600: his solution is the same as that given in *Newton's Universal Arithmetic*. Another solution may be seen in Lemma 16, Book I., of the Principia (this question being there necessary for some determinations in Physical Astronomy), where Newton, by a remarkable dexterity, reduced the two higher loci of Romanus to the intersection of two straight lines. Moreover, Descartes attempted to solve this problem by algebraic analysis, but without success; for, of the two solutions which he derived from thence, he himself acknowledges that one furnished him with so complicated an expression, that he would not undertake to construct it in a month; while the other, though somewhat less complicated, was not so very simple as to encourage him to set about the construction of it. Lastly, the Princess Elizabeth of Bohemia, who it is well known honored Descartes with her correspondence, deigned to communicate a solution to this philosopher; but, as it is deduced from the algebraic calculus, it labours under the same inconveniences as that of Descartes."

Euler, Fuss, T. Simpson, and other eminent analysts have given algebraic solutions, though not at all commensurate with the requirements of the problem. T. Simpson has also given a geometrical solution in the appendix to his Elements of Geometry, which, in reality, does not differ in principle from Newton's in the Principia.

These solutions, like those of Euler, are very imperfect, though complete ones of a similar nature, and much more simple, can be easily formed.

The late John Mulcahy, L.L.D., professor, Queen's College, Galway, after giving Gaulthier's solution as improved by Gergonne, in article 68 of his *Principles of Modern Geometry*, again returns to the subject in article 95, and deduces Gaulthier's original method depending on the circle which cuts the three given ones orthogonally: this of course labours under the disadvantage of being inapplicable when the radical centre is within the three given circles.

Those who are acquainted with the *Principles of Modern Geometry*, or the writings of the late Professor Davies, of the Royal Military Academy, will at once see that all my methods are applicable when, instead of *three circles in a plane*, there is given *three circles on the surface of a sphere*. The only difference being that straight lines, whether in data or solution, will be represented by great circles of the sphere.

My solutions have also analogous ones answering to the following celebrated problem, which was proposed by Descartes to Fermat:—"*Suppose four things*, A, B, C, D, *to be given in position, consisting of points, planes, and spheres, which may be taken of any one of these kinds exclusively, or of any two of the kinds, or of all of the three kinds; it is required to describe a sphere which shall pass through each of the given points, and touch the given planes or spheres.*"

All we have to do is (as in considering the Apollonian problem) to form the solution for the general case in which the data is four spheres, and then make the modifications necessary when we suppose one or any number of the spheres to become infinitely small or infinitely great, or—in other words—when we suppose one, two, three, or all of the spheres to be replaced by points or planes.

The analysis similar to my first solution is evidently as follows:—

ANALYSIS.

Let a, b, c, d be the respective points of contact of the required sphere with the given spheres A, B, C, D.

Then the straight lines ab, ac, ad, pass respectively through O, P, Q, known vertices of similitude to the pairs of spheres AB, AC, AD.

Now, if a' be any point in the surface A, and that b', c', d', are the respective points in the surfaces of B, C, D, made by the straight lines a'O, a'P, a'Q which are dissimilar to that of a' on the surface of A, it is evident $Oa'.Ob' = Oa.Ob$, $Pa'.Pc' = Pa.Pc$, and $Qa'.Qd' = Qa.Qd$, and therefore that the spheres $a'b'c'd'$, $abcd$, have the plane OPQ as radical plane.

This being borne in mind, it is evident that the tangent plane to any of the given spheres at the point of contact will cut the plane of section of this sphere and the sphere $a'b'c'd'$ in a straight line situated in the plane OPQ.

But as we may assume the point a' anywhere in the surface of A, we know the resulting points $b'c'd'$, and the sphere $a'b'c'd'$, and its planes of intersection with the spheres A, B, C, D, and also the intersections of these planes with plane OPQ, and the tangent planes from these lines to the given spheres, and $\therefore$ the sought sphere of contact.

And it may be remarked that to each plane of similitude OPQ there are two answerable spheres $abcd$ whose centres (as also the centre of the corresponding sphere $a'b'c'd'$) are on the perpendicular from the radical centre of the four given spheres to the plane OPQ; and, moreover, that as there are eight planes of similitude OPQ there are sixteen answerable touching spheres (real or unreal in pairs). We may further remark that this solution furnishes a proof that the twelve vertices of similitude of the four given spheres lie in sixes in the eight planes OPQ, and are the vertical points of a complete octahedron.

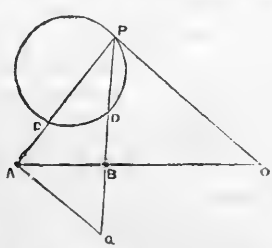
It is also easy to see that the chords aa of the sphere A pass *respectively* through the poles of the corresponding planes OPQ in respect to sphere A, and *all* through R the radical centre of the four given spheres; and therefore, it follows, that the eight lines in which the planes of intersection of the eight spheres $a'b'c'd'$ with the sphere A cut the corresponding eight planes OPQ of similitude, are situated in the *polar plane* of the radical centre R in respect to the sphere A, &c.

Or we might determine the point a (and hence b, c, d) from the following considerations:—Since $\mathrm{O}a.\mathrm{O}b$, and $\mathrm{P}a.\mathrm{P}c$ are of known magnitudes and that $a\mathrm{O}.ab$ has to $a\mathrm{P}.ac$ a known ratio, therefore the point a must be on the surface of a known sphere having its centre in the straight line through O and P.

Similarly, since $\mathrm{P}a.\mathrm{P}c$ and $\mathrm{Q}a.\mathrm{Q}d$ are of known magnitudes and that $a\mathrm{P}.ac$ has to $a\mathrm{Q}.ad$ a known ratio, therefore the point a must be on the surface of a known sphere having its centre in the straight line through P and Q. Hence, as the point a is on the sphere A, it follows that it must be a point of intersection of the circular traces made on the sphere A by the two known spheres having their respective centres in the straight lines PO and PQ.

The other solutions to Descartes' *problem of the spheres*, which are analogous to those I have given to Apollonius' *problem of the circles*, may be easily made:—the tangent to two circles in the plane being represented by a plane touching three spheres, &c. And the actual operations are very simple when performed according to Monge's practical processes of the geometry of figured space, known by the name of "Descriptive Geometry."

APOLLONIAN LOCI PROBLEM.



Given two points A, B, *and the magnitudes of four lines* a, b, c, d, *to find the locus of a point* P, *such that* $\mathrm{AP}^2 + \mathrm{a.b}$:

BP^2 + c.d : : m : n,—*(the ratio* $\frac{m}{n}$ *being known in sign and magnitude, and the rectangles* a.b, c.d *being also of known magnitudes and signs).*

ANALYSIS.

Suppose the points C and D on AP and BP such that CA.AP = *a.b,* and DB.BP = *c.d;* then we have AP.CP : BP. DP : : : *mn.*

But if Q be the point in BP such that the angle QA right to P = CP right to D, we have QP.DP = AP.CP; and therefore it follows that QP : BP : : *m* : *n.*

Hence if we draw PO parallel to AQ to cut AB in O, we have AO : BO : : *m* : *n,* and therefore the point O is known. Moreover, the angle PO right to Q or D being equal QA right to P or D, it is equal to CP right to D, and therefore OP is a tangent to the circle CDP.

Now it is evident that if P′ be any point whatever, and that C′ and D′ are taken on AP′ and BP′ so that C′A.AP′ = CA.AP, and D′B.BP′ = DB.BP, then will the circles PCD and P′C′D′ have AB as radical axis, and therefore (as O is a point on this radical axis) the tangent OP equal to the tangent from O to the circle P′C′D′; but the circle P′C′D′ is known; therefore OP is of known magnitude, and hence the locus of P is a known circle having O for centre.

COMPOSITION.

Find O in AB such that AO : BO : : *m* : *n;* assume any point P′, and in the straight lines AP′ and BP′ find the points C′ and D′ such that C′A.AP′ = *a.b,* and D′B.BP′ = *c.d;* describe the circle P′C′D′, and draw a tangent to it from O; with O as centre and this tangent as radius describe a circle; this circle will be the required locus.

For let P be any point in its circumference, and C and D the points in AP and BP such that CA.AP = C′A.AP′, and DB.BP = D′B.BP′; and let Q be the point in which AQ parallel to PO cuts PB.

The straight line ABO is evidently the radical axis of the circles PCD and P′C′D′, and therefore OP is a tangent to the circle PCD. Hence angle CP right to D being equal angle PO right to D, it is equal QA right to D or P, and therefore

AP.CP = QP.DP. But QP.DP : BP.DP :: QP : BP :: AO : BO :: $m : n$; hence AP.CP : BP.DP :: $m : n$, and since AP.CP = $AP^2 + a.b$, and BP.DP = $BP^2 + c.d$, therefore $AP^2 + a.b : BP^2 + c.d :: m : n$.

DISCUSSION

It is evident the locus is real only when the centre and radius are real; and it is also evident the centre is real for all real values of $\frac{m}{n}$, and that the radius is real only when the point O does not lie within the circumference P′C′D′.

It is evident the circle P′C′D′ will cut AB in real points when $a.b$ and $c.d$ are both positive, or when one of them is positive and the other negative; but when $a.b$ and $c.d$ are both negative, as the points P′, C′, D′ are then on the same side of AB, it is obvious the circle P′C′D′ will or will not cut AB in real points according to the conditions of the data.

And if f and f represent the points in which the circle P′D′C′ cuts AB, it is evident that fA.A$f = ab$, and that fB.B$f = cd$, the equalities being in signs as well as magnitudes.

When a.b *and* c.d *are both negative.*

Putting s and t to represent the magnitudes of mean proportionals between a and b, and c and d, it is evident that when the distance between the given points (disregarding directions) is less than the sum of s and t, or greater than their difference, the circle P′C′D′ will not cut AB in real points; and when the distance between A and B is equal to either the sum or difference of s and t, the circle P′C′D′ will cut AB in real coincident points; and when this distance is greater than the sum of s and t or less than their difference, the circle P′C′D′ will cut AB in real distinct points f, f.

When the circle P′C′D′ does not cut AB in real points, it is evident the tangent OP′ is real, and therefore that the locus is a real circle for all real values of $\frac{m}{n}$ positive or negative.

When the circle P′C′D′ touches AB, the tangent OP′ is always real, and in this case too the locus is always real: moreover, it is evident that when $m : n :: \mathrm{A}f : \mathrm{B}f$, the centre O coincides with the double point f and the locus is an infinitely small circle.

When the circle P′C′D′ cuts AB in real distinct point f and f; it is to be remarked that these points are both between A and B, or both on the same side of A and B, according as the distance between A and B is greater than the sum or less than the difference of s and t; moreover, when the distance between A and B is less than the difference of s and t, the two points f and f will lie in the production of AB through A when s is less than t, and in the production through B when t is less than s. And it is obvious that the locus is real for any value of $\frac{m}{n}$ to which the corresponding centre O does not lie between f and f.

Hence, when AB is greater than $s + t$, the locus is real for all positive values of $\frac{m}{n}$; and, for negative values of $\frac{m}{n}$, the locus is a real finite circle, a real infinitely small circle, or an imaginary circle, according as $\frac{m}{n}$ is not comprehended between the limiting values $\frac{Af}{Bf}$ and $\frac{Af}{Bf}$ or equals one of them, or is comprehended between them.

Similarly, when AB is less than the difference of s and t, it is evident the locus is real for all negative values of $\frac{m}{n}$; and for positive values of $\frac{m}{n}$ the locus is real and finite, real and infinitely small, or imaginary, according as $\frac{m}{n}$ is not comprehended between, or equal to one of, or is comprehended between the limiting values $\frac{Af}{Bf}$ and $\frac{Af}{Bf}$.

In the case in which $c.d =$ zero, the point D′ coincides with B and the circle C′P′D′ cuts AB in B and in another point f which lies between A and B, or coincides with B, or lies in the production of AB through B according as s is less than, or equal to, or greater than AB, and therefore the limits are a known negative value and infinity negative when s is less than AB, and a known positive value and positive infinity when s is greater than AB. ∴ when s is less than AB the locus is real for all positive values of $\frac{m}{n}$, and also for the negative values of $\frac{m}{n}$ which are not comprehended between the negative limit and negative infinity; and when s is greater than AB the locus is real for all negative values of $\frac{m}{n}$, and for the positive values of $\frac{m}{n}$ not comprehended between the positive limit and positive infinity; and when $s =$ AB the locus is real for all real values of $\frac{m}{n}$. And in any of these three cases it is evident the locus is an infinitely small circle when $\frac{m}{n}$ is equal either of the limiting ratios of the case.

In case $a.b$ = zero, and $c.d$ = zero; then the points C′ and D′ coincide with A and B, and the points f and f also coincide with A and B. And it is evident the limits are equal zero and infinity, and that according as any value $\frac{m}{n}$ is positive or negative, so will the locus be real or imaginary; when $\frac{m}{n}$ is equal either of the limits, the locus is an infinitely small circle coincident with one of the given points.

If the points A and B coincide, and that $a.b = c.d$, and that $\frac{m}{n} = +1$; then since the point O may have any position whatever in the line through A and B, and that the circle P′C′D′ is real, it follows that there are innumerable circles such that any point P in the circumference of any of them fulfils the conditions of the locus. The problem in this state of the data is said to be "porismatic."

When we suppose $\frac{m}{n} = +1$, the centre O of the locus is infinitely distant (when the points A, B are distinct) and the tangent to the circle P′C′D′ is parallel to AB; and it is evident the perpendicular from the point of contact on AB is entirely in the infinitely great circle constituting the locus, and passes through o' the center of the circle P′C′D′. In this case we have $AP^2 - BP^2 = c.d - a.b$, and the problem can be enunciated as follows:—*Given two points* A *and* B *to find the locus of a point* P, *such that the square of its distance from* A, *one of the given points, minus the square of its distance from the other, shall be of a given magnitude* c.d − a.b *of known sign.*

And if we suppose I a point in the line AB such that BI.IB = $c.d$, and that I remains fixed when B is infinitely distant; then it is obvious that P′D′ and PD are parallel to AI and bisected by the perpendicular to AB through I; and it is evident that when $\frac{m}{n}$ is of a finite magnitude, this perpendicular through I is entirely in the infinite locus.

Now it is further evident that if we suppose n always = BI, and that B is at infinity in the direction AI, then since AP.CP : BP.DP : : m : BI, and that for points P at finite distances, BP = BI, therefore AP.CP = DP.m. And it is obvious that as DP is double the perpendicular from P on the perpendicular through I to AB, the problem becomes tantamount to what is given in the enunciation:—

"*To find the locus of a point* P *such that the sum of the square of its distance from a given point* A *and a given negative magnitude a.b. shall be equal to the rectangle under its distance* PK *from a given straight line* IK, *and a line 2.m of a given magnitude whose sign is known in respect to the direction of the perpendicular to the given line* IK."

And since AO : BO : : AP.CP : BP.DP and that, in this case, BO = BP, therefore AO.DP = AP.CP = DP.m, and hence AO = m. Therefore the solution for the problem just enunciated may be worded as follows:—

In AI perpendicular to IK find O such that AO = $\frac{1}{2}$ (twice m) = m; assume any point P′, and in AP′ find C′ such that AP′.C′A = $a.b.$; draw P′K′ perpendicular to IK, and extend it on the other side of IK until K′D′ = P′K′; describe the circle C′P′D′; draw a tangent from O to this circle; from O as centre with this tangent as radius describe a circle, and it will be the required locus.

It is to be observed that the locus is real and finite, real and infinitely small, or imaginary according as O is outside, on, or inside the circle C′P′D′. It is evident that when — $a.b$ is greater than AI^2 the circle C′P′D′ does not cut AI in real points f and f, and therefore that the locus is real for all real values of m. When — $a.b$ = AI^2 the circle C′P′D′ touches AI in I, and the points f coincide in I; and the locus is always real for real values of m, and infinitely small when m = AI. When $a.b$ is less than AI^2 the circle C′P′D′ cuts AI in real points f and f equidistant from I, and on the same side of A as I; and it is evident the locus is real for all values of m having a different sign to the direction AI; and, moreover, for a value of m having like sign with direction AI, it is evident that according as it is not comprehended between the limits Af and Af, or is equal one of them, or is comprehended between them, so will the locus be real, real and infinitely small, or imaginary.

Further, if we suppose $a.b$ = zero, the limits Af and Af are evidently = zero and twice AI, and include the values of m for which the locus is imaginary.

When a.b *is positive and* c.d *negative.*

Here it is evident the point C′ is on a different side of AB with the points D′, P′, and that the circle P′C′D′ cuts AB, in one point between A and B, and in another in the production of AB through A. Hence, we see that the limits $\frac{Af}{Bf}$ and $\frac{Af}{Bf}$ are the one positive and the other negative.

And it is evident that for all positive values of $\frac{m}{n}$ the locus is real, or real and infinitely small, or imaginary, according as $\frac{m}{n}$ is greater than the positive limit $\frac{Af}{Bf}$, or equal to it, or less than it. And for negative values of $\frac{m}{n}$ it is evident the locus is real, real and infinitely small, or imaginary, according as $\frac{m}{n}$ is numerically greater than the negative limit $\frac{Af}{Bf}$, or equal to it, or less than it.

If $c.d$ = zero; one of the points f coincides with B, and one of the limits = infinity; and the other point f is in the production of BA through A. In this case the locus is imaginary for all finite negative values of $\frac{m}{n}$, and real only for positive values of $\frac{m}{n}$ which are not less than the other limit $\frac{Af}{Bf}$; and when $\frac{m}{n}$ is equal either limit, the locus is real and infinitely small.

If $a.b$ and $c.d$ be each equal zero; then one point f coincides with A, and the other with B, and the limits are + zero and − infinity, and the locus is real only for finite values of $\frac{m}{n}$ which are positive.

And, by similar considerations as were made use of when $a.b$ and $c.d$ were regarded as negative, we are led to know that a particular case of this problem may be enunciated as follows:—"*Given a point* A *and a straight line* IK *in position; to find the locus of a point* P, *such that* AP^2 + *a given positive magnitude* a.b *shall be equal to the rectangle under a given length* 2.m, *and the perpendicular distance* PK *of the point* P *to the given line* IK. *In which the sign of* 2.m *in respect to the direction of* PK *is given.*"

The solution may be worded exactly as in the similar case when $a.b$ and $c.d$ were regarded as negative. But it may be remarked that here the points f, f, are always real when the data is real, and that they are equidistant from I, and on opposite sides of A, &c., &c.,

When a.b *and* c.d *are both positive.*

It is evident the points C′, D′, and the point P′ are on opposite sides of AB, and that the circle P′C′D′ always cuts AB in real points f and f, one of which is in each production of

AB. And it is obvious that for all negative values of $\frac{m}{n}$ (as the corresponding points O lie between A and B) the locus is imaginary; and it is further evident that for positive values of $\frac{m}{n}$ between zero and the lesser limit, and between infinity and the greater limit, the locus is also imaginary; and that for all other positive values of $\frac{m}{n}$ the locus is real. And for a value of $\frac{m}{n}$ equal either limit, the locus is infinitely small.

Having remarked the principal features of these three divisions, the problem can now be considered under a different form. For as the relations of the involved data were expressed by

$$AP^2 + a.b : BP^2 + c.d : : m : n$$

they are evidently expressed by

$$n\,(AP^2) - m\,(BP^2) = m\,(c.d) - n\,(a.b)$$

and this can be orally expressed in the two following manners; just according as we suppose $\frac{m}{n}$ positive or negative, viz :—

First enunciation—(when $\frac{m}{n}$ is positive)—"*Given two points* A *and* B *in position; to find the locus of a point* P, *such that* n *times the square of its distance from* A, *minus* m *times the square of its distance from* B *shall be equal to a given magnitude* g.h," regarding n and m as real numbers.

Second enunciation—(when $\frac{m}{n}$ is negative)—"*Given two points* A *and* B; *to find the locus of a point* P, *such that* n *times the square of its distance from* A, *plus* m *times the square of its distance from* B, *shall be equal to a given magnitude* g.h," regarding n and m as real numbers.

It is evident we can always determine $a.b$ and $c.d$ so that $m.(cd) - n\,(ab) = gh$, or, better still, we can always find $a.b$ such that $-n\,(a.b) = g.h$, and then regarding cd = zero, we still have $m(c.d) - n(a.b) = g.h$, and

$$AP^2 + a.b : BP^2 : : m : n.$$

In this form it is evident (from the preceding part of the discussion) that one of the points f coincides with B, and that the other point f satisfies the relation fA.AB $= a.b$.

Now, when $\frac{m}{n}$ is negative (and O between A and B) as we can always assume m negative, and n positive, it is evident that as $n(AP^2 -)\ m(BP^2)$ consists of two necessarily positive terms, the $g.h$ in the second of the two preceding enunciations, can be regarded as always necessarily positive. This being done, it follows that the $a.b$ for the second enunciation is negative, and $\therefore$ according as AO or $\frac{m}{m-n}$ AB is less than, equal to, or greater than Af or $\frac{-a.b}{\text{AB}}$ or $\frac{g.h}{n\,(\text{AB})}$ so will the locus be real, real and infinitely small, or imaginary; or which amounts to the same thing—according as $\frac{mn}{m-n}$ AB^2 is less than, equal to, or greater than $g.h$, so will the locus be real, real and infinitely small, or imaginary.

Again, when $\frac{m}{n}$ is positive (and therefore O is in a production of AB) according as $g.h$ in the first of these two enunciations is negative or positive, we can take m and n, both positive or both negative. Doing this makes the corresponding $a.b$ always positive, and gives the point f which does not coincide with B always in the production of AB through A. Hence we see that the locus is always real in this case when m is numerically greater than n. But when m is numerically less than n, it is evident that according as AO or $(\frac{m}{m-n})$AB is longer than fA (or $\frac{ab}{\text{BA}}$ or $\frac{-gh}{n.\text{AB}}$), or equal to it, or less than it, so will the locus be real—real and infinitely small—or imaginary; or, which amounts to the same thing, according as $(\frac{mn}{m-n})$AB^2 is in extent greater than—equal to—or less than $g.h$, so will the locus be real—real and infinitely small—or imaginary.

NOTES.

In respect to the general loci problem just investigated, it may be remarked that if S be the point in which CD cuts AB, then will AS : BS : : AC.PD : BD.PC. And since this last ratio is evidently compounded of the known ratios, AC.AP to BD.BP, and PD.PB to PC.PA, it follows that the point S is known, as also the magnitude of the rectangle SC.SD.

And from this it is evident the problem may have had its origin in the following

GENUINE* ANCIENT PORISM.

If the sides ab, bc, cd, de, ef, fg, *of a polygon* abcdefg *in-*

---

* The *ancient porisms* were formal investigations for theorems, and for the relative states of the data of problems which might cause the solutions to be innumerable. The *modern porisms* are but theorems originally derived from porismatic researches.

scriptable in a circle pass through fixed points A, B, C, D, E, F, G, *and that the rectangles* Aa.Ab, Bb.Bc, *&c., under the distances of the fixed points from the angular points on the sides through them are constants; to find the relations amongst the data so that the locus of* a, *any angle of the polygon, may be found, &c.*

ANALYSIS.

Let O be the centre of the circle *abcdefg*. Then, since $AO^2 - \text{rad}^2\,O$ and $GO^2 - \text{rad}^2\,O$ are equals to $Aa.Ab$ and $Gg.Ga$, $\therefore\ GO^2 - AO^2$ must be constant, and the perpendicular from O on AG must cut it in a fixed point. Similarly, the perpendicular from O on BG must cut it also in a fixed point. And hence we see that when any three A, G, B, of the points are not in a straight line, the centre O of the circle is fixed, as also the circle O itself. And in this case the locus of a must be—if anywhere—in the circumference of the circle O.

But if the fixed points A, B, C, &c., be in a straight line, it is evident the centre O is not a fixed point, and that its locus is restricted to a straight line perpendicular to the line ABC, &c., and that its circumference must pass through two fixed points, real or imaginary, in the line ABC, &c. Moreover; it is evident that if we put X for the point in which the perpendicular from O cuts AB, &c., and that we put x', a', b', c', &c., for the distances of X, A, B, C, &c., from an assumed point on ABC, &c., then must the following relations exist, viz.: $(a'-x')^2 - (b'-x')^2 = l-m$, $(a'-x')^2 - (c'-x')^2 = l-n$, $(a'-x')^2 - (d'-x')^2 = l-p$, $(a'-x')^2 - (e'-x')^2 = l-q$, $(a'-x')^2 - (f'-x')^2 = l-r$, $(a'-x')^2 - (g'-x')^2 = l-s$; in which l, m, n, p, q, r, s, represent the magnitudes of the constant rectangles. And determining on any $N+2$ of the $2N+1$ quantities represented we can easily find the remaining $N-1$. Now looking on the three consecutive sides *ab, bc, cd,* of the polygon, we know (from involution property of inscriptable quadrilateral) that when the points A, B, C, D, E, F, G are in a straight line, *ad* passes through a fixed point in this line; and looking on the three consecutive sides *ad, de,* and *ef*, we know that *af* passes through a fixed point in the same line ABC, &c. And in this manner we may evidently proceed until we come to the last so formed quadrilateral having its fourth side coincident with a side of the polygon, or infinitely small, and tangent at *a,* just according as the number of sides of the polygon is even or odd. Now the points and magnitudes being as above indicated, it is evident that when the number of sides is odd, the locus of a is a circle having as centre the fixed point in which the tangent at a cuts ABC, and a radius equal this tangent, whose magnitude is evidently constant. And when the number of sides of the polygon is even, the locus, under the prescribed necessary conditions for inscriptable polygons, is not restricted in the plane.

Again, returning to the case in which the points are not in a straight line, we have seen that the circle O is fixed, and that the locus of a—if a is at all capable of innumerable continuous positions—must be the circumference of circle O. And here, in order to facilitate the investigation of the relations, let us first suppose a polygon of three sides, and see whether it is possible to have three points A, B, C not in a straight line, so related that if through any one of them C we draw any chord rs to a fixed circle, and $\mathrm{A}r$ to cut the circle again in t, and $\mathrm{A}s$ to cut the circle again in v, then will st and rv pass through B.

Now, from the properties of poles and polars, it is easy to see that when each of the three points is the pole of the line joining the other two, these conditions will be fulfilled; moreover, since if any two A, B of the points so determined be fixed, the third C is in the intersection of the perpendiculars from A on OB and from B on OA, it follows that the given points must be restricted to the number *three* when they are not all in a straight line.

I need scarcely mention that similar investigations may be made when instead of points in a plane, &c., we are proposed points on the surface of a sphere, and the products of the tangents of the halves of the segments made on the sides of the inscriptable polygon by the fixed points through which they pass; or, when we are proposed points in space, and a figure inscriptable in a sphere, and constant rectangles under the distances from the fixed points to its angles situated on the sides passing through these fixed points.

PORISMATIC RESEARCHES.

(The figures to be supplied by the reader.)

Given three straight lines MM, NN, *and* LL, *in position, and given the point* P *in the first line* MM, *and the point* Q *in* *the second line* NN; *through two given points* B, C, *to draw two straight lines* BI, CI, *intersecting each other on* LL, *the third given line, so that* E *and* F *being the respective points in which* BI *and* CI *cut* MM *and* NN, *we shall have* PE *to* QF *in the given ratio of* m *to* n. *(The magnitude of* $\frac{m}{n}$ *is not only considered known, but its sign also—the directions on* MM *and* NN *being considered.)*

ANALYSIS.

From porisms in the *Transactions* for 1859, we know that if we draw QA making the angle QN right to A = PM right to B, and that we make QA to PB as QF to PE or as $m : n$, then will BE and AF intersect in a point O in the circumference of the circle described through A, B, and the point R of intersection of PB and QA.

And from porism 8 in the *Transactions* for 1859, we know that if we draw CG and CD parallels to NN and LL to cut LL and NN in G and D, then will GI.DF be equal to the known magnitude GC.DC. Therefore, since the points B and A are known, and also the circle ABR, it follows (by problem second, *Transactions* for 1859) we can draw the straight lines BOI and AOF, and therefore also CIF through I where BO cuts LL.

COMPOSITION.

Through C draw CG and CD parallels respectively to NN and LL, to cut LL and NN in G and D; draw QA making the angle QN right to A equal to PM right to B, and make QA : PB : : $n : m$, describe a circle through A, B, and R the intersection of PB and QA; find a point O in the circle's circumference (by problem second, *Transactions* for 1859) such that I and F being the points in which BO and AO cut LL and NN, we shall have GI.DF = GC.DC; draw FC to cut LL, then will BI and FC be answerable lines.

For let E be the point in which BI cuts MM. By porisms (in *Transactions* for 1859) we have the point I on the line FC; and PE : QF : : $m : n$.

PORISMATIC RELATIONS OF DATA.

Before entering on the investigation of the porismatic relations, it may be as well to observe that it is evident that as there are two answerable pairs of lines BO, AO (see problem second, in *Transactions* for 1859), there are two pairs of answerable lines BI, CI; and that according as the lines BO, AO are real and imaginary, so will BI CI be real or imaginary. Moreover, it is evident that when $\frac{m}{n}$ is not restricted as to sign, there are four solutions to this problem, two of which cannot be always real, &c.

Now, it is evident (from porismatic theorems in *Transactions* for 1859), that in the porismatic state of the data of the present problem, we must have the angle DN right to A = angle GB right to L, and DA.GB = DC.GC; and, moreover, a straight line through A parallel to NN must cut BG in a point S on the circumference of circle ABR. But (from porisms in *Transactions* for 1859) the angle OA right to B is equal angle NN right to MM, and ∴ angle SA right to B being equal to this last angle, it follows that SGB must be parallel to MM. Again, for any finite value of $\frac{m}{n}$, it is evident that QC must pass through the point H in which BP cuts LL. It is also evident the triangles BGC, CDA, are similar. And if T be the point in which DA cuts the circle ABOSR, we have the angle BS right to T = AS right to T = DN right to A = GB right to L; and therefore BT is parallel to LL.

Hence, we see that in the porismatic state QC and PB intersect on the line LL, and that BG and CG parallels respectively to MM and NN intersect on LL, and that the ratio $\frac{m}{n}$ is equal to the ratio of the segments PU and QD, made on MM and NN by straight lines BU and CD parallel to LL.

And we deduce the following important porisms:—

PORISM.

Given two points B, C, *and two straight lines* MM, NN, *in position, and the point* P *in* MM, *and the point* Q *in* NN; *a straight line* LL *can be found, such that* I *being any point in it, and* E *and* F *the respective points in which* IB *and* IC *cut* MM *and* NN, *we shall have* PE *to* QF *in a constant determinable ratio.*

For BG and CG parallels to MM and NN, give us one point G in the required line; and QC and BP give us another point in the required line by their intersection: therefore the line LL through G and H is known. The determinable ratio can be found by drawing CD and BU parrallel to LL, to cut NN and MM in D and U: it is that of PU to QD.

PORISM.

Given the point P *in a given straight line* MM, *and a point* Q *in a given straight line* NN, *given also a point* B, *and a straight line* LL; *a point* C *can be determined such that lines drawn from any point* I *in the third given line* LL, *through the given point* B *and the determined point* C *to cut* MM *and* NN, *respectively in* E *and* F, *we shall have* PE *to* QF *in a constant determinable ratio.*

For BPH is known, and BG parallel to MM is known, and therefore GC through G parallel to NN is known in position; and hence the point C where GC cuts QH. And I being any assumed point in LL, and E, F, the points in which BI and CI cut MM and NN, the required ratio is evidently the same of that of PE to QF. Or, drawing CD and BU parallel to LL to cut NN and MM in D and U, the required ratio is evidently the same as that of PU to QD (the lines CD, BU intersect at infinity on LL).

PORISM.

Two points B, C, *and two straight lines* MM, LL, *are given in position, and a point* P *in the first of these lines* MM; *a straight line* NN *and a point* Q *in it can be found, such that if lines* IB *and* IC *be drawn from any point* I *in the second* LL *of the given lines through* B *and* C, *to cut* MM *and* NN, *in* E *and* F *respectively, then will* PE *have to* QF *the given ratio of* m *to* n.

For we can draw BG parallel to MM to cut LL in G, and therefore we have CG to which NN must be parallel. Again we have BP and point H where it cuts LL; and therefore HCQ through H and C is known in position. And we have PU, U being the point in which BU parallel to LL cuts MM. And if D be the point in which CD parallel to LL cuts NN, then since QD : PU : : $m : n$, and that QD is parallel to CG, it follows QD is known, and therefore NN with which it is coincident.

If the ratio $\frac{m}{n}$ be not restricted in sign in respect to directions on CG and MM, it is evident there are two positions for QD or NN equidistant from C and parallel to CG; and ∴ also two points Q, one in each line NN.

PORISM.

Given the lines MM, NN, *and the points* P *and* Q *therein —one in each line; given also a point* C *and a ratio* $\frac{m}{n}$: *innumerable points* B *and corresponding straight lines* LL *parallel to any given direction can be found, such that* I *being any point in* LL *and* E, F, *the points in which* IB *and* IC *cut* MM *and* NN, *we shall have* PE : QF : : m : n.

For QCH is known in position, and CG parallel to NN is known in position, and CD parallel to the given direction is known in position, and DA making the angle DA right to C = NN right to MM is known in position; and the circle QPR is known. And since PU : : QD : : m : n, the point U is known, and hence UB parallel to CD is known. And R being any point in the circle which passes through the intersection of MM and NN, and through the points P and Q, the lines RP and RQ will cut UB and DA in B and A, making the triangles DAQ, UBP similar; therefore drawing BG parallel to MM to cut CG in G, we have the triangles BGH similar to QDA, and therefore LL through G parallel to CD is a required line LL, and B is its corresponding point (the locus of B is evidently a known straight line UB).

If $\frac{m}{n}$ be not restricted as to sign, then evidently the entire locus of B is two known parallels equidistant from P, &c., &c.

PORISM.

Given two points B, C, *and two lines* MM, NN, *in position, and a point* P *in* MM; *a point* Q *can be found in* NN, *such that straight lines* BI, CI, *to any point* I *in a determinable straight line* LL *shall cut* MM *and* NN *in* E *and* F, *so that* PE *shall have to* QF *the given ratio of* m *to* n.

For we have BG and CG parallel to MM and NN; and therefore as the triangle CDA is similar to BGC, the locus of A is a known straight line KK. And as QA lies between NN, KK, making the angle QA right to N = PB right to M, and that it has to PB the given ratio n : m, ∴ QA is evidently known in magnitude and position; hence, the line CD (making the angle CD right to A = BG right to C) is known, and ∴ LL through G parallel to CD.

If the ratio $\frac{m}{n}$ be not restricted in sign, it is evident there are two positions for QA equally distant from the intersection of KK and NN, and therefore also two answerable lines LL corresponding to the points Q and Q.

PROBLEM II.

Given three straight lines MM, NN, *and* LL *in position; and the points* P *and* Q *in the two first lines—one in each; through two given points* B, C, *to draw straight lines* BI, CI, *intersecting each other on the third given line, so that* E *and* F *being the points in which they cut* MM *and* NN *(the first and second lines) we shall have* PE.QF *equal a given magnitude* m.n *(the sign of* m.n *is supposed known, &c.).*

ANALYSIS.

From porism 10 in the *Transactions* for 1859, it is obvious that if we draw QA making the angle QN right to A = the angle PB right to M, and QA.PB = QF.PE = $m.n$, and that through A we draw a parallel to NN to cut PB in K, then will FA and EB intersect in a point O in the circumference of the circle ABK.

And from porism 8, in the *Transactions* for 1859, it is evident that by drawing CG and CD parallels respectively to NN and LL, to cut LL and NN in G and D, we will have GI.DF = GC.DC = a known magnitude. And since through A and B, the lines AO and BO (intersecting in the known circumference AKB), make GI.DF of a known magnitude; therefore (by the second problem in the *Transactions* for 1859) AO and BO are known in position, and hence the points E and F, and line FCI, &c.

REMARKS.

The Composition and Discussion may be easily made if thought necessary, but as my chief object is to develop the porismatic relations of the involved data, I will at once proceed to do so.

Porismatic Relations of Data.

It is evident, from porisms in the *Transactions* for 1859, that this problem will become porismatic when the angle GL right to B = DA right to N, and that GB.DA = GC.DC. And if K′ be the point in which GB cuts the circle ABK, K'A must be parallel to NN, because the segment GI corresponding is infinitely small. Therefore in the porismatic state of the data, PBGK must be a straight line. And the point Q must be such that after drawing DA making the angle DA right to N = GL right to B, and DA.GB = DC. GC, we shall have the angle QN right to A = PB right to M, and QA.PB = *m.n*.

And for similar reasons to those which cause PB to pass through G, will the straight line QC pass through the point H in which BH parallel to MM cuts LL.

Hence we easily deduce the following important porisms.

PORISM.

A point P *(and but one) can be found in a given straight line* MM, *and a corresponding point* Q *in another given line* NN, *such that if straight lines* BI, CI, *be drawn from any point* I *in a third given line* LL *through two given points* B, C, *to cut* MM *and* NN *respectively in E and F, we shall have* PE.QF *of a constant determinable magnitude.*

For (from what has been observed) drawing BH and CG parallels respectively to MM and NN, to cut LL in H and G, it follows that GB will cut MM in P, and HC will cut NN in Q. And drawing CD and BU parallels to LL, to cut NN and MM respectively in D and U, it is evident (since these parallels intersect at infinity on LL) PE.QF must always = PU.QD.

PORISM.

Given in position a straight line LL *and the points* B *and* C; *through two other given points* P, Q, *two straight lines* MM *and* NN *(and but two) can be drawn, such that* I *being any point in* LL *and* E *and* F *the points in which* IB *and* IC *cut* MM *and* NN, *we shall have* PE.QF *of a constant determinable magnitude.*

For the lines PB and QC give us the points G and H in their intersections with LL; and PMM, QNN, must be parallels (respectively) to BH and GC. And PE.QF = PU.QD = a known magnitude.

PORISM.

Two points B, C, *and two straight lines* MM, LL, *are given in position, and a point* P *in* MM; *a straight line* NN *and a* *point* Q *in it can be found, such that* I *being any point in* LL, *and* E, F *the points in which* IB, IC *cut* MM *and* NN, *then will* PE.QF *be of a given magnitude* m.n.

For PBG, BU, and BH are known, as also HC; and CD parallel LL is known in position; and ∴ since PU.QD = *m.n*, it is evident NDQN between HC and CD and parallel to CG is known in position.

If *m.n* is not restricted in sign, there are two answerable lines NN equidistant from CG, &c.

PORISM.

Given the points P, Q, *in the given lines* MM, NN, *and given also a point* B *and a straight line* LL *in position; another point* C *can be found, such that* I *being any point in* LL, *and* E *and* F *the points in which* IB *and* IC *cut* MM *and* NN, *we shall have* PE.QF *of a constant determinable magnitude.*

For PBG, BH, and HQ are known, and therefore the point C where GC parallel to NN cuts HQ, and therefore also PE.QF = PU.QD is determined.

PORISM.

Given the points P *and* Q *in the given straight lines* MM *and* NN, *and given also a point* B; *a point* C *and a straight line* LL, *parallel to a given direction can be found, such that* I *being any point whatever in this line, and* E, F *the points in which* IB *and* IC *cut* MM *and* NN, *we shall have* PE.QF *of a given magnitude* m.n.

The straight line PBG is known in position, and the line BH parallel to MM is known in position; and QA and point A are known; and drawing BU parallel to the given direction, the point U in MM is known, and therefore D in NN (because PU.QD = PB.QA = *m.n*); therefore DC parallel to BU is known in position. And since if through A we draw AD′ parallel to CD (since angle AC right to D′ = CA right to D = BC right to G) the circle ACB is known; hence the point C in which this circle cuts DC is known, and therefore CG parallel to NN, and the point G in which it cuts PB, and therefore LL through G parallel to DC or BU.

It is evident there are two answerable points C, and that to each one corresponds an answerable line LL.

If the sign of *m.n* is unrestricted, there are four answerable points and their corresponding lines LL, &c., &c.

NOTES.

By means of the porisms now given, and those in the *Transactions* for 1859, we are enabled to give simple solutions to the following interesting problems, viz. :—

To construct a quadrilateral having its four sides passing through given points, and two of its opposite angles on given straight lines, and such moreover that the other two angles shall be of given magnitudes, or be situated on given straight lines, or such that one of them shall be of a given magnitude and the other be situated on a given straight line.

They can be easily reduced to the third problem in *Transactions* for 1859.

And from the porismatic state of the data in these problems numerous interesting and useful porisms may be derived—one of which is as follows :—

Given a point P *and two straight lines* MM, NN; *then if* B *and* C *be any points in these lines such that the angle* PB *right to* C *shall be of a given magnitude, another point* Q *may be found such that the angle* QB *right to* C *shall be of a constant determinable magnitude.*

FINAL OBSERVATIONS.

In the preliminary observations I have pointed out advantages to be derived from my new methods of defining angular magnitudes; and those who have carefully studied the solutions to the problems contained in this paper, cannot be unaware of the value of these advantages. However, I will now give a few other instances of the improvements which they effect in important theorems :—

First. The theorem on page 465 of the Géométrie Supérieure should be replaced by the following :—

A moveable tangent tt *rolling on the circumference of a circle whose centre is* C, *cuts two fixed tangents* m′m′. n′n′, *in two points* m, n, *such that the "angle* Cm *right to* n*" is constant* = θ right.

Second. The theorem on page 457 (which is so defective that its reverse is untrue) should be replaced by the following :—

If A, B *be two fixed points in the circumference of a circle, and* P *any point whatever in the circumference, then will the angle* PA *right to* B *be constant* $= \theta$ right.

And I may remark that by adopting this property as the fundamental definition of a circle, it would be easy to frame an Element of Geometry in which we could give a direct demonstration to the fact, that *a point* O, *and but one, exists from which lines drawn to the circumference of the circle (or locus of* P) *are equal to each other.*

This might be done in various ways; but perhaps the most simple, as well as the most natural,* would be to have a knowledge of the Theory of Numbers, including proportion in its most general form, precede the study of geometrical science, so as to establish the relations of straight-lined figures as early as possible.

The demonstration might be made as follows:—

Bisect AB in C and through C draw MM perpendicular to AB; find O in MM such that the angle OC right to B $= \theta$ right; then will O be the sought point.

For let I be the other point in which the circle described from C as centre with CA or CB as radius again cuts AP.

---

* On careful examination it will be found that all our Geometry rests ultimately on our power of conceiving the positions and motions of points, lines, and surfaces, and on acquirements in the Theory of Numbers, whether we depend on our intuitive ideas of these things, or that we acquire a more extended systematic knowledge before commencing the study of a regular course of geometry. And this should lead us to look on the Theory of Numbers as primary to geometry, inasmuch as without some knowledge of numbers there can be no systematic treatise, and that the introduction of it from the commencement confers simplicity and comprehensiveness on the *Elements*. However, many are to be found who think they proceed without the use of numbers or proportion, when they disguise their investigations so as to mislead themselves: for wherever there is an idea of equality there must be an idea of proportion; though not necessarily so refined or comprehensive a one as Euclid's. Others are to be found who would trammel the natural action of the intellect, and compel the geometer to discard all conceptions of motion, as foreign to the spirit of pure geometrical science. They point confidingly to what works of the "Ancients" now remain in support of their *crotchet*, as if the philosophy of the Greeks were perfect, and should prescribe limits to the march of progress. But, though truth may be for a time suppressed, by the combined efforts of masters and professors it will yet triumph; and an axiomatic motional philosophy will correct the faulty links and defective logic in the system of geometry which now unfortunately prevails. Indeed, as in other sciences, it will be found, on careful examination, that geometry has inherent properties independent of man's endowments, and exacts peculiar mental operations, from capable beings who fathom some of its various truths, which cannot be prescribed or varied at man's pleasure: for they are ordinances of the laws of nature, and can change only at the will of Providence.

The triangles BCI, ICA being isosceles, we have the angle IA or IP right to B = CB right to O; but PA or PI right B = OC right to B; therefore the angle BC right to O = angle BI right to P, and the equiangular triangles OCB, PIB give BC : BI : : BO : BP.

And since the angle BC right to O = BI right to P, we have the angle BC right to I = BO right to P; and, therefore, since BC : BI : : BO : BP, the triangles BCI, BOP, are similar, and give OB : OP : : CB : CI.

Hence, as CB = CI we have OB = OP

COROLLARY.

If P′ be the position of P infinitely near to or coincident with B, then P′B is tangent at B; and putting MM for this tangent, we have angle BA right to M = PA right to B = OC right to B, and ∴ BM is perpendicular to BO.

Art. II.—*A Communication from the Reverend* W. B. Clarke, *of Sydney, to His Excellency* Sir Henry Barkly, K.C.B., &c., &c., *President of the Royal Society of Victoria, on Professor* McCoy's *"New Tæniopteris" from the Coal-bearing Rocks of the Cape Paterson District in particular, and on the Evidence bearing on the Question of the Age of Australian Coal Beds in general.—Communicated to the Society by His Excellency* The President.

[Read before the Royal Society, 25th June, 1860.]

St. Leonard's, 1st June, 1860.

My Dear Sir,

I received with much thankfulness the kind reply which you were good enough to send to the letter which I did myself the honour of addressing to your Excellency.

The information contained in it respecting the discovery of *Tæniopteris,* at Cape Paterson, is very interesting. But I hesitate, at present, to admit that such a discovery determines the fact of the existence of the Jurassic formation in Victoria. Of course, not knowing what species have been found, or even if the genus be really *Tæniopteris* (for many of those plants so called are not *Tæniopteris* at all), it is impossible for me to come to any conclusion on the subject. But in a paper which I propose to write, so soon as I can find leisure, I will endeavour to show what are the real grounds upon which I have ventured to contend, and still do contend, against the sweeping assertion of those geologists who maintain that a formation so abundant in zoological fossils (more so than, perhaps, any other) as the Jurassic, is found here, where no one, in any part of the Australian continent, has ever detected one single species, on the strength of the evidence derived from a few (probably not six in all) species of plants, the true description of which does not agree in all things with the typical characters of the genera under which the species are ranked.

The two genera, *Tæniopteris* and *Glossopteris (Sagenopteris)*, have been the means of placing, by some geologists, the coal deposits of Australia and India in the horizon of the oolitic coal. Now the latter occurs in no less than five distinct formations in India, as Mr. Oldham informs me, and it also occurs in Africa, where the evidence appears to be against the supposed epoch.

As to *Tæniopteris*, so far from the genus determining the age of a formation, Jukes, who follows Bronn, assigns the species thus:—

Carboniferous	1	Oolitic 6, not 7.
Permian	2	
Trias	3	
Oolitic	6	
Tertiary	1	

It is, therefore, the species which must determine whether the new found plants belong to the oolites or not; and when we come to Yorkshire, which is one of the references, we find in Phillips no figure of any species of *Tæniopteris*, and only one catalogued *T. latifolia*, of which he gives as synonym *T. major* of Lindley and Hutton, which is not a *Tæniopteris* at all, *i.e.* if we are to regard Brongniart's description of the genus as that to which we are, undoubtedly, to have respect. Again, Morris assigns to *T. major* the synonym *Aspidites Williamsonis*, from Göppert, to which genus it certainly belongs. The last writer also shows that another species, *T.*

vittata, which Morris classes as Phillips' *Scolopendrium solitarium,* the figures of which, in Brongniart and Phillips, are neither in agreement with Brongniart's generic characters of *Tæniopteris,* is an *Aspidites,* viz., *A. tæniopteris,* and so of others. It appears therefore, to me, that, without taking any positive evidence from stratigraphical data into account, to assign an epoch to an enormous formation (for such it is in this colony), in which no zoological evidence has been detected on account of *even two* genera of plants, the species of which are in the present condition, and the genera of which are referable to more than the assumed epoch, is anything but philosophical.

Mr. Morris, rather on the absence of certain forms, than on the presence of what Strzelecki had collected, though admitting the full force of conclusions from the examination of his plants, thought, in 1845, that in Australia the carboniferous formation had a different vegetable facies from what it had in Europe. And later, Mr. McCoy, who knew nothing of Australian plants, except from the collections which I had made and sent to Professor Sedgwick, came to a conclusion which I have always considered hasty, that because of the absence of certain genera, and the presence of others which have a relation to some oolitic species, there are two carboniferous formations "without any confusion of type," one of which was then shown to be at the base of the mountain limestone, and the other assumed to be oolitic. At the time, I requested, in a note to the *Philosophical Magazine,* that geologists would suspend their judgment on the point in dispute. Since then, in full confirmation of what I stated in a paper read to the Geological Society of London, others besides myself have found some of the missing true coal plants, and I am now in a position to point out six localities in this colony, and in Queensland, where they are to be found; and I was glad to see, on my first visit this year to the Melbourne Museum, that one of the said plants had also found its way from Gipps Land, whence I had long before had fine carboniferous specimens.

The whole question, then, is resolved into this: are there really two carboniferous formations?

Professor McCoy has admitted my facts in his paper on the Clark-Sedgwick fossils, in adopting my habitats. But he was slow in admitting what I stated to him in February last, that now we have found, in New South Wales, coal seams in the very heart of his mountain limestone fossils, and that plants known in the Newcastle beds, which he calls oolitic, were found at the very bottom of the whole series of these newly-opened beds, containing the mountain limestone fossils.

Whilst, then, such is the case, I look with great interest, but with great suspicion, on any alleged discovery of true jurassic or oolitic evidence, in the small patchy coal formation in Victoria.

And as what I saw in the museum of so-called Glossopteris Browniana, from Darley and Bacchus Marsh, did not appear to me to be certain evidence of the species even, I do not yet know how far even that genus, aided now by *Tæniopteris*, will go to establish the probability of the supposition in question.

At the same time, I have no wish to speak otherwise than respectfully of Professor McCoy's judgment and learning. Only, I wish to know, whether the new plants are really what they are called?

Whilst on this topic I would mention, that there is a living genus of ferns in Africa, which Sir W. Hooker calls *Tæniopteris*, which, however, does not agree with the fossil genus, nor belong, I believe, to the same group. But in India, and in the Islands of the Pacific, there is a genus, *Oleandra*, which does agree with Brongniart's definition; and which has its fructification like that of *Aspidites*, under which head I would class many so called *Tæniopteris*.

I saw some months ago, at Elizabeth Bay, a large collection of ferns from the Pacific, in the collection of my friend Mr. Macleay, and I then recognised the peculiar form and structure which I have mentioned.

Would it be at all remarkable if every genus, or even many species of genera, of ferns found in our carboniferous formation, whatever its real epoch, should be found in some part of the lands in the Pacific?

The fossil mammals are represented by living forms—why not the fossil plants? Is it credible, that in the carboniferous epoch of Europe, though the sea swarmed with the same zoological genera and species, that the land should bear nothing but the identical plants of Europe, in Australia? Or, is it incredible that in Australia, plants might then exist which did not come into existence in Europe till long after?

I have been led to think on this by the discovery recently of so many living genera of plants of Australia, &c., in a fossil state in the tertiaries of the Vienna basin.

Whilst there are so many increasing proofs of varying centres of life, all dogmatism on insufficient evidence must be held unsound.

It is only within a few days that I have had brought to me, from Brunswick, a collection which proves that there may be grounds yet found for placing some portions of what Mr. McCoy calls our oolitic beds, and which I consider parts of one series, going down to the true carboniferous of Europe, in a new light. In the Hartz, or a little to the north of it, there has been found a series with plants which lies between the Lias and the Keuper, and if these beds shall be found not to be Keuperian, they must still be considered older than the Lias.

Certainly one species is very much like a plant I showed to Mr. McCoy, and which he did not consider *Tæniopteris*. The Ofen plant (for that is its locality), like that I took to Melbourne from the Wianamatta beds of the New South Wales series, and which I place on the exact horizon of the Barrabool Hills beds, from careful comparisons of the formations, *i.e.*, at the very top of our New South Wales coal beds, or rather coal formations, agrees with *Tæniopteris* in the form and independence of the frond, and in the thickness of the midrib, but differs in the neuration, having only minute perpendicular simple nerves.

The Ofen plants have been found in Sweden, and have been, I think, described by Angelin. Professor Blasius discovered them near Brunswick. With them are found dicotyledonous leaves like the Myricaceæ, and others like Salix, Corylus, Oak, &c.

These are not ferns, as some persons at first believed.

There are also one Nilsonia, one Cycadites, Calamites and one Carpolithus, with some true ferns, and small portions of brown dirty coal and remains of wood.

The specimens brought hither are in a sad broken state, owing to accidents on board ship. But I give not my own determinations, but those of Dr. Blasius.

I would not be surprised, when the whole deposit of our carboniferous series shall be made known, if doubts should arise as to the confidence with which some persons speak as to the correlation of the Australian and Indian coal beds.

Trusting that you will kindly pardon this long letter, and allow me to defer to another time the discussion in full of the subject of it,

I have the honor to remain,
My dear Sir,
Your Excellency's faithful servant,
(Signed) W. B. Clarke.

His Excellency Sir Henry Barkly, K.C.B.

P.S.—I have written the foregoing in haste; but if any discussion arise at the Royal Society, to which my friend Dr. Müller wishes me to contribute a paper on the subject of the coal formation, and if your Excellency please, I have no objection that what I have written should be made use of. It might serve to foreshadow some points in the argument.

In my letter I have not alluded to *Virginia;* but on reference to Mr. Bunbury's description of *Tæniopteris magnifolia,* brought by Mr. Lyell, and on which stress is laid, I find he considers it in some respects akin to the living *Oleandra pilosa,* which justifies what I have said before; and I think his description of the neuration agrees very nearly with that of the plant I mentioned from Ofen, near Brunswick, and that also from my Wianamatta beds of Paramatta. (See what he says, Q. J. III., 281, 287.)

Nor have I said anything of India. But if we refer to M'Clelland's figures—(Report, 1850, t. XV., XVI.,) we shall see that his *T. spatulata* and *T. acuminata* are NOT *Tæniopteris;* and his third species, *T. danæoides,* as defined by Göppert (p. 352), is an *Aspidites.*

The bearing of the reference to *Aspidites* is this: that it is a genus which is not confined to the Jurassic epoch; and one species called *T. vittata* belongs to the Keuper. This last formation has more to do with us than some think.

Tæniopteris.

I. (A Brongniart Hist. des Veg. Foss., tom I., p. 262.)
(1.) Folia simplicia, integerrima.
(2.) Nervo medio crasso rigido.
(3.) Nervulis perpendicularibus.
(4.) Vel BASI furcatis.

Fructificatio punctiformis.

II. (Göppert Die Fossilen Farrnkräuter, p. 58.)
(1.) Frons simplex—integerrima.

(2.) Nervo medio crasso rigido.
(3.) Nervulis perpendicularibus.
(4.) Simplicibus vel BASI furcatis.

Die Arten diser Gattung sind den Aspidien mit ganzen Wedeln ähnlich.

III. (Lindley and Hutton, Vol. I., p. XLVIII.)

(1.) Leaves simple entire.
(2.) With a stiff thick midrib.
(3.) Veins perpendicular, simple,
(4.) Or forked AT THE BASE.

They assign three species to Lias and Oolites, and give two figures:

(a.) Vittata—not in agreement with the definition.
(b.) Major—not, &c.

They admit that (a) is hardly distinguishable from the living Indian *Aspidium Wallichianum;* (b) may be almost identified with *Scolopendrium officinarum,* a living British plant.

(IV.) (Brongniart Prodrome, p. 61.)

(1.) Fronde simple, entière, etroite à bords parallèles, traversée, par
(2.) une nervure moyenne, forte, epaisse, qui s'ètend jusqu' à l' extremité ; nervures secondaires
(4.) presque simples ou bifurquée
(3.) à la Base, presque perpendiculaire sur la nervure moyenne.

ART. III.—*A Commentary on "A Communication made by the Rev.* W. B. CLARKE *to His Excellency Sir* HENRY BARKLY, K.C.B., &c., &c., *President of the Royal Society of Victoria, on Professor* McCOY'S *new Tæniopteris, &c., &c."—By* FREDERICK McCOY, *Esq., F.G.S., Honorary Fellow of the Cambridge Philosophical Society, Professor of the Natural Sciences in the University of Melbourne, Government Palæontologist, and Director of the National Museum.*

[Read before the Royal Society, 25th June, 1860.]

MY great dislike of controversy, and my belief that the time of a scientific man may be better employed in endeavouring to add new facts to the general store of human knowledge, than in defending himself or his views, when once put forward, would certainly have induced me on this occasion, as on most similar ones, to let my opponent's views and mine stand without discussion for the judgment of those concerned. Having, however, been honoured with a request—which to me is a command—to furnish a written comment on Mr. Clarke's paper to the Royal Society this evening, I do so cheerfully; and the more so as it is just possible that some members of this Society might feel inclined to attach some weight to any deliberate statement of mine on natural science, and not having time to sift the evidence for themselves, might wish to hear my reply when such statements were controverted.

I will pass over without remark the apparent discourtesy in the first paragraph, in which (without having seen the fossil) he doubts my assertion, made at the last meeting of the Society, that a fossil fern from the coal rocks at the mouth of the Bass River belonged to the genus *Tæniopteris*. I will simply prove my assertion, if not to the satisfaction of Mr. Clarke, certainly to that of every one else, including one authority at least (Dr. Mueller), to whom, I believe, he admits the necessity of paying deference in botanical matters. Mr. Clarke has been at the pains to copy out, in the concluding part of his paper, the true generic characters of *Tæniopteris*, as he accepts it, from the works of Brongniart, Göppert, and of Lindley and Hutton. I was not ignorant of these characters, when I referred my fossil to the genus in question at our last meeting; and I now prove that it possesses all those characters (including the furcation near the base of some of the secondary nerves, underlined strongly in Mr. Clarke's manuscripts), by laying the specimen again on the table, for the satisfaction of those present, and by giving Dr. Mueller's written testimony* that he had compared the specimen with Brongniart's definition, and finds my previous determination rigidly exact on the strictest view of the genus—for the satisfaction of those at a distance.

Having now, I hope, satisfactorily vindicated the generic character of our Victorian *Tæniopteris,* we may consider the next point in the same paragraph, namely, Mr. Clarke's protest against those geologists "who maintain that a formation "so abundant in zoological fossils as the jurassic is found here, "where no one in any part of the Australian continent has ever "detected one single species, on the strength of the evidence "derived from a few (probably not six in all) species of plants, "the true description of which does not agree in all things with "the typical characters of the genera under which the species "are ranked." On this I would remark—1st. That the number of species of plants, described by competent authorities in English and German books, from the coal beds of Australia is not six, but twenty-three. All of these are more allied to oolitic than to palæozoic types, and of five entire genera of them—viz.: *Glossopteris, Tæniopteris, Phyllotheca, Zeugophyllites,* and *Vertebraria*—no single species has ever been found in any undoubted palæozoic coal-field in any part of the world; while, of the other genera, two species are scarcely separable by any tangible characters from species of the oolitic coal-beds of Scarborough. 2nd. The very nature of generic groups is such that no naturalist expects *all* the species of a

---

* *(Copy of note from the Government Botanist to Professor McCoy.)*

Melbourne Botanical and Zoological Gardens,
21st June, 1860.

My very dear Sir—

To so world-famed celebrity amongst palæontological authors as yourself, it is perfectly superfluous to state that the Victorian fossil determined by you as an undescribed species of *Tæniopteris,* accords fully with the generic diagnosis originally published by Brongniart (Prodr. 16); but as you were particularly desirous that I should compare this new species of the genus *Tæniopteris* with recorded definitions, I gladly responded to your request, and beg to give it as my opinion that I regard the *T. Daintreei* in no way different from its congeners.

Most regardfully, dear Professor, yours,
(Signed) Ferd. Mueller.

Professor McCoy, &c., &c.

genus "to agree in all things with the typical characters of the genus;"—this would require nearly as many genera as species, and destroy the advantages of the larger groups. The accepted rule might be roughly exemplified thus: If a genus be characterised by three positive characters, *one* of them may vary in any species which, possessing the other two unaltered, might be classed with the given genus; but different species would not necessarily vary in the same character. Apart from this general illustration, I may observe that the generic references of the Australian fossil plants have never been objected to by botanists, and they have all been carefully made by observers (except myself) of universally acknowledged accuracy. 3rd. As for the objection that the plant beds cannot be oolitic, because no oolitic animal remains have been found, there is nothing in it; for at Richmond, in Virginia, there is a coal-field twenty miles long, with beds of coal forty feet thick, worked by shafts one thousand feet deep, the coal-beds, accompanied by layers of fossil plants, having a strong general resemblance to those of the New South Wales coal deposits, the whole series being, after deliberate survey and examination (amongst others by Sir Charles Lyell and Professor Rogers), distinctly and unanimously referred to the oolite * formation by all the geologists and palæontologists of America and Europe; and yet, in the whole of North America, though more fully examined than New South Wales by geological surveyors, not a trace has yet been found of any oolitic zoological fossil.

Mr. Clarke's next paragraph says, "The two genera, "*Tæniopteris* and *Glossopteris* (*Sagenopteris*) have been the "means of placing, by some geologists, the coal deposits of "Australia and India in the horizon of the oolitic coal. Now, "the latter occurs in five distinct formations in India, as Mr. "Oldham informs me, and it also occurs in Africa, where the "evidence appears to be against the supposed epoch." This paragraph shows that Mr. Clarke has missed some important links in the chain of reasoning by which I considered the coal rocks of the Hunter related in geologic age to the oolitic formation. I rarely take the liberty, in any paper of mine, of stating

* Very recently the suggestion has been discussed of the "Triassic" age of these American beds, but the evidence is inconclusive, and at farthest the trias is as much mesozoic as the oolites, and the discussion in question would not help Mr. Clarke's position of his Newcastle plant-beds being of the Pælæozoic Carboniferous age of the underlying marine-beds with Trilobites, nor invalidate my view of their mesozoic character.

anything which might be assumed to be known to the reader from a study of previous writers; and when, in former papers, I used the identity of the fossil plants of the Indian and Australian coal-fields as one step in the comparison of the latter with the oolites of Europe, I was not simply arguing in a circle, as Mr. Clarke seems to suppose, but making use of the knowledge published to geologists for more than twenty years that in India these coal plants are accompanied by abundance of ammonites and other marine zoological fossils, having the clearest relations with the lower oolitic fossils of the clear sections of Europe. I thus, by a fair philosophic process, transferred to the Australian beds the whole of the geological arguments applied to the identical Indian ones from the association with the latter of those zoological fossils, the absence of which in Australia, Mr. Clarke attempts to use in a powerful manner, but for which I just now indicated an exact parallel in America. Mr. Clarke, in the above paragraph, putting the word "*Sagenopteris*" in brackets after "*Glossopteris*" when speaking of the Indian and Australian plants, proves that he cannot have read Professor Presl's remarks, when founding the genus *Sagenopteris*, in Sternberg's "Versuch einer Geognostisch-botanischen Darstellung der Flora der Vorwelt," as the very object of establishing the genus was, by separating some abnormal European forms, to leave the Indian and Australian plants *as the true types of the genus Glossopteris*. Mr. Oldham's quoted statement of *Glossopteris* occuring in five distinct formations in India, is only intelligible on the supposition that the word "formation" is used—not in the technical sense of geologists, but as synonimous with "bed." The reference to the occurrence of *Glossopteris* in Africa, as supporting the view of the palæzoic coal age of the genus, is also unhappy, as the researches of Dr. Rubidge clearly prove that the *Glossopteris* of Bloemkop, in South Africa, are only found in the Karoo beds containing the bones of the *Dicynodon*.

Mr. Clarke's next paragraph states :—"As to *Tæniopteris*, "so far from determining the age of a formation, Jukes, who "follows Bronn, assigns the species thus :—

"Carboniferous	1	
Permian.........	2	
Trias...........	3	Oolite 6, not 7.
Oolite..........	6	
Tertiary........	1	"

I have no doubt Mr. Jukes would be much surprised to find himself quoted as an authority on Palæontology: he describes himself, in a note, as ignorant of the subject; and the many errors in that part of his book should not, therefore, be counted against him. But as the Rev. Mr. Clarke has undertaken to overwhelm me with this authority, I suppose I am bound, as a mere matter of courtesy, to return him a few taps with the same weapon. Mr. Clarke's extract above is from p. 375 of Jukes' Manual, but if he had read his own authority as far as p. 437, he would have found a list of the genera of plants dating their appearance in time from the carboniferous epoch, and that *Tæniopteris* was not there. If, again, he had continued his studies of his author to p. 462, he would have found a list of the plant genera dating from the Permian, and that *Tæniopteris* was not there. If the perusal of his book had extended to p. 466, the list of genera of plants originating in the Trias would have been found, again without *Tæniopteris;* and if, finally, he had been so unhappy as to have read to p. 473, he would have found the authority of his own choice distinctly marking *Tæniopteris* as a genus of plants which *commenced and ended its existence with the oolitic* or jurassic period. This is probably enough for the present of this authority; and I will now lay before the Society a somewhat better list of the distribution of clearly ascertained species of *Tæniopteris* (Mr. M'Lelland's two Indian species being omitted, as I have not his report at hand):—

Tabular View of the Geological Distribution of the clearly ascertained Species of the Fossil Genus Tæniopteris.

TÆNIOPTERIS.

None from the Coal.		
2. Permian.	P.	*abnormis* (Gutbier) Rotheliegende, Planitz; Saxony.
	P.	*Eckhardi* (Germ.) Copper Slate; Mansfeld.
2. Keuper.	Tr.	*marantacea* (Stern.) Keuper; Stuttgardt.
	Tr.	*Schœnleini* (Ettingsh.); Keuper.

14. Oolite.	O.	*obovata* (F. Braun.) ; Lias.
	O.	*vittata* (Brong.) Lias and Oolite ; Whitby.
	O.	*Zoebingiana* (Ettingsh.) ; Weald.
	O.	*ovalis* (Presl.) Oolite ; Scarborough.
	O.	*major* (Lindley and H.) Oolite ; Yorkshire.
	O.	*magnifolia* (Rogers.) Oolite coal-field ; Virginia.
	O.	*Asplenioides* (Ettingsh.) ; Lias.
	O.	*Münsteri* (Göppert) ; Lias.
	O.	*Haidingeri* (Ettingsh.) ; Lias.
	O.	*Scitaminea* (Presl.) ; Stonesfield Slate.
	O.	*latifolia* (Brong.) ; Stonesfield Slate.
	O.	*Danæoides* (Royle sp.) ; Burdwan coal beds.
	O.	*Phillipsi* (Presl.) Oolites ; Yorkshire.
	O.	*Nillsoniana* (Brong.) Jurassic beds ; Coburg.
2. Tertiary.	T.	*Bertrandi* (Brong.) Tertiary ; Lombardy.
	T.	*Ungeri* (Ettingshauser) ; Tertiary.

No trace of *Tæniopteris* has ever been found in a palæozoic coal bed : the erroneous carboniferous citations in many books of this genus—like those of *Glossopteris*—referring to the occurrences in the Indian mesozoic coal-fields. Two doubtful species are Permian, 2 upper Triassic, 14 highly typical forms Oolitic, and 2 Tertiary. The evidence from known species is therefore overwhelmingly in favor of any rock containing a typical *Tæniopteris* being oolitic, and decisively against its belonging to the palæozoic coal epoch, supported by Mr. Clarke.

In his next paragraph Mr. Clarke says:—"When we come "to Yorkshire, which is one of the references, we find in "Phillips no figure of any species of *Tæniopteris*." At our last meeting I stated that the new *Tæniopteris Daintreei* was most nearly allied to the *T. vittata* (Brong.) of the Whitby oolitic shales figured in Phillips' Geology of Yorkshire, t. 8, f. 5. I have the figure referred to under my eyes, and now lay it on the table for the inspection of members. As Mr. Clarke, however, denies its existence, there is no more to be said on the matter. The next part of this paragraph, and portions of several subsequent ones, are taken up with some involved confusions about the genus *Aspidites* of Göppert. In brief, this is so unnatural a group (formed of portions of various genera of various ages), that it has been unanimously rejected by all more modern writers ; and Mr. Clarke's or

Göppert's references of *Tæniopteris* thereto is against the sense of Ettingshauser, Morris, Bunbury, and all the other highest living authorities on fossil plants. This paragraph concludes with a statement that it is unphilosophical for me to assign an epoch to the Australian coal without stratigraphical evidence, and on the indication of plant genera, "referable to more than the assumed epoch." To which I reply that all the known stratigraphical evidence is in my favor, and that the plant genera are *all admitted* as belonging to the mesozoic epoch for which I contend; but they *do not* belong to the epoch for which Mr. Clarke contends, and that seems just the difference between our positions—that *all the evidence,* as far as it goes, is in my favor, but wherever of a distinctive nature, is against my opponent.

The next paragraph of Mr. Clarke's paper commences with a notice of the reasons which induced Morris, Strzelecki, and myself to form our opinions on the age of the coal and underlying formations in New South Wales and Tasmania, which, I consider, gives so imperfect a view of the question, that I must state it differently:—About twelve years ago I examined critically a very large collection of fossils sent to England from these rocks, by Mr. Clarke, and formed an opinion on the age of their formation, from such data, different from that to which Mr. Clarke had pledged himself before the necessary data for forming an opinion had been examined. The reasons for my conclusions I will briefly quote from the concluding part of a paper I published on the subject eleven years ago, in the Annals and Magazine of Natural History:—

"In the above notice" (I state after describing the fossils) "I have given eighteen species of fossil plant from the Mulu- "bimba district, which is a portion of the great Newcastle "and Hawkesbury basin, twelve of which are considered new, "Those plants belong to ten genera, two of which—*Vertebraria* "and *Zeugophyllites*—are only known here and in the supposed "oolitic coal-fields of India; one genus *(Gleichenites)* I have "provisionally used for the *Pecopteris odontopteroides* of Morris, "from the verbal characters given by Göppert for that genus, "the species of which are found only in the palæozoic coal; "the plant, however, agrees much better with the species of the "Keuper genus *Heptacarpus* than with those of the carboni- "ferous *Gleichenites;* and if we look rather to the plants them- "selves than to the definitions given of the genera, I should "certainly place it there.. All the other genera (with the

" exception of *Phyllotheca**, which is confined to the locality)
" are well known in the oolitic coal deposits of Yorkshire, and
" one species, the *Sphenopteris germana* (McCoy) is scarcely to
" be distinguished from the common *Pecopteris Murrayana*
" (Br) of the Scarborough shales. Several of these genera
" are common both to the carboniferous and oolitic periods;
" but the most abundant and characteristic plants of the
" Australian beds belong to a genus (*Glossopteris*) never found
" in the old coal-fields, but several species of which are, on the
" other hand, well known in coal-beds of the oolitic age in
" various parts of the world. I am, therefore, strongly of
" opinion, from the evidence of more than double the number
" of species of plants known before, that the coal deposits of
" Australia should be referred to the oolitic period; and this
" opinion derives much additional weight from the negative
" fact that, among the large quantity of remains of plants
" which I have examined from this district, not a trace has
" been observed of any of the characteristic carboniferous
" genera—not a trace of *Lepidodendron* or any allied plant—not
" a trace of *Sigillaria, Favularia, Stigmaria,* or even of true
" *Calamites.* I might further add, that the list of plants I have
" given destroys any negative arguments formerly based on the
" fossil evidence for considering the Jerusalem coal basin to be
" of a different age from the Newcastle one, as I have detected
" the most characteristic plants of the former abundantly in
" the latter beds, so that the fossil evidence now would go with
" the admitted identity of the walls of the basins, and the
" general analogy of the sections to prove them all of one age.

" In the underlying rocks I have been able to determine
" 83 species of animal remains, of which 14 are *Zoophyta,* 3
" *Criniodea,* 4 *Crustacea,* 25 *Brachiopoda,* 24 *Lamellibranchiata,*
" 6 *Gasteropoda,* 4 *Pteropoda,* and 3 *Cephalopoda* (including
" *Bellerophon*); of these, 4 genera and 32 species are figured
" and described as new. These 83 species belong to 39 genera,
" all of which (with the exception of the genera *Tribrachyocrinus,*
" *Pachydomus, Notomya,* and *Eurydesma*—new forms—at
" present only known in Australia) are abundant in the carbo-
" niferous rocks of Britain, many of them not being found in
" any higher series, and several of them not being known in
" any older deposits, so that the age, even if *we only look to the*
" *genera of the fossils,* is clearly limited to the carboniferous
" period; but when we descend to the critical examination of

* Phyllotheca has, since the Paper was read, been also discovered in the Oolitic Sections of Europe by de Zigno.

"species, we find so extraordinary and unexpected an amount "of agreement between these beds and the similar shales, "sandstones, and impure limestones forming the base of the "carboniferous system in Ireland, that it is impossible not to "believe them to be nearly on the same parallel; and there is "equal difficulty in imagining them to be either younger or "older than those deposits. Of those species no less than 11 "are believed to be positively identical, on the most careful "comparison of the Australian and Irish specimens; and nine "more are so closely allied that it has been found impossible "to detect any difference of character, as, either from "imperfect preservation or want of sufficient specimens to "display, all the characters have not been specifically iden-"tified. With such evidence as I have mentioned, I do not "think it improbable that a wide geological interval occurred "between the consolidation of the fossiliferous beds which "underlie the coal, and the deposition of the coal measures "themselves; that there is no real connection between them, "but that they belong to widely different geological systems, "the former referable to the base of the carboniferous system, "the latter to the oolitic, and neither showing the slightest "tendency to a confusion of type."

Since the above was written, Mr. Dana, who in 1839 published his observations, with the American Exploration Expedition, visited the localities, and got several more fossils, without causing any alteration in the above views; and a few years ago Mr. Selwyn, the director of the Victorian Geological Survey, made an official survey of the Tasmanian coal-fields, in which Count Strzelecki thought the clays containing large shells of the genus *Pachydomus*, such as are found *under* the coal-beds at Newcastle, seemed doubtfully to *overlie* the coal-beds of Tasmania, which would thus be proved to be of the same age as the underlying palæozoic shell-beds. Mr. Selwyn found the *Pachydomus* beds, however, all in their true normal position, *under* the coal everywhere in Tasmania as in New South Wales, thus clearing away the only even doubtfully suggested stratigraphical objection to my views. It may also be satisfactory for me to state that all the information I have been able to acquire, for the last twelve years, bearing on the question, and derived from N. S. Wales, Victoria, or Tasmania, stratigraphical as well as palæontological, tends to confirm my original impression above quoted, and that I know of no fact invalidating it, or which, in fairness, I could state on the other side.

I now, with much reluctance, approach the most disagreeable part of my task. On the publication of my results, as above quoted, Mr. Clarke, as he states in the paragraph of his paper we have now reached, wrote to the English journals, asking geologists to suspend their judgment—the point going against him; and, shortly after, he wrote to a leading geologist and mutual friend, to this effect: "Mr. McCoy's "most powerful argument against my view of the palæozoic "age of our Newcastle coal-beds, is founded on the supposed "absence of all the characteristic genera of true coal-measure "plants. I should like to have his opinion of the enclosed fossil, "which I think will satisfy him." My opinion on the fossil enclosed was, that it was a distinct species of one of the sections of *Lepidodendron,* clearly indicative of the true palæozoic coal epoch; to which I added the reasons for my equally strong opinion *that it never came from the beds we were arguing about.* Every one who saw Mr. Clarke's letter thought it impossible to doubt his meaning, that the fossil he sent to upset my objection that no coal-measure plants had been seen in certain beds, came from those beds; as I was positive, however, the pointed questions were put to him—"Did you find the specimen your-"self, and did it come from the actual beds which afforded the "other plants on which the dispute turns?" The tardy admissions were thus extracted from him:—That the specimen of *Lepidodendron* had been given him by an unscientific friend, and came from a geologically unknown locality far to the north, in the country now called Queensland; so, that instead of invalidating my conclusions, my views were strengthened by the proof, that the palæozoic and oolitic coal formations might be found near together in Australia (as in England and America), each with characteristic distinctive palæontology; and here, as in Virginia, the vague baseless supposition (revived in the present communication of Mr. Clarke), that the geographical distance from the European types might have caused the palæozoic formations to assume the palæontological characters of the oolitic ones, falls to the ground as unsupported by new facts, as by induction from the old ones. Mr. Clarke, in his present communication, says:—"Others besides myself have found some of the missing true "coal-plants, and I am now in a position to point out six localities "in this colony and in Queensland where they are to be "found." On which I remark, that they are not, however, found in the beds in dispute, *nor mixed with* the plants to which I have assigned a mesozoic age, as any reader of Mr. Clarke's paper would be in danger of taking for granted. As to the specimen he alludes to in the Melbourne Museum, the Government Geologist can testify that, on first seeing it, some years ago, in a store in Melbourne, I at once characterised it to him as the most important palæontological specimen ever found in the colony, as it proved the existence of the true palæozoic coal formation in Gipps Land; and, I further told him, it was of the same species as a fragment sent many years ago from the Moreton Bay district by Mr. Clarke, and the specimen was distinctly pointed out to Mr. Clarke, when he visited the Museum, as one likely to interest him.

In his next paragraph Mr. Clarke says, "He was slow in "admitting what I stated to him in February last, that now "we have found in New South Wales coal seams in the very "heart of his mountain limestone fossils, and that plants known "in the Newcastle beds, which he calls oolitic, were found at "the very bottom of the whole series of these newly opened "beds, containing the M. L. fossils." The facts of the case are these, and can be vouched by the Government Geologist.* Mr. Selwyn brought me, at the date mentioned, a fragment of shale with the Newcastle species of plants, which he said Mr. Clarke had brought from the bottom of a coal-pit, the sides of which gave a clear section, showing the marine carboniferous fossils at a certain distance from the surface less than the depth from which the plants came, so that he supposed the matter in dispute was finally decided. I asked him if Mr. Clarke had himself got the specimen, and could himself vouch for the existence of a bed containing such plants below the bed of marine zoological fossils. Mr. Selwyn had no doubt that the words and sketches of Mr. Clarke clearly and unmistakeably conveyed the impression that he had. To Mr. Selwyn's astonishment, however, it turned out, on my pressing Mr. Clarke, who then joined us, that he had never been at the spot; that the bit of stone had been brought up by one of the workpeople from the bottom of the pit, sunk through the coal beds, intercalated with shales containing the Newcastle species of plants into the underlying marine beds; that there was no evidence whatever of a

* Mr. Selwyn, the Government Geologist, was present when the above paper was read, and confirmed the references made to him.

bed containing the plants at the bottom of the pit, but that such specimens as had been made use of as a geological argument might tumble in *from the coal beds in the upper part of the pit,* and fall to the lower part, composed of the mountain limestone beds, every hour of the day; and might be brought up, like any other extraneous matter, in the way in which the fragment in question had. Mr. Clarke's final phrase, in answer to some remonstrance of Mr. Selwyn, who found the arguments which he had accepted in the morning entirely without foundation, being his often repeated one, "that nevertheless he was quite satisfied they were all of one age." This phrase Mr. Clarke continually used in writing to English geologists on the evidence afforded by his stratigraphical sections, until at my suggestion pushed to give an accurate representation of any actual case in point, instead of vague assertions, when it proved that he had not a single section in support of his view, and even up to February last he had not been able to find one either in New South Wales, Victoria, or Tasmania.

As to the Bacchus Marsh and Darley sandstones, I have not yet seen perfectly decisive specimens from them of the *Glossopteris,* but there are abundance of fronds of a new genus*, to which belongs the plant I have figured from the New South Wales coal beds under the name of *Cyclopteris(?) angustifolia,* which occurs there, as well as in India, with the *Glossopteris,* and has exactly the same geological significance as the *Glossopteris* for the Bacchus Marsh sandstones, in which the *C. (?) angustifolia* is distinctly present.

In conclusion, I feel that some apology is due to the Society for occupying so much time, but at the same time I would remind the members that I said all I had got to say on the discovery of the *Tæniopteris Daintreei,* and its geological significance, which I considered worth saying, in less than five minutes at our last meeting; to which I will add, that I shall be the first to communicate to the public, through the Society, any fact which may hereafter come to my knowledge tending to weaken the views I hold, and which I have been defending simply from a sincere belief in their accordance with truth.

---

* This genus I have called *Gangamopteris,* the chief characters being those referred to in my old paper quoted above, as separating the plants in question from *Glossopteris* on the one hand, and from *Cyclopteris* on the other.

Art. IV.—*The Conjugal Condition of the People of Victoria, considered in relation to Laws of Divorce.*

[Read before the Royal Society, 16th July, 1860.]

A consequence of progress in speculative science, and one which shows how circumscribed are the views of the most ingenious—by how little any man can outstrip his generation—is that new investigations in one direction lead to the reopening of inquiry in others. Matters which, it might be supposed, had long since been viewed in every possible light, and thoroughly exhausted, are rendered capable of being presented in novel aspects, or in connexion with associations not previously noticed, calling upon us to review conclusions, and subject them to new tests. Thus inquiry into the economical condition of nations, though its object is material, inevitably turns upon the moral and psychological, because it is found that the production of wealth is powerfully affected by institutions, habits, customs, and even by the principles of human nature variously developed. Social science, which is so rapidly rising to importance, may be said to have arisen out of this connexion. Not merely from the sentiment of benevolence does the social economist propose to enlighten the ignorant, but because the more gentle any man is, the better producer of wealth he is found to be; and because it is believed that ignorance is productive of poverty and crime, which in their turn are burdensome and oppressive; not from the instinct of a charitable heart is he prompted to improve the habitations of the poor, to cleanse the haunts of vice, and to let the sun into the gloomy dwellings of the miserable, but because disease impoverishes the community, by disabling the strong arm of him who had heretofore kept a wife from the workhouse, and children from the corrupting patronage of the receivers of stolen goods; because premature death deprives society of many of its most valuable contributors to industrial progress before they have discharged the cost of bringing them to man's estate. So long as it was supposed that learning made the poor man discontented, and unfit for daily toil, or so long as it was supposed that death removed consumers rather than producers, so long were schools for the poor, athenæums, and mechanics' institutes looked upon with coldness, and hospitals left to the care of the religious and tender-hearted. What the charitable and sympathising did for the sake of the poor sufferer—for the individual—the social economist proposes to do for the good of society at large.

To the recognition of the fact that many of the phenomena observable in the comparatively unequal distribution of riches amongst the population of different countries, or in the same country at different periods, are attributable to their peculiar institutions and usages, are we indebted for the more extended statistical inquiries which have of late years been made, and amongst others for that relating to the Conjugal Condition of nations; and by the results which are obtained in the latter investigation, or, more correctly speaking, by viewing these results statistically, we are led into a series of reflections, and brought to draw deductions which would scarcely occur to our minds, if we were insensible to these relations. It is true that we do not require statistical facts to perceive the immense consequences of monogamy as compared with polygamy, or to understand that they could scarcely exist under similar political systems. The most careless thinker must at a glance perceive the vastness of the difference between a system which makes one half of a population little better than the slaves of the other half, and one which aims at making woman the social equal and partner of man, interested in his fortunes, the manager of his household, and the principal instructor and moral trainer of his children. Neither are any figures requisite to impress upon the mind the prodigious social change which would result from such a relation of the sexes as would follow the adoption of the principle of a Rousseau, who would throw the support and instruction of the child upon the State; supplanting by the foundling hospital the *family*, or self government localized to the minutest degree; abolishing at once both parental and filial ties and duties; educating the children of a country by one rule common to all, through the hard instrumentality of salaried masters and matrons, rigid disciplinarians, on whose part manifestations of affection would be partiality and weakness; replacing individuality by uniformity of character, and taking from the parent the inspiriting desire of transmitting his name, wealth, and honours to successors, and removing the necessity of even working for them. When we recollect that from his instructors a man has obtained little more than precepts, but that those qualities which are, as it were, engrafted into his soul, and which, form his character, are derived from those in whose company he constantly is; and, therefore, in most instances from his family, we can guess at the magnitude of the revolution which would follow from the overthrow of our present system by the substitution of one so different. But when we look more minutely into the matter, we perceive that monogamy admits of variations, productive of very serious consequences, some of which are not far short of those which would flow from the extremes referred to. For example, the law may allow a man to have but one legal wife, but nevertheless it may sanction what in effect would amount in practice to polygamy; or it may, while confining the man to one wife at a time, admit of an unlimited number in succession, by giving the husband the power to divorce on the lightest grounds, as became the usage in Rome in the latter period of the Republic, and during the Empire; a usage, it may be remarked, to which probably more than to any other circumstance, may be attributed that decline in the population of central Italy, which ultimately led to the removal of the seat of Government to the shores of the Bosphorus—the virtual extinction of the Empire of Rome.

Of the mischievous consequences of too great a laxity of the marriage contract, Augustus was conscious, and attempted a return towards that system under which a small colony grew into a colonizing empire; but, as we are informed by Gibbon, "once, and once only, he experienced a sincere and strenuous opposition. His subjects had resigned all political liberty; they defended the freedom of domestic life. A law which enforced the obligation and strengthened the bonds of marriage, was clamorously rejected. Propertius, in the arms of Delia, applauded the victory of licentious love, and the project of reform was suspended till a new and more tractable generation had arisen in the world."*

The measure referred to in this passage was the *Lex Julia* and *Papia Poppæa*, designed to discourage celibacy, and encourage marriage, with a view to the promotion of population; and may have done what all the legions on the Rhine and the Danube failed to do—protected Italy from the iron heel of the barbarian. Unfortunately, however, the efforts to set limitations to the liberty of divorce signally failed, so much

* Gibbon, Chapter xliv.

so that "Jerome saw at Rome (A.D. 321 to 340) a triumphant husband bury his twenty-first wife;*" and so infatuated were these unhappy people in their desire for licentious indulgence, that the successor of Justinian had, we are told, to yield to the prayers of his unhappy subjects, and restore the liberty of divorce by mutual consent.†.

To a state of things pregnant with so many evils, and which irretrievably weakened the vast domains of the Cæsars, England appeared to be verging from the times of Charles II.; but fortunately the effects of licentiousness were felt at a period when a legislative remedy was practicable, and the eloquence of a Fox, specious but unsound, failed to overthrow a measure‡ which divested the marriage ceremony of the disgraceful associations which are attendant more or less upon all that is clandestine—lifting it from a mere verbal promise that might be denied to suit convenience, faithlessness, or caprice, into a solemn public contract. To this reform we cannot refuse to attribute a great improvement in the character of parents. It was, as it were, a restoration of "the family"—a term to the Anglo-Saxon mind fraught with meaning—and the health, education, and career of the child became more and more an object of solicitude to parents, more united, more interested in each other's welfare, and more virtuous. The quiet enjoyment of the domestic circle succeeded to the gin-palace, the gambling table, and the "assembly room," where the woman, half wife, half mistress, endeavoured to secure her hold upon a capricious lover by blandishments and intrigue. Sober industry and thrift succeeded to habits wasteful of time, exhaustive of energies, and prodigal of earnings; and a smaller number of illegitimate children—illegitimate, perhaps, only by the father having broken his plighted faith—became a burden upon society, to add in their turn to the evils of a community to which they were bound by no tie, with which in fact their position made them at war.

But the power of the legislator to affect the social, moral, and material circumstances of the governed, through the institution of marriage, is not confined to the broad principles of measures. The minutest details are not without their influence. For instance, a law such as that of the Twelve

---

* Gibbon, note, Chapter xliv. † Gibbon, Chapter xliv.
‡ Lord Hardwicke's Act, 1753.

Tables, by which a woman who lived for one year without interruption with a man as his wife, became a wife, though, at first thought, it might seem just in principle, must evidently have the effect of making such associations less disreputable, lowering the standard of female morality, and leading to the formation of illicit ties in the hope of their terminating in honesty. The same remark applies to laws such as those of Scotland, by which a marriage is held to be legally contracted merely "by habit and repute;" and, though to a less extent, it holds good in reference to an enactment by which children born out of wedlock are legitimized by subsequent marriage. Seduction, concubinage and bigamy are facilitated, if not actually encouraged, by such regulations; and libertinage, with its inevitable concomitant, celibacy, are adverse to the growth of population as well as to moral advancement. To the laws of marriage which obtain in Scotland must, in part, if not entirely, be ascribed the fact that so much smaller a proportion of the population of that country are living in the marriage state than is the case in England and Wales. Thus, while in the latter country 59 in every 100 women aged 20 and upwards are returned as wives, but 49 in every 100 of the same age in Scotland are married, that is, one-sixth less — an immense difference for contiguous parts of the same kingdom. The difference in the conjugal condition of England and Scotland, or, to express it in another form, the effect of the disparity in the proportion living in a state of celibacy, namely as 30 males (England and Wales) to 35 (Scotland), is manifested in the unequal rate of increase of the population north and south of the Tweed*.

While on the subject of celibacy, which, it is to be recollected, is increased by the late age at which people marry, as well as by their not marrying at all, it may be remarked that another of the many ways in which marriage laws may act upon population, and upon the morals of the people, is by advancing the age of majority. This in France is four years later than in England, and has no doubt much retarded the progress of population in that country, and moreover in all probability has proved a potent agent in producing that state of things of which so saddening a picture is presented by Michelet and others; the great multitude of young women in France, who are a prey to poverty and drudgery, struggling

---

* Since 1801 the population of Scotland has increased but 74 per cent., while that of England and Wales has increased 97 per cent.

to maintain the dignity of their sex, in an isolation not consonant with human nature. For, be it remembered, the later in life men marry, the greater, as a general rule, is the disparity between the ages of man and wife; and the greater the comparative youthfulness of the wives, the greater the number of females who never can be married, who sink into the grave victims of hard work or despondency, and but too often of vice.

There is no detail in any law so trifling as to be without a result, though we may not immediately be able to trace it; and no change can be made in so surpassingly important an institution as that of marriage, without operating upon the social, moral, and material condition of the people.

Having said so much of the importance of a thorough comprehension of all that is directly and collaterally involved in laws of marriage and divorce, and of the recurring circumstances which tend to revive the interest, and justify the re-investigation of subjects so often and so ably discussed, the peculiar situation of our own colony may fitly be entered upon.

Attention has been directed to the fact, that in tracing up the causes which influence the progress of population, in examining the varied relations of the sexes in different places, and in devising those changes in the laws of marriage and divorce which are rendered necessary by alterations in the circumstances of the people, a knowledge of their conjugal condition has of late years been esteemed of the highest importance; and it may be added that, if such be the case in older and more settled nations, it ought to be much more so in a country where the population is so small in proportion to the extent and capabilities of the territory, and where so remarkable a sexual disparity occurs. Indeed, it may safely be alleged, that when these and similar questions are under consideration, our conjugal condition should be kept constantly in view; inasmuch as our statistics disclose a state of things more startling in many respects than may have been anticipated, and ranging very widely from the normal condition of nations, as may be seen by a comparison of the figures exhibiting our condition with the corresponding ones for Great Britain, a country which may be taken as presenting a very near approach to the natural order of things.

Great Britain, at the time of the census of 1851, contained 3,391,271 husbands, 3,461,524 wives, 382,969 widowers, 795,590 widows, and the bachelors and spinsters, taking persons of the age of 20 years and upwards, amounted to

1,689,116 and 1,767,194 respectively. The corresponding numbers to these in Victoria* are 70,051 husbands, 61,955 wives, 5,147 widowers, and 3,966 widows, 88,355 bachelors, and 12,545 spinsters, both of the age of 20 years and upwards.

The figures which are representative of the two countries are, therefore, most dissimilar. In Great Britain there are more married women than married men; in this colony the married men are more numerous, outnumbering the wives in the proportion of 113 to 100. In the former-mentioned country, the widows are more than double the number of widowers; while in the latter, there are nearly 130 widowers for every 100 widows. In Great Britain the bachelors are only half as numerous as the married men, whereas in Victoria there are 126 bachelors of the age of 20 and upwards for every 100 husbands. But the greatest disparity is in the proportion of spinsters to bachelors. In Great Britain, the unmarried women are in excess of the unmarried men; but in this colony the figures given above show that, comparing equal ages, there are rather more than seven bachelors for every spinster—the excess of the former being no less than 75,810. But even viewing our circumstances in this respect in a less unfavourable light, and contrasting the number of bachelors who have attained the age of majority, with the number of unmarried females of the age of fifteen years and upwards, we find the excess to be 61,859—that there are but 22,082 of the latter to 83,941 of the former. Thus, if our social habits were to be subjected to such a disorganisation as would result from all those females who are performing the duties of daughter, sister, housekeeper, domestic or fram servant, and similar indispensable offices, abandoning their positions and entering into the married state, only 26 per cent. of the bachelors would be provided with wives, leaving 74 out of every 100 of them, besides the greater part of the 5147 widowers, who would find it impossible to obtain wives within the colony.

From the foregoing statement it will be perceived that the effective disparity of the numbers of the two sexes† in this country is but feebly conveyed by a comparison of the gross numbers of males and females of all ages, because the juvenile population under the age of sixteen years, which forms 31

---

* In all the figures respecting Victoria in these pages the Chinese are excluded.

† 160 males for 100 females.

per cent. of the inhabitants, presents no sexual disproportion of any consequence*; and that even a comparison of the adults of either sex, though the disparity in that case is as 2 to 1, does not enable us to realise to the full extent the unsatisfactoriness of our position. It is by examining our situation in a conjugal point of view that we become thoroughly impressed with the deficiency of adult females as compared with the wants of the colony, and learn how very small a proportion of them is suffered to remain unmarried.

In Victoria the unmarried women of the age of twenty and upwards are to the married women of all ages only in the proportion of 1 to 5; in Great Britain the proportion is as 1 to 2. This difference between the circumstances of the two countries is undoubtedly, to a great extent, owing to the eagerness with which the hands of young women are sought in marriage in this colony; and the evidence which our census tables present on this point would apparently warrant the conclusion, that if social circumstances less intervened to retard the intercourse of the unmarried of the two sexes, the number of spinsters would bear even a much smaller proportion to the number of married women than it does. In support of this position, the returns furnish two-fold evidence, namely, the difficulty which the men experience in obtaining wives, and the comparative ease with which the young women obtain husbands. Of this the following facts are sufficiently illustrative.

In Victoria the proportions of married among the population of the age of twenty and upwards are, in the males 42 in 100, and in the females 78 in 100; while in Great Britain the proportions are 62 in 100 males, and 57 in 100 females.

At the age-period of twenty to forty, the proportion of married in this colony is 38 in 100 males, and 78 in 100 females. The proportional numbers corresponding with these are, in Great Britain 52 in 100 males, and 55 in 100 females.

At the age-period of forty to sixty, the proportions of married here are 61 in 100 males, and 81 in 100 females; and in England, Wales, and Scotland the proportion is 79 in 100 men, and 70 in 100 women.

The inferences to be drawn from these figures, so far

---

* Excluding Chinese and Aborigines, the number of males were 237,743 and of females 145,925. The numbers under 16 years of age were, male, 60,552, and females 59,614; and the numbers of the age of 16 and upwards were, males 177,191, and females 86,311.

as the men are concerned, are that, but for the great difficulty of procuring wives, there would at the respective ages indicated be 62 married instead of 42, 52 instead of 38, and 79 instead of 61; and that, but for the unusually favorable position in which the women are placed, there would be but 57 and 55 of them married where there are 78, and only 70 where there are 81. It may further be added that, as regards the men, these figures cannot be considered as fully representing their difficulty in procuring wives, when the fact is taken into account that the laboring population of Victoria is better circumstanced, so far as the ability to support a family is concerned, than the mass of the inhabitants of almost any other country; and it is a universally recognised principle, that in all old countries pressure of population against the means of subsistence acts as a check upon marriage, or causes a very large number to postpone the age at which they would, under less unfavorable circumstances, marry.

Pursuing further the facts illustrative of the deficiency of adult females, as compared with the demand for wives, we find that while the British census returns show that of the whole number of females of the age of fifteen to twenty but $2\frac{1}{2}$ per cent. are married, the inducements to early marriage, as regards our female population, are such that there are over $16\frac{1}{2}$ per cent. married at that age. Of the number of females living at the age-period twenty to twenty-five, the proportion married in Great Britain is but 30 per cent., while in Victoria it is nearly 63 per cent. At the next period (twenty-five to thirty) there are 82 per cent. married in Victoria, and 57 per cent. only in Great Britain. At the age-period thirty to thirty-five the proportion in Great Britain rises to 70, and in this country is 88. So much for the proportions of the married.

As regards the proportions of the unmarried at different periods of age, these are, of course, the inverse of the married. Of the male population at the age twenty to forty, there are 60 in 100 unmarried in Victoria, and only 46 in 100 are unmarried in Great Britain; at the period forty to sixty there are 30 unmarried here, and 12 there. Of the female population the proportion in this colony of the unmarried at the age twenty to forty is only 19 per cent., and is in Great Britain 42 per cent. Of the age forty to sixty there are little more than 4 in 100 unmarried in Victoria, against 14 in 100 in Great Britain.

Such are the leading features of the difference between the average conjugal condition of this colony and that of Great Britain; but it is not merely the average of a country which is to be taken into account in cases of this kind. Where social defects or difficulties have to be considered in legislation, provision has, if possible, to be made for all cases, for the worst as for the best. It is for this purpose that statistical information in detail for every political and municipal division of a country is desirable; and a great deal of all legislation, though it ostensibly has a general application to a whole country, is really designed to apply only to certain parts of it. Many enactments, though law as regards a whole territory, are practically nullities throughout the greater portion of it—being designed to meet cases which arise only amongst certain classes, or in certain branches of industry.

Passing, accordingly, from the average to the special, we find on examining the conjugal condition of the population in various localities, or rather of the principal industrial classes into which the inhabitants of Victoria have determined, that there is here a greater variety in this particular than is to be found in older countries, and that the picture presented by the colony in the aggregate is, though bad, much less unfavorable than that offered by portions of it. This remark, though applicable in a high degree to those parts where pastoral pursuits are prevalent, is intended to apply particularly to the mining population, whose circumstances are more deserving of attention, because this class is more numerous than either the manufacturing and trading, or the agricultural sections of the community, forming, as it does, 38 per cent. of the population of European origin.

Turning, in the first instance, to the circumstances of the male population of the age of twenty years and upwards, we perceive that while the proportion of husbands in the rural districts nearly corresponds with the average of the colony, being 42 in 100, and that while the proportion in the seaport towns—57 in 100—does not vary much from that prevalent in Great Britain—62 in 100—the husbands form but 35 in 100 on the gold-fields. Moreover, the excess in the number of married men above married women there, which amounts to 6,072, shows that no less than 22 per cent.* of this small pro-

* The total number of husbands was 27,632; and deducting those who could have had no wives with them, the balance left was 21,560.

portion of husbands are absentees from their homes, a circumstance, be it noted, of great moment in relation to divorce, reducing the proportion of the adult male population who are living in the married state to about 28 in 100, or less than half the proportion of Great Britain.

As regards the unmarried of the male population, aged twenty and upwards, we find that the proportion on the gold-fields amounts to 61 in every 100, while the proportion among the seaport towns' population is but 39 in 100. In Great Britain only 31 in 100 are bachelors. Supposing the ability to marry, so far as affected by the wages of labor, to be the same throughout the colony, and assuming the inclination towards the formation of domestic ties to be the same on the gold-field as in the seaport town, we cannot fail to see much privation in the great disparity between the figures 61 and 39, which represent the relative circumstances of these two sections of our population in this most important respect.

Passing to the comparative position of the females on the gold fields, we find that, of women aged twenty and upwards there is a difference of 16 per cent. between the proportions of the married there and in the seaport towns; the proportion in the former rising to the high degree of 87 in every 100, or 9 higher than the average of the colony*; and being in the latter 71 in every 100, or 7 lower than the average of the colony. The relative numbers of women living in the married state on the gold-fields of Victoria and in Great Britain†, therefore, present the enormous disparity of 30 in every 100.

Referring to the proportions of the unmarried females, it appears that of every 100 women of the age of twenty and upwards, on the gold-fields, but 9 are spinsters. This proportion is to the average of the colony as 9 to 16; to the average of the seaport towns as 9 to 21; and to the average of Great Britain as 9 to 29‡.

The insufficiency, in a conjugal point of view, of the number of adult females on the gold-fields, is manifested by the early marriage of those residing there. Of 2,823 women belonging to the age-period fifteen to twenty, no less than

---

* Namely, 78 in 100.

† The proportion in Great Britain is 57 in 100.

‡ The proportions are—in the colony, 16 in 100; in seaport towns, 21 in 100; in Great Britain, 29 in 100.

851 had entered into the married state. There are, therefore, more than 30 per cent. of the entire number of women living on the gold-fields of the age of fifteen and under twenty, either wives or widows. This proportion is nearly twice as high as the average for the entire colony, and is to the ratio for Great Britain as 12 to 1.

As regards the numerical deficiency of females on the gold-fields, there were at the period of the last census, 46,144 bachelors, aged twenty-one years and upwards, to 4,301 spinsters aged fifteen and upwards; that is, making a comparison with a disparity of six years between the ages of males and females, nearly 11 to 1, or an actual excess of 41,843.

Disparity between the mean ages at which men and women marry is a point of too much importance to be overlooked in discussing the conjugal condition of a people, because great inequalities in age, just as inequality in other respects, is not unfrequently a source from which disunion in married life springs. As regards this point, it may be observed that against 846 of the 851 women whom I have already noticed as having been married under twenty years of age, there were but 34 husbands belonging to the same age period. Of the age-period twenty to twenty-five there were 5,180 wives to 1973 husbands; being altogether 6926 married women to 2007 married men under twenty-five years of age. Taking the married of all ages on the gold-fields, the average age of the men appears to be thirty-five years, and of the women thirty, being a disparity of five years, or twice as great as that of Great Britain. This seems to correspond very closely with the difference between the ages of men and women about to marry, as recorded in the marriage registers of the colony, and presents a marked contrast to England and Wales, where the disparity is only one year. An average disparity of five years betokens a great number of instances of very young women being joined to men of mature years; and deducing from one disparity other disparities, we are led to infer that there are many unions of persons unsuited in rank, education, and temperament. The attractions of wealth on one side overcome objections on the other which would in ordinary circumstances be insuperable; while the difficulty of procuring suitable wives, no doubt, often leads men to selections which they would not make in more favorable positions. As an instance in support of this view, it may be mentioned that the marriage statistics show unsuitability as regards education in the fact of 243 women signing with marks for every 100 men. The proportion in England and Wales is about 149 to 100.

These are the most prominent of the general and special facts disclosed by the Census, illustrative of the conjugal condition of this colony as contrasted with that of the mother country; and it can scarcely be considered a rash position to maintain that, if any statistics have a practical value as a guide in legislation, these are pre-eminently entitled to attentive consideration in connection with the question—Whether an experimental measure, supposed to be adapted to a country circumstanced as Great Britain is, may not, in some respects, be unsuitable to this? Uniformity in laws, though desirable in the abstract, is rendered impossible by the force of nature, by difference in climate, variety of natural productions, dissimilarity of industrial pursuits, and by the habits and sentiments engendered by varied physical and moral circumstances. It is, perhaps, sound in policy that as near an approach to uniformity as is consistent with their peculiarities should be adopted by all nations in their institutions, especially by all the divisions of the same empire; but it should also be kept in mind, that to follow blindly is not to follow wisely. Divergence, sooner or later, seems inevitable, because legislation is never ending, experience having shown that regulations well adapted to one period are sure to become inconvenient in another, and that laws imported from one community are found unsuitable to the other.

Legislation affecting the marriage state, one of the most important branches of which is that relating to the dissolution of the contract itself, if contrived barely with a view to meet the circumstances of the British Isles, and not designed to meet all cases, can scarcely be altogether applicable to Victoria. The probability that there exists a larger amount, comparatively speaking, of disunion in married life in this country than in Britain (and the daily revelations in our courts, as well as the numerous advertisements in our papers respecting wives who have deserted their homes, seem but too confirmatory of the inference deducible from our statistics — of the existence of much social derangement) points to the greater need of a measure of relief; but it also points to the greater necessity of repressive conditions being conjoined with such relief, inasmuch as numerous instances of desertion, whether on the part of the husband or wife, suggest the existence of greater facilities, or greater inducements for so doing; and if the latter, there is the more necessity for taking precautions that the most valuable of human institutions cannot be assaulted with impunity—that the most sacred of contracts cannot be violated at the instigation of caprice, passion, or interest.

The necessity of including repressive conditions in any measure which may be enacted for this colony is most appositely illustrated by the consequences which attended too great a laxity of the divorce law in California, a country which resembles Victoria in the disproportionately small number of marriageable females, as in many other respects. Repressive measures, which have been dispensed with in other portions of the Union, have had to be resorted to in that State, "to put an end," to use the words of an able article in a San Francisco paper, "to a disgraceful evil, which sat like an 'old man of the mountain,' upon the vitals of its prosperity."

The causes of divorce, as just intimated, are not the same throughout the Union. Each of the States has its special legislation on the matter; and the laws of some are much more restrictive than others—so much so, that the legislature has to be resorted to very frequently in many of the States, in cases not provided for by the statutes. The laws of some of the States prohibit the guilty party from marrying again; but it would seem that in California a discretionary power of prohibition is given to the courts. It appears, however, that this power was but little exercised until a recent period, and the ease with which divorce could be obtained, and the permission to the divorced to re-enter the marriage state, had been found to offer temptation to numbers of profligate unmarried men to sow discord between man and wife, so as to bring about a state of things that might lead to separation. After describing the abominable means resorted to, as revealed on the divorce trials, to effect this end, and denouncing the "vile and degrading system of espionage established over the husband," the *San Francisco Herald* thus proceeds:—"After enough of this kind of evidence has been collected to make out a case, the deluded wife is informed that there is no trouble in procuring a divorce. She is further told that our society is very facile on these points — that divorce suits are conducted *sub rosa* — that no unpleasant publicity ever accompanies them — that the divorced parties are left entirely free to satisfy their separate inclinations afterwards. * * * The courts have manifested a disposition to put a check upon the facilities for divorce that have obtained in this city. * * * This determination is the direct and legitimate result of a greatly improved condition of public opinion. California to-day is a very different affair from California before thousands of our own children were growing up around us. The public opinion of a community of single families is a very different thing from the public opinion of a community of single, and by no means over-scrupulous, men; and within the past week two mortal blows have been struck at the very root of the monstrous social evil that so long fed like a canker on the dearest interests of our State. * * * A divorce (in Wood's case) was sought on the ground that the defendant was an habitual drunkard; but it was shown that the charge was unfounded. The defendant, like thousands of other men in the city, against whom intemperance has never been alleged, was in the habit of indulging occasionally by drinking with his friends and acquaintances. He seems to have been subjected to a vile system of espionage by the very parties who participated with him and drank wine at his expense. * * In the case of *Buessard* v. *Buessard*, divorce was granted for adultery, clearly proven; but the judge ordered that the guilty party should be for ever debarred from again disgracing the sacred rite of matrimony, and mock at its obligations by assuming them. In the case of *Krueger* v. *Krueger*, divorce was granted for good and sufficient cause, but coupled with a like injunction. These decisions were in accordance with that of the Supreme Court in the case of *Conant* v. *Conant*, establishing the principle mentioned. We cite these facts in proof that Californians are fully awake to the pernicious influence of divorce suits, for which no reason exists other than in the inflamed imaginations of weak-minded or viciously disposed persons."

In this statement respecting the law of divorce in California, we have it presented to us that a preponderance of unmarried men led to an abuse of that measure; that, though in some of the other States no such great evil, comparatively speaking, had resulted from the absence of the restrictive clauses prohibiting the guilty parties from marrying again, yet in California it was found expedient to exercise this power; proving the necessity of adapting the laws to the peculiar circumstances of the country which has to be legislated for.

Most undoubtedly the circumstances of our population—at least of a large portion of it—more nearly approach the condition of the Californians than that of the inhabitants of the British Islands. Is their experience, it may be asked, altogether unworthy of our consideration?

With reference to the policy or justice of placing on the guilty a prohibition from again marrying, it is possible that cases may occur where to do so would prove a hardship, or cause a life of crime to be the sequence of a moment of guilt; but the most salutary contrivances have their drawbacks. The punishment we inflict for a small theft, hampers the progress of the reformed and hardworking man throughout his after-life, making him perhaps in the end a burden on society. The fraudulent bankrupt is refused permission ever again to enter into trade; and probably continues a rogue and a pauper for the remainder of his life. If, therefore, for a breach of the contract between merchant and merchant a severe restriction is imposed, surely it seems but consistent that a similar course should be adopted towards those who violate the most important contract which legislation can foster. It seems but a simple duty to protect the unwary from those whose unfitness to fill the position of husband or wife has been established; and it does not follow that because people are relieved from the burden of a dangerous or odious contract, that they who rendered its dissolution an act of justice, should be allowed to form a new engagement, or that the law should step in to place those who have shamelessly violated one engagement, in a position to violate a second; neither does it follow, because the injured call for a measure of relief, that the opposite extreme should be rushed into, and that, in our zeal for facilitating divorce, we should also legislate in favour of evil-doers.

Restrictions on the re-entering of guilty parties into the marriage state, similar to those to which attention has been directed, are not without other parallels. Previous to the present law of the United Kingdom, there was an order of the House of Lords that every divorce bill, on account of adultery, should contain a clause prohibiting the marriage of offending parties with each other, and this clause was maintained in one very flagrant case. The *Code Napoleon* restricted the liberty of divorce which had been introduced in the earlier revolutionary period, and amongst other restraints prohibited a woman from contracting a new marriage until the expiration of ten months from the dissolution of the preceding. The object of this is so obvious, that it seems strange any divorce law could be without such a clause.

We have the testimony of Chancellor Kent, that in the United States adultery has been committed for the purpose of divorce; and the records of the English Divorce Court, short a time as it has been in operation, presents an instance of a wife's family having employed detectives to get up a case against a husband of blameless character, and exercising an honorable profession. If precautions against a social flaw so mischievous as these instances would indicate, are necessary in countries where people may, as a general rule, form marriages with less chances of disunion than in a country so circumstanced as this, the more desirable it is that we should set greater limitations on the liberty of divorce.

In conclusion, it may not be out of place to urge that while every reasonable effort should on the one hand be made to meliorate the conjugal condition of the people of this colony, caution on the other hand should be observed in adopting any course calculated to aggravate it—and this on economical as well as on moral grounds. Though there are men whose temperament enables them to dispense with family association and affection, the vast majority are affected by inability to enter into the marriage state. Men whose minds have not the intense occupation which such studies as theology, philosophy, science or literature can afford, or who have not entered successfully into the arena of the politically ambitious, are but too apt to supply the absence of conjugal relations by dissipation. Drunkenness, which is considered excessive in this country, is no doubt much increased by want of the occupation entailed by domestic ties. Vices cannot, unfortunately, be indulged in without companions, and those who are hurried along by them drag others into the vortex. The licentiousness of the unmarried amongst the men is not without a corresponding amount of baneful results upon the unmarried women. Every circumstance which deteriorates the moral character of a people, augments the cost of governing them, and diminishes their wealth-producing powers. Not only is time squandered, and health and energy wasted, but the position of the celibate is a bar to the successful practice of many branches of industry. The assistance of a wife to the small trader or farmer is of almost inestimable value; and though many unmarried men in this country endeavour by partnerships to overcome the drawback, many more would gladly turn to other pursuits than those to which they are confined by the circumstances of being bachelors. Most unquestionably the moral character of our population, which should be a primary object of legislation, would be greatly improved by such an increase of the adult female population as would enable the relative proportion of the married men to be increased; and it is a question worthy of consideration whether the industrial efficiency of the existing male population may not be equally augmented by an accession of females, as by the addition of some thousands to the number of unmarried men. But be this as it may, it would be far better as regards the permanent prosperity and greatness of our country to legislate for an increase of virtue rather than for an increase of numbers; for an increase of human happiness rather than for a factitious appearance of wealth. Exports and imports, though they may be mercantile deities and have their worshippers, are not everything; and it would be well if those who would remedy excessive importation by introducing male consumers, could realise the fact that they would thereby aggravate some of our social evils; it would be well if they could recognise, with Michelet, that the aim of political economy "is not riches; even comfort is a secondary consideration, the more completely acquired when the aim is higher. The aim of political economy and all policy is *to make men*—men intelligent, benevolent, courageous, and robust. This is riches in the highest sense of the word."

APPENDIX.

Table showing, at Five Periods of Age, the proportions of Unmarried, Married, and Widowed of every 100 Males living at each of those Periods in England, and Wales, and Scotland, in the year 1851; and in Victoria, and in the Seaport Towns, Mining, and Rural Districts thereof, in the year 1857.

MALES.

Years.	UNMARRIED.						HUSBANDS.						WIDOWERS.					
	Great Britain.		Victoria.				Great Britain.		Victoria.				Great Britain.		Victoria.			
	England and Wales.	Scotland.	The Colony.	The Seaport Towns.	The Gold-fields.	The Rural Districts.	England and Wales.	Scotland.	The Colony.	The Seaport Towns.	The Gold-fields.	The Rural Districts.	England and Wales.	Scotland.	The Colony.	The Seaport Towns.	The Gold-fields.	The Rural Districts.
All Ages	62·5	66·8	67·9	62·6	69·9	69·6	33·7	29·8	29·9	35·4	27·8	28·0	3·8	3·4	2·2	1·9	2·3	2·3
Aged 20 and upwards	30·3	35·3	54·6	39·6	61·2	53·7	62·6	58·0	42·3	57·2	35·8	42·8	7·1	6·6	3·1	3·2	2·9	3·5
15 and under 20	99·5	99·5	99·2	99·5	99·1	99.2	·4	·4	·7	·4	·8	·7	·0	·0	·0	·0	·1	·0
20 and under 40	45·3	52·0	60·6	50·5	66·3	61·5	53·1	46·5	37·9	48·0	32·2	37·2	1·6	1·5	1·4	1·4	1·5	1·3
40 and under 60	12·1	15·4	30·1	18·7	34·9	36·1	79·8	76·7	61·7	73·5	55·9	56·3	8·1	7·9	8·2	7·8	9·2	7·5
60 and under 80	8·8	10·6	27·2	16·3	31·2	33·6	64·9	65·9	48·7	60·8	41·3	43·1	26·3	23·5	24·1	22·8	27·5	23·2

APPENDIX.

Table showing, at Five Periods of Age, the proportions of Unmarried, Married, and Widowed of every 100 Females living at each of those Periods in England and Wales, and Scotland, in the year 1851; and in Victoria, and in the Seaport Towns, Mining, and Rural Districts thereof, in the year 1857.

FEMALES.

Years.	UNMARRIED.						WIVES.						WIDOWS.					
	Great Britain.		Victoria.				Great Britain.		Victoria.				Great Britain.		Victoria.			
	England and Wales.	Scotland.	The Colony.	The Seaport Towns.	The Gold-fields.	The Rural Districts.	England and Wales.	Scotland.	The Colony.	The Seaport Towns.	The Gold-fields.	The Rural Districts.	England and Wales.	Scotland.	The Colony.	The Seaport Towns.	The Gold-fields.	The Rural Districts.
All Ages	59·8	63·7	54·6	56·6	48·6	58·0	33·0	27·9	42·7	39·7	49·6	39·7	7·2	8·4	2·7	3·7	1·8	2·3
Aged 20 and upwards	28·3	36·1	16·7	21·7	9·3	16·4	58·7	49·1	78·2	71·5	87·3	78·9	13·0	14·8	5·1	6·8	3·3	4·7
15 and under 20	97·4	97·9	83·2	80·2	69·9	85·0	2·5	2·1	16·6	11·6	29·9	14·7	·0	·0	·2	·1	·2	·3
20 and under 40	40·9	48·2	19·2	25·1	10·2	20·5	56·3	48·4	78·5	71·9	88·1	77·4	2·8	3·3	2·3	3·0	1·7	2·1
40 and under 60	12·8	21·2	4·3	5·6	3·6	4·3	71·5	59.5	81·8	77·4	85·5	84·8	15·7	19·3	13·9	17·0	10·8	10·9
60 and under 80	11·3	20·9	4·9	5·8	7·6	3·4	43·4	32·5	44·1	36·5	44·5	54·4	45·3	46·6	50·9	57·6	47·8	42·2

Art. V.—*Remarks on the Physical Geography, Climate, &c., of the Regions lying between the Rivers Lachlan and Darling.* By W. Lockhart Morton, Esq.

[Read before the Royal Society, 18th August, 1860, on the occasion of the departure of the Victorian Exploring Expedition.]

Under the impression that some remarks concerning the country lying between the rivers Lachlan and Darling may be not uninteresting, I have undertaken to place a few before this Society.

It is well known that various individuals have, at different times, made incursions into that extensive tract of country, but none of them, so far as I am aware, have ever placed any of their observations upon record. I believe, therefore, that I may be able to furnish some new and interesting facts.

Towards the end of April last, in company with a brother of the Honorable the Attorney-General, and a Mr. Hamilton, I started from Melbourne for the purpose of looking for good sheep country between the rivers above named. On the 2nd of May we arrived at Euston, a township belonging to New South Wales, and situated on the north bank of the river Murray, about eighty miles above the junction of the river Darling. From this place it was our intention to have proceeded northward, through the Mallee Scrub, but hearing that Mr. W. Ross, one of the most enterprising settlers on the Murray, had another station back fifty miles from the river, and that to it there existed a good road through the scrub, we proceeded up as far as his head station. Going thence northerly, after passing over seven miles of undulating country, abounding with limestone gravel, and much burrowed by wombats—which are evidently much smaller than the common variety—we came to the edge of the Mallee Scrub. On the sandy soil at the edge of the Mallee, we first saw the water-yielding *Hakea,* which was to me quite new. One fine tree seemed so full of water that the outer bark, to the height of a foot from the ground, seemed quite saturated with moisture. This valuable thorny tree is not found except on sandy soil, or on sandhills. It is easily recognized by its peculiarly white silvery foliage. Its roots run along, near to the surface, and after being cut from the root, can be torn up to the distance of ten or fifteen feet with the greatest ease. The structure of the root of this tree or shrub is tubular, so that water can easily be drawn up through it to the height of several feet.

I had supposed that the country lying back from the Murray would be found nearly on a level with the rest of the Murray country, but on entering the mallee we soon found that we were gradually ascending. The scrub is large and remarkably open; limestone, in the form of coarse gravel, generally crops everywhere through the surface. There is an undergrowth of saltbush, and numerous prickly shrubs, so that even the mallee is capable of being, hereafter, depastured by small flocks of sheep.

We had not proceeded far through the scrub when we came to ridges of loose red sand, covered with bunches of spinefex. These ridges, which resemble those observed by Sturt and Gregory, occur irregularly at intervals of a mile, or of a few hundred yards. They invariably trend in one direction, coincident with the true east and west—not the magnetic. It is worthy of remark, that wherever those ridges of sand occur, it is on the brow of a step to a higher level. This and the extreme purity of the sand, seem to indicate that they owe their origin to water, and not to the influence of the winds.

A few miles into the scrub, Mr. Ross has had a well sunk to the depth of fifty or sixty feet, but the workmen having come upon a bed of sand, with abundance of salt water, they had to stop. The whole of the material dug out of this well consists of an unctuous white clay or marl, containing lime. Mr. Ross has had altogether three wells sunk, the furthest out one being about fifty miles back from the Murray. In all of them water was obtained, but invariably salt; in the furthest out one, however, not so much so as in those nearer the Murray.

Proceeding N.N.E., the mallee becomes even more open, and saltbush and beree—a scented wood, like the myall—are plentiful. At the distance of about twenty-five miles from the Murray we came to the edge of the open plains.

The line of division between the scrub and the open plains runs nearly north and south; and it would appear that there has been here some subterranean disturbance, causing a depression, extending irregularly along the line of division, for the open country slopes from the north-east, towards the high ground on which the mallee grows; hence it is along this line of division that water may be more easily found. For a width of ten miles, along the edge of the scrub, the undulating country is very good, abounding with grass, herbs, and many varieties of saltbush. No better fattening country could be found anywhere, especially for sheep.

Our course was now northerly, along the edge of the fine open country. On our right vast plains stretched eastward to the horizon, and on our left was the higher ground of the mallee, into the irregular bends or indentations of which shallow watercourses from the plains frequently enter, and terminate in depressed hollows or gullies.

For eleven miles we were evidently rising higher above the level of the sea. The country has a general slope from the north-east towards the south-west. This remark, I believe, will be found correct in reference to the whole of that extensive region. So far as my own observation goes, this is plainly discernible by the eye; and, I believe, the table of the registrations of the aneroid and of its attached thermometer will prove the opinion as correct.

Farther north, about eleven miles, we come to the Head Winter Station, occupied by Mr. Ross. Having been kindly invited to rest our horses for a few days, we spent the time in examining the locality, and in drying a quantity of meat.

A number of men were here engaged in excavating a very large tank, twelve feet in depth. They told me that they frequently came upon masses of shells, like oyster shells. I could not find any, but I picked up a few curiously shaped pieces of lime, resembling teeth of animals, and pieces of roots of plants. The upright side of the tank, twelve feet high, exhibited a blue clay, in small hard angular pieces, and much mixed with lime-earth and limestone gravel.

Having previously heard from the superintendent of the station, that strata of sandstone rock were to be met with, within a few miles of the station, I felt very anxious to find them, but no one on the station knew anything about the subject; and, although we searched for the locality, we did not succeed in finding it. I, however, saw several specimens. It is not a ferruginous sandstone like the coarse sandstone found on the Murray, but is very hard and compact, and, in its general character and colour, resembles closely the sandstone of the coal formation on the eastern coast of Australia. In such places good water might be found without sinking to any great depth. Even to some distance from where the sandstone appears, it is probable that the tertiary drift overlying it is not of great depth.

The whole surface of this region is apparently composed of tertiary drift; but there is a marked difference between the open country and that covered with mallee. In the latter limestone greatly abounds, and the ridges of red sand, already mentioned, are always present, and come close up to the edge of the open plains, but never enter them. The plains, on the other hand, possess extensive tracts, having a surface of hard blue clay, and wide areas covered by a thin stratum of red clay. Vast portions of the plains, however, have neither description of clay on their surface; but, it is worthy of remark, that where this is the case, water seems to have carried away the clay stratum from the surface down into the absorbent beds of lime-earth and limestone gravel beneath; for such places are always in hollows, or in great land depressions, and a careful examination of the edges of them proves that this alteration of the surface is a progressive change of a chemical and mechanical character. There is a deep trench, destitute of vegetation, on the one side of which is the clayey surface, on the other, an extremely loose soil, like a level mass of recently slaked lime, and standing higher than the original surface.

Thus the traveller in vain looks for water, even immediately after rain, if he looks for it in the larger depressions of the surface; for it is on the red clay, or on the blue clay tracts only, that it is to be found in very shallow pools. This constitutes the grand question for finding water on that level country of boundless plains—is the surface of red or blue clay? But the red is the most certain, for, being mixed with much red or ferruginous sand, the surface does not crack so much as that of the pure blue clay.

It is highly interesting, I may here observe, to notice the total change in the vegetation of the one surface from the other; the clayey surface abounds with numerous varieties of saltbush, but on the loose absorbent surface, where all the salts have been carried deep into the earth, no saltbush grows; nothing but herbs and a coarse grass, which produces a fine large grain, not unlike French millet; some of this seed I have presented to Dr. Mueller, having found it in the crop of a crested pigeon. The Doctor informs me that it is *Panicum decompositum,* from which the natives make bread.

In reference to the difference between the formation of the plains and the mallee country, one thing, I think, seems evident, and that is, that on the surface of the plains there is a stratum of comparatively modern drift.

While resting our horses at Mr Ross's, we had also leisure to experiment on the water-yielding *Hakea.* The first root, about half an inch in diameter, and six or eight feet long, yielded, quickly and in large drops, about a wine glassful of really excellent water. Near Mr. Ross's station, and all along the edge of the open country, there is a species of *Casuarina* that I had never met with before. The bark is smooth, the foliage short and erect, the wood is yellow, and so remarkably soft that, with a small tomahawk, I could cut down a tree a foot in diameter in a few seconds. It makes an excellent fire, burning readily when newly cut. I felt much interest in finding there a tree which I had met with near Peak Downs. I am indebted to Dr. Mueller for its botanical name, *Myoporum platycarpum.* The dry wood of this tree, split into laths and tied with bark by the natives, I had found on the river Isaacs, last year. Concluding from this circumstance that it possessed good burning qualities, I put the end of a piece into the fire, when it burned like a candle. Upon finding it near Mr. Ross's, I applied to it the same test with the same result.

On the 10th of May we started from Mr. Ross's, with the intention of proceeding north till we got well back into the centre of the country, and then north-east, so as to get a good view of the whole. There was plenty of water in a shallow creek near this station, from recent rains, but we were doubtful whether any water could be met with farther north. We went about thirty miles north, over a fine country abounding with saltbush, grass, and herbs; we could, however, find no water, and had to camp without it. It was evident that this locality had been visited by herds of cattle and troops of wild horses, and that these had emptied all the shallow water-holes, and gone elsewhere, for none of their tracks were fresh. Thus disappointed, we resolved to cross to the Lachlan, and make an incursion from thence. We therefore returned to the water by Mr. Ross's, and next day started for the nearest point of the Murrumbidgee, steering E. 30° S. For six miles the surface is undulating, and there is a general slope of the land towards the south-west. Beyond this point the fall of the country is towards the south, and shallow water-courses pass through the level plains in the same direction. For ten miles the plains are very level and elevated, then they again become undulating; and, on approaching the Murrumbidgee, there is a considerable descent from the high plains towards the flats of that river. We were late in getting into camp, and darkness overtook us, but we went on till we saw water. Some of the flats near the river were dangerous to ride over, from the number of deep fissures in the ground, caused by descending currents of water washing away the upper soil. In the morning we found ourselves close by the Murrumbidgee, on an old reed-bed, which was being slowly submerged by the rising and overflowing waters of the river.

We next proceeded up the Murrumbidgee, and thence up the Lachlan for a hundred miles; but it is unnecessary to refer to that part of our journey.

On the 22nd of May we reached the point from which we intended to start for the north-west. We had just got into camp, about noon, when rain began to fall, and it continued till three o'clock p.m. on the 23rd, filling my pint-pot with an inch and a half of water. We now found that the plains were excessively heavy; and as our horses, from their long journey and want of sufficient grass, had become much reduced, we waited a day to allow the surface to dry. On the 25th of May we started in a north-west direction, from a point on the Lachlan about three miles above Dr. Ramsay's station. Passing over seven miles of beautiful plains, well grassed and sound, and apparently on a level with the banks of the river, we came to a dry creek, lined with box and red gum trees; the bottom of this creek is fifteen feet below the level of the plains. From this point we saw a hill-top bearing N. 8° E. In four miles farther, over a fine plain abounding with grass, cottonbush, and some saltbush, we reached a sandhill covered openly with pine trees. Here we camped for the night, our poor horses enjoying plenty of grass. The hill seen on the previous day bore N. 15° E.

Next day we passed over twenty miles of excellent plains, abounding with cottonbush, herbs, grass, and saltbush, as well as much of the grass that yields a seed like millet. The plains possess numerous water-channels, most of them without timber, and but a few feet lower than the level of the plains; all of them have a general south-west course. Sandhills, and ridges of sandy ground, lumps of timber, and patches of hop-scrubs afford dry beds and shelter for stock.

Thirty miles from the Lachlan we came to a very large dry creek, from its size and its extensive system of river flats, almost entitled to be called a river bed. It has a general course of W.S.W. For four miles on each side the land slopes towards it. This has at no remote period been an important creek, and may become such again if its outlet from the Lachlan, now said to be silted up, were again opened. Thus a fine and extensive pastoral country might be supplied with water frontage. It is impossible that this creek can bend round again to the Lachlan; its direction is towards the Darling, and it is probable that it either reaches that river, or ends in some great inland depression. We camped by this creek, and in the morning I saw that there was now quite a range of hill-tops in view towards the north. These bore respectively—N. 14° W., N. 18° E., N. 23° E., N. 37° E., N. 48° E., and the point first observed, N. 65° E. Having always carefully timed our horses, I thus obtained a base by which to measure the distances those hills were from us with some degree of accuracy. One of our six horses had to be left here, unable to go farther. In leaving it we were not without some apprehension that it might be taken off by the wild horses that, in numerous troops, inhabit this otherwise unoccupied country.

Four miles from the large creek we came to a swamp about a mile wide, with an undulating hard clay bottom, covered in some places with a very coarse sand of disintegrated granite. We had now evidently got upon a different description of country; a level country, with merely local depressions, to receive any water that may flow from the plains, and altogether without the shallow water-channels such as we had seen on the south side of the large dry creek already referred to. In crossing this swamp bed, which is thinly covered with the rough-barked box-tree peculiar to a dry country, much polyizonum scrub, and a tall, coarse reed grass, we had some sport with a large emu. Stopping our horses, I dismounted, and making a sound like a young emu, I brought it up within shot, when I discharged both barrels at its head, but without effect. It is of importance to know that emus that have not often seen white men can be thus attracted. When in the north of Queensland, last year, I often, out of curiosity, induced these birds to come quite within shot, and even to follow us for long distances. But it is of no use to fire at them with small shot, as I did on this occasion.

At the distance of two and a half miles farther, we passed another box-swamp, which had a bottom of loose blue clay, cut in the most extraordinary manner with deep and steep-sided fissures, the effect, I believe, of descending currents of water.

In two and a half miles farther we came to another dry swamp, covered with box-trees and polyizonum, when we resolved to camp, as we could see no timber beyond. The nights were always most bitterly cold, with white frosts, the thermometer falling below the freezing point, and we were therefore careful to secure abundance of firewood to burn opposite to the open end of our tents.

At this camp I obtained a fine view of the range of hills before mentioned. The various hills bore respectively—N. 42° E., N. 40° E., N. 57° E., N. 72° E., N. 76° E., N. 80° E., and the almost vertical end of the range first seen, N. 86° E. From the outline of some of these hills, exhibiting an inclined plain and an abrupt cliff alternately, I am of opinion that they are hills of a stratified rock. Vast saltbush plains stretched away on our right and left. Some of the plains are very level, and, having a soil of hard blue clay, grow nothing but a stunted saltbush; but in general there is plenty of cottonbush, herbs, and grass; in short, it is a fine country for fattening sheep.

During our next day's stage, we came again in sight of the *Casuarina* seen at Mr Ross's station; numerous clumps break the monotony of the plains; the soil became more sandy, and grass and herbs more plentiful. Two miles after starting we crossed some rising ground, when we saw before us to the right a long belt of timber stretching south-east and north-west. This was a belt of the *Casuarina,* and towards it the plains seem to slope for at least a mile. In six miles farther we came to an elevated bank, from which we obtained a view to the westward and south-west of far greater extent than usual. The whole surface seemed to slope again to the south-west. The plains were so extensive and so very loose and difficult to travel over, that if we kept our north-west course there was no prospect of our being able to reach any timber. We therefore now went N. 63° W., and crossing an extensive depression of the ground where the surface was as loose as that of newly-ploughed land, in five or six miles we reached a clump of Casuarina trees. Here were many old camps of the natives, who had been there but a short time before. Some vertebræ of snakes lying about revealed both the poverty of the locality in game and the abject condition of its temporary inhabitants.

Leaving here our horses and our tents and outfit, we made a journey on foot. The weakness of our horses, and the loose and soft nature of the ground, had prevented us from making long stages, although we frequently relieved them by walking afoot; and our small stock of provisions began to fail, without being able to find any creature to shoot larger than a common sparrow. We had previously shot so many native turkeys that we had calculated on getting more, but all that we saw after leaving the settled country were too wild. We had now fulfilled the object of our journey, and seeing that all the plains were much alike, we thought it best to push to the south, and thence back to the Lachlan before starvation overtook us. Afraid that the natives might come upon our camp in our absence, we went to the north-west only five miles, obtaining a view extending about five miles beyond. It is all a good sheep country, but so small are the shallow pools that contain water, that without the fall of rain, with which we had been favoured immediately before our visit, we could not possibly have gone where we did.

Returning to our camp at noon, I resolved to spend an hour or two in making a waterhole that might be of use hereafter to myself or to others. Making a spade and crowbar of wood, and having hardened them in the fire, in two hours and a half I dug out of the solid hard ground, a hole capable of containing at least two tons of water, and with the material made a dam across a gulley. Having finished my work I stuck up my spade and crowbar with a playful injunction that they should remain there till my return.

We now went S. 10° E. for twelve miles over loose plains, and others abounding with saltbush and grass, when we had reluctantly to turn to a course E. 15° S., to pick up our horse which had been left. The plains were now more extensive than usual. To the east, west, and the south, there was no tree, no bush, no object to serve as a landmark. On our way we passed several sheets of very shallow water, lying on beds of slippery white clay, and covering several acres. Far to our right, after travelling about five miles, we saw the timber of the large creek already mentioned, and I was thus enabled to mark its course for many miles to the westward of where we had crossed it.

Next day we returned to where we had left our horse and some of our saddles, and other articles, and thence pursued again a southern course, over fine plains, reaching the Lachlan in about sixty miles, and ten miles above Oxley's marked tree, which still stands, though only portions of the letters now remain.

I fear that I have made this paper already too long, notwithstanding that I have excluded much that might have been amusing and interesting; but I wish to ask for a little further indulgence that I may make a few general remarks on the peculiarities of the country travelled over, as they may prove of service to others. In many parts of Australia the red gum tree indicates permanent water, and thus a distant line of tall white timber may tell of a creek or river. In dry level regions, within our own territory, there is a box tree with a coarse bark, that indicates the presence of water, not permanent; but, in the locality lying between the rivers Lachlan and Darling, the same box trees only indicate swamps of the past, and which have beds so riddled with deep fissures, that, if a river were to flow into them to-day, they would be dry to-morrow. The indications of water, in that country, are a tall, coarse-jointed grass, and the largest variety of saltbush. Polyganum scrub always indicates a flooded country; where there is plenty of this scrub, but stunted and perishing, it seems merely to indicate that the country was once flooded, or better watered. I think the numerous dry watercourses prove this also. The land has either risen, or the bed of the Lachlan has become deeper; for in my opinion there is great weight of evidence to prove that numerous canals, at no very remote period, went out from the Lachlan to water the lock plains. Hills and ridges of sand, altogether different in color from the ferruginous sand ridges of the mallee scrub, owe their origin, I believe, to currents of fresh water.

We always found our vision much circumscribed by mirage. From four to five miles is the utmost limit at which trees can be seen during the sunshine. The only time to get a clear and distant view on such plains as those referred to, is before sunrise.

In reference to certain animals being able to live without water, wombats, rats, mice, snakes, and dew and knobby-tailed lizards, appear to be continual residents in localities where there is no water near. The first two named may probably migrate, but not the others. Our dog frequently found such creatures, especially small mice.

On the plains the mesembryanthemum plants are always to be met with. It has often occurred to me that this plant might be made use of in cases of emergency. Any quantity of water could be obtained from it, and it would only require a small still for the purpose, unless the soda or potash which it contains could be otherwise extracted.

I think it ought to be generally known, that wherever wells have been sunk, either on the Murrumbidgee or Murray plains, beds of sand have always been met with, and in the sand brackish water is found.

The following particulars of a well that has been sunk on the Murrumbidgee plains may be not without interest:— The well was sunk to a bed of sand, when water was obtained. It is 49 feet deep, has 7 feet of water in it. The water tastes like lime-water, probably from the potash of the decomposing felspar, for the sand found is a disintegrated granite. On the 9th of June, the temperature of the water was 66°, that of the Murray being 50°. On the 27th of April, at Swan Hill, the temperature was 62°.

It was my earnest wish to have got some fresh horses, and to have returned to follow down the large creek, because I considered it as an object of great interest to do so; but my companions did not feel justified in incurring the necessary expense.

The whole of that country might, in a few years, be occupied by millions of sheep, but a policy, as shortsighted in general as in its details it is unworthy, stands up like some monster of antiquity to repel the tide of settlement. One commissioner, like a king of the wilderness, reigns over forty millions of acres. He is allowed one horse only. Now, as all runs are obtained by tender, and all tenders must wait for the report of the commissioner, and as that gentleman is expected to visit each run tendered for over a country in extent equal to two-thirds of Victoria, with only one horse to ride, it follows that runs applied for by the present generation will be ready for the occupation by the next. Meanwhile, New South Wales is content to defraud itself of additional revenue, Victoria is prevented from extending her commercial limits, a great increase of stock, with its production of wool and human food is hindered, and a vast region of illimitable salt-bush plains slumbers on as a wilderness, where no man dwells.

I have only to add, that I have been indebted to the indefatigable Dr. Mueller for his list of names of plants collected during our journey.

List of the Plants collected by Lockhart Morton, Esq., between the Rivers Darling and Lachlan:—

Flindersia maculosa, Ferd. Mueller
Dodonæa viscosa, Linne
Heterodendron oleifolium, Desfontaines

Sida intricata, Ferd. Mueller
Abutilon halophilum, Ferd. Mueller
Erodium moschatum, l'Heritier
Zygophyllum crenatum, Ferd. Mueller
Acacia stenophylla, All. Cunningham
Cassia platypoda, R. Brown
Cassia heteroloba, Lindley
Euphorbia Chamæsyæ, Linne
Senecia lautus, Forster
Minuria leptophylla, Candolle
Therogeron integerrimus, Candolle
Teucrium racemosum, R. Brown
Solanum pulchellum, Ferd. Mueller
Myoporum platycarpum, R. Brown
Myoporum dulce, Bentham
Hakea stricta, Ferd. Mueller
Salsola Australis, R. Brown
Sclerolæna paradoxa, R. Brown
Sclerochlamys brachyptera, Ferd. Mueller
Kochira sedifolia, Ferd. Mueller
Rhagodia nutans, R. Brown
Exocarpus aphylla, R. Brown
Eragrostis Brownii, Kunth
Panicum decompositum, R. Brown

OBSERVATIONS OF THE ANEROID AND ATTACHED THERMOMETER ON THE LACHLAN AND DARLING PLAINS, &c., &c.

Date.	Place.	Aneroid.	Ther.
1860.			
April 21	Porcupine, near Mount Alexander, Victoria...	28·63	26·50
,, 21	Hill at head of Bendigo Creek, 5 p.m..........	28·58	25·00
,, 21	Sandhurst, 11 p.m. (raining)	29·11	22·00
,, 23	Serpentine Inn, River Loddon, 6.30 a.m.......	29·09	16·75
,, 23	Duck Swamp, Serpentine...........................	29·37	18·00
,, 24	Loddon Inn, 45 miles N. of Serpentine Inn...	29·87	20·00
,, 25	Same place, 6.30 a.m................................	29·93	8·00
,, 25	Near Murdering Lake, 2 p.m......................	29·99	27·00
,, 26	Lake Boga, water level, 1 p.m....................	30·05	24·50
,, 27	Swan Hill, 6.30 a.m.	29·95	12·50
,, 28	Tyntyndyer, 7 a.m.....................................	29·81	18·00
,, 30	Coghill's Old Station, 16 miles down from Tyntyndyer, 7 a.m..........................	29·79	23·50

OBSERVATIONS ON THE ANEROID, &c.—*continued.*

Date.		Place.	Aneroid.	Ther.
1860.				
May	1	Hamilton's Station, 20 miles from last, 7 a.m.	29·88	46·00
,,	2	M'Callum's Station, 12 miles below the junction of the Murrumbidgee	30·11	15·00
,,	3	Euston, 22 miles below last place	30·12	5·00
,,	4	Dry Lake, 8 miles E.N.E. from Euston	30·15	13·00
,,	5	Mr. Ross's Station, Mailman	30·15	11·00
,,	5	Sand-ridge, in Mallee Scrub, 1.30 p.m.........	30·16	24·00
,,	6	Edge of open country, 30 miles N. E. from Mailman..	30·20	4·67
,,	6	Tacnall, 38 miles N.N.E. from Mailman	30·21	18·33
,,	7	Head Winter Station (Mr. Ross's)...............	30·14	2·50
,,	11	Camp, 30 miles N. of last place, or of latitude 34° 17′ 44″	29·82	1·75
,,	12	10 miles E., 30° S., towards Murrumbidgee, 1 p.m..	29·94	28·00
,,	13	River Murrumbidgee	29·87	2·75
,,	15	Above junction of River Lachlan	29·82	Zero
,,	16	Oxley Reserve	29·47	9·75
,,	18	21 miles above Oxley	29·52	15·50
,,	19	Waljeers, 41 miles above Oxley	29·56	7·50
,,	20	Hurst's Station, 20 miles above Waljeers......	29·76	5·50
,,	21	Anabranch of Lachlan, 16 miles above Hurst's	29·69	2·25
,,	22	18 miles above last place, and 14 above Sullar and Bowler's	29·46	14·50
,,	23	7 miles above last place, and 2½ above Ramsay's (raining)	29·47	15·75
,,	26	11 miles N.W. from Lachlan, on sand hill 50 feet high	29·65	9·00
,,	27	Large creek, 30 miles N.W. from Lachlan...	29·74	3·50
,,	28	Windmill Swamp, 10 miles N.W. from large creek..	29·84	0·50 below Zero
,,	29	Casuarina clump..	29·94	2·00
,,	29	Farthest point reached, about 5 miles from last	30·40	18·00
,,	31	Camp 13 miles S. from where the large creek was first crossed........................	29·84	1·00
June	1	Camp by a dry creek, about 8 miles N. W. from Anabranch of Lachlan, and supposed to be the same as that crossed 7 miles N.W. from Ramsay's	29·70	3·00 below Zero
,,	3	Suttor's Station, on Anabranch	29·57	2·00
,,	5	Oxley's Marked Tree	29·50	11·75
,,	7	Sand hill, 5 miles E. of Waljeers	29·48	6·50
,,	8	Hay, on Murrumbidgee.............................	29·40	4·50
,,	9	Old Man Plain, S. of Murrumbidgee	29·50	2·00
,,	10	Billibong Creek	29·64	1·50 below Zero
,,	11	12 miles N. of Deniliquin..........................	29·54	7·00
,,	11	Deniliquin (sunset)...................................	29·51	14·00

ART. VI.—*On the Nest and Eggs of the Coach-whip Bird* (Psophodes Crepitans, Gould), *and of the White-fronted Epthianura* (Epthianura Albifrons, Gould), *with some general remarks on the Nidification of Australian Birds.* By A. DOBREE, ESQ.

[Read before the Royal Society, August 27, 1861.]

As neither Mr. Gould's work on Australian ornithology, nor such others as I have been able to consult, contain any particulars of the nidification of the two above-mentioned species, I am led to the conclusion that, although probably casually discovered, no description has as yet been published, and beg therefore to communicate the following notes, from personal observation.

1*st*. *Psophodes Crepitans* (Gould). *Coach-whip Bird.*

This bird is well known to most Australian colonists, though, probably, far more frequently by the peculiar note whence it derives its current name, than by its appearance, as it generally keeps itself concealed amidst thickets and brushes. To naturalists this species is extremely interesting, as its singular characteristics have long rendered it a matter of doubt what precise place to assign to it in the ranks of Australian birds. The details of its nidification may tend to the further elucidation of this point.

It will not be out of place first to quote a few of Mr. Gould's very accurate remarks on the habits of this bird. He says, "It is only to be found in dense brushes, and is a shy and recluse species; for although its full notes—ending sharply like the crack of a whip—indicate its presence, it rarely exposes itself to view, but generally keeps in the midst of the densest foliage and among the thickest climbing plants, frequenting alike those that have intertwined themselves with the branches of the tallest shrubs, and those that form almost impenetrable masses near the ground, and through which it threads its way with the utmost ease. It is extremely animated and sprightly in all its actions. Of its nidification, I regret to say I know nothing, although I paid great attention to the subject myself, and offered rewards for its nest and eggs, and for any information respecting them."

The present nest and eggs were obtained by me near the banks of the Yarra Yarra, near Heidelberg, on one of those points of land or "bends" of the river still left in their original state, and where the underwood and tangle are extremely dense. Being on a visit in the neighbourhood on the opposite side of the river late in the previous summer, my attention was attracted by the remarkable note of this bird, but as the breeding season was then past, I merely noted its haunt. Finding, however, on reference to Gould's work, that its nidification was unknown, and relying on a general fact I had often observed, namely, that the same pair (apparently) of birds will, if undisturbed, return for several years to the same locality for breeding, I revisited the spot about the commencement of the next summer, and, after a short search, was rewarded by the discovery of the nest, on which the female bird was sitting so closely as almost to allow herself to be captured; thus removing all doubt as to the identity of the nest and eggs. The nest was in the most tangled part of the thicket, and placed in the forked branches of a shrub, about four feet from the ground—it is cupshaped, about five inches outside diameter, the exterior of dry slender twigs, and the interior lined with thin fibres and a few pieces of horse-hair, the latter evidently owing to the accidental vicinity of some farms; the whole structure is neither very solidly nor elaborately built. It contained two eggs—length, *exactly one inch;* extreme width, *three quarters of an inch.* In shape they are not much pointed at the thinner end, and the greatest girth is at about the middle. Their ground-colour is pale greenish blue, with streaks and dots of various sizes scattered pretty equally over the whole surface; these markings are of a brownish black colour, and of two kinds, the one being very distinct and sharp, the other somewhat less numerous, more greyish, and much fainter, having the appearance of being under the shell. From the fact of the bird sitting so closely, I conclude that no more than two eggs are generally laid, though the present ones had not yet been perceptibly incubated.

I regret to say I have kept no precise memorandum as to the date of finding the nest, but believe it to have been about the end of October.

2nd. Epthianura Albifrons. White-fronted Epthianura.

This bird, which at the first cursory glance recals the familiar English black and white Water-Wagtail, both by its general appearance and motions, is by no means uncommon round Melbourne.

Mr. Gould writes as follows in his notice of this species:—"I first met with it in a state of nature on the small islands in Bass' Straits, where it had evidently been breeding, as I observed several old nests in the barilla and other stunted shrubs—its natural province is the ground, to which it habitually resorts, and decidedly evinces a preference for spots of a sterile and barren character; it trips along with amazing swiftness, with a motion that can neither be described as a hop or a run, but something between the two, accompanied by a bobbing action of the tail. Of its nidification I regret to say nothing is at present known."

It may be met with in the dry portion of the swamps extending between the Saltwater and Yarra rivers. I discovered its nest about four feet from the ground, in a stunted bush, on the edge of the dense "teatree" scrub which covers part of that locality. The structure is cupshaped, somewhat deep, and about four inches outside diameter; dried fibres, fine twigs, and stalks form the exterior, and the lining is composed of horsehair and fine grasses. It contained three fresh-laid eggs; length, 11-16ths inch; extreme width, 17-32nds inch; shape, not much pointed; ground-colour, white, with fine red-brown markings, consisting of points, streaks, and roundish dots, the larger markings being most abundant at the thicker end, where they form a sort of wreath, while some of the smaller ones are scattered over the other parts of the surface. The markings are, in nearly every case, surrounded by a faint ashy margin of their own colour, imitating the appearance of their having been painted on the white ground before the latter had properly dried, thus causing them partially to run into the white surface. This seems to be a decided characteristic in these eggs. The nest was discovered about October.

Mr. Dobrée then proceeded to make some general remarks on the most interesting forms of nidification of Australian birds, in which respect, he stated, this country maintained its reputation for singularity. He alluded to the mound-raising *Leipoa*, or mallee-scrub pheasant, an egg of which he exhibited; the *Yellow-tailed Acanthiza*, of whose singular double-roomed pendant nest a specimen was shown; and remarked on the burrowing habits of the *Paradolotus*, as well as the hanging structure of the Yellow-throated Sericornis, which he produced for inspection, he also recurred to the fact of the Australian representatives of the Cuckoo-family, though deprived of the familiar note, differing in no way from their European cousins in the habit of confiding their progeny to foster-parents. He further exhibited a valuable collection of Australian eggs, including that of the Lyre-bird (*Menura superba)* of which hitherto only a limited number of specimens have been obtained; and pointed out that many further observations were still desirable for the completeness of information in this branch of natural history. He remarked, in conclusion—

One of the secondary causes of the often noticed scarcity of birds in Australia, as compared with England, is undoubtedly that so many species here lay a much less number of eggs. Amongst the commoner of Australian birds, the *Honeyeaters* (Meliphagæ) average 2, and some species only one solitary egg; the *Wattlebirds* (Antocheræ) 2 or 3; the *Sericornis* tribe 3; the *Fosterops* 3; the *Woodswallows* (Artamis) 4, &c., and this opinion is corroborated by the fact that the few exceptional species whose individuals are really numerous, such as the common quail (Cotarnix pectorelis) and the *Parokeet tribe* are found to be large layers, the quail producing 11 to 14, and the parokeets 6 to 8 eggs. In England nearly all our commoner birds average 5, or at least 4 eggs, and there are many instances of a larger number. I said that this is a secondary cause, for Reason at once ascends higher in the scale, and asks *why* it should be so arranged that only a limited average is produced? Is it that this country would, in the case of most species, not offer sufficient food of a suitable kind to maintain a greater number of individuals, and therefore the all-balancing hand of Nature has struck the present adjustment as the true one between supply and consumption? Or, to change the line of inquiry, can we entertain the notion of a more recent origin of Australia, and thence deduct that the scarcity of animal life is in some degree owing to the fact that the same amount of time has not elapsed as in the older countries to enable this continent to be stocked up to its full capability? However this latter may be, it is certain that the rate of reproduction, as represented in the instance of most Australian birds, cannot be proceeding at a rate nearly equal to the annual increase in many other countries. In order to investigate fully this subject of the abundance or scarcity of animal life, it would however be necessary to take into account the different destroying causes in the countries under comparison, as well as the reproducing ones; and altogether the matter is one which deserves more than the few hasty glances here incidentally bestowed on it.

ART. VII—*On the Application of Galvanic Electricity to Practical Astronomy.* By R. J. L. ELLERY, ESQ., Government Astronomer.

[Read before the Royal Society, August 27, 1860.]

THE application of electro-dynamics to astronomical purposes presents one of the most marked features in the history of modern astronomy; and it is probable that without the assistance of the electric current, no improvements that could be devised in the optical construction of the instruments used would secure the almost absolute precision we can now attain in those observations in which the accurate determination of time is of primary importance.

The application of electro-dynamics, styled indifferently *chronography* and galvanic registration, has resulted in such decided advantages in the great American and European observatories, into most of which it has been introduced, that no observatory of any pretensions can be considered complete without it.

The aim of my paper this evening is not so much to enter upon the history and successive improvements made in this application of electricity, as to describe to the society the manner in which it has been adopted in the Astronomical Observatory of this colony, and especially to call attention to a recently constructed chronographic apparatus, which will be of great assistance in making the astronomical observations in connection with the geodetic survey.

The first use of the galvanic current in astronomical observing was made by Professor Locke, of the United States, as early as 1849, and although its successive adoption in various observatories has led to many improvements and modifications of the original mechanical arrangements, the principle remains the same. The general form of the apparatus may be described as consisting of an electro-telegraphic register, with a double system of electro magnets and indenting styles, each system having a separate galvanic circuit.

The chronographic apparatus now in use at the Astronomical Observatory may be thus described:—

The register, with the exception of its possessing a double system of electro magnets and levers, is in all respects similar to Morse's Telegraphic Recorder, which is the instrument used in the telegraph offices in this colony. By means of a weight and regulating train of clock-work, a fillet of paper is kept moving between two small rollers at a pretty uniform rate of an inch per second; and the armatures and levers are so arranged, that, when acted on by the electro magnets, they indent the paper as it runs between the rollers in parallel lines, about half an inch apart. The indenting styles are placed in a line perpendicular to the margin of the fillet, so that if the action of the two electro magnets be coincident, the two indentations will be exactly in the same point with relation to the length of the paper. The clock-work is wound up by a key, but there being no maintaining power, this cannot be done during the working of the apparatus. The regulation of the train is attained by a simple "fanfly," and can be stopped at any moment by means of a catch pressing against the fly arbor. The clock-work will run regularly for a quarter of an hour.

The voltaic circuits, for working the electro magnets, are two: the clock circuit, and the observing circuit.

The observing circuit is thus arranged, a battery of three cells of Daniel's or Smee's combination being generally used for producing the currents. From one pole of the battery a wire is led to one terminal of the electro magnet of the circuit, from the other terminal a wire is led to the purs of the transit instrument, and then up the side of the purs to wooden frames fitting round them, where it is connected with an insulated portion or anvil of a small telegraphic key; a wire attached to the other portion, or hammer of the key, is led to the opposite pole of the battery, and thus, with the exception of the interval between the hammer and the anvil of the key, the circuit is complete. A slight pressure of the finger on the key will complete the circuit, when the electro magnet attracting the armature, causes the style to indent the paper. The indentation, when the paper is in motion, will be in the form of a *dot* or a *stroke*, as the pressure on the key is momentary or prolonged. The keys are so arranged that in whatever position he may be observing, there is always one convenient to the right hand of the observer.

The clock circuit, which includes the astronomical clock, is double, in consequence of the necessity of introducing what is known as a relay magnet, whose office will be presently described.

From one pole of a three-celled battery a wire is led to a terminal of the electro-magnet of the clock circuit, and a wire also connects the other terminal with the relay, where it ends in a platinum point on the top of the armature lever; the other pole of the battery is connected directly with the relay, and ends also in a platinum point, close and opposed to the other. The circuit of this system is therefore incomplete only by the separation of the two platinum points above mentioned, which are kept apart by means of a delicate spring. The second circuit includes the clock contact apparatus, and the delicate electro magnet of the relay, and may be thus traced:—A pole of a single cell battery is connected by a wire directly with one of two springs, which are a portion of the contact apparatus of the astronomical clock; the other pole is connected to one terminal of the relay magnet coil, whose other terminal is connected by a wire with the second spring of the clock contact; this circuit then is only incomplete by the separation of the two springs.

The "clock contact" is thus arranged:—An extra wheel of sixty conical teeth is fixed in the escape wheel arbor of the astronomical clock; a delicate spring, with a jewelled pallet, is so placed that when the clock is at rest the pallet drops into the angle between the teeth; at the back of this spring is a little platinum stud; another spring, with a platinum stud, is placed just behind this, and is so adjusted that a slight lifting of the front spring brings the two platinum studs into contact.

When the clock is going, the escape wheel revolves once in a minute, and the extra wheel moves one tooth each second, which in passing presses against the pallet, and lifts the spring just sufficiently to bring the studs into contact for an instant, and so on for each second. One of the teeth of the contact wheel is filed down, so that it passes without lifting the spring, and the seconds' hand is so placed that it points at 60 on the dial when this short tooth comes to the pallet. The two springs are firmly but separately attached to a block of insulating material, which is itself screwed to the front plate of the clock, so that the springs are insulated from the clock works and from each other. There are screw adjustments for regulating the lift of the front spring and the distance between the studs.

The object of introducing a relay magnet into the clock circuit is to avoid the oxydization of the platinum studs in the clock contact, which would result from using directly a battery sufficiently powerful to work the register magnet. The oxydization would give rise to imperfect contact, and the necessity of frequently disturbing the clock works in order to re-polish the springs, which of course should be avoided if possible.

The operation of the clock circuit will now be readily understood. The "contact" being made every second by the clock itself, the current from the one-celled battery causes the relay magnet to attract its armature, thus bringing the two platinum points of the relay before mentioned into contact; the contact completes the circuit from the battery to the clock register, whose magnet immediately attracts the armature and lever, causing the style to indent the paper. This action being repeated every second, coincidently with the oscillations of the clock pendulum, if the paper be put in motion, a series of dots about an inch apart is made on it as it passes through the rollers, every sixtieth dot being left out by reason of the short tooth in the extra wheel, this serving to mark the commencement of each minute.

The following is the mode of observing with this instrument, as practised in our Observatory:—

After seeing that the circuits are complete, the register and relay in good adjustment, and the seconds' dots being plainly indented on the paper, the observer proceeds to make his observation. Let it be, for instance, the transit of a star over the wires of his transit instrument:—The instrument being in position, and the observer seated at the transit instrument, he watches for the stars' approach to the first wire; when near it, he releases the detent of the clock train of the register, and the paper commences to move through the rollers indented at each second by the clock circuit. Immediately the star appears behind the wire, he touches the key for an instant, and the style of the observing circuit indents the paper; he does this for each wire, until the observation is complete, when he stops the chronograph—always taking care before he stops it that a minute space has occurred on the paper during the observation, in order that the seconds may be dated; if it has not, he must let it run till one occurs; and it is usual to mark this space with the number of the minute at once, to facilitate "reading off," as well as to indicate by a number or symbol the object observed. Of course, if several observations are being made in quick succession, the instrument is not stopped till the series is complete.

It is the custom at the Observatory to "read off" every morning, unless the result of any observation be required at once, the fillet used in the previous night's work, and with a needle point puncturing in the lines of seconds perpendicular and corresponding to each dot made by the observer's circuit. The seconds' dots are then counted from the minute spaces; the number of the second dot preceding any puncture is noted, and the fraction represented by the position of the puncture with relation to the dot is measured by a small transparent conical scale, by which means any little irregularity in the length of the seconds' spaces is rectified. The "reading off" is directly transcribed into the transit-book.

The usual mode of observing without the chronographic apparatus is styled the eye-and-ear method, and a short description of it will at once make the superiority of chronography obvious.

In observing by the eye-and-ear method, the clock or chronometer must be in such a position that the movements of the hands on the dial shall be visible, and the "beats" of the pendulum or balance distinctly audible to the observer. Shortly before the occurrence of any astronomical phenomenon, such as the transit of a star, he observes the time of the clock, "taking up" the beats, mentally counting them until the star passes the first wire, when he writes down on his observing slip the corresponding seconds indicated; and if it occurs between any two consecutive seconds, he estimates as nearly as he can the fraction of a second also. For a complete transit, this has to be done over several wires, writing down the times between each observation. It has been found that 15 seconds are required to observe and record for each wire, and to "take up" the "beats" again without hurry. The wires, therefore, are generally arranged so that an equatorial star shall take 15 or 16 seconds to pass from one to another. The time required to complete a transit observation over seven wires of a star having a declination of 45 degrees, is over two minutes; and the utmost precision that can be attained by the best observers, under the most favorable circumstances, in a mean of seven wires, is limited to one-tenth of a second, and it is very much to be doubted if anything near this precision is ever attained.

Two different observers will seldom agree as to the exact instant of a transit or occultation, owing to what is known as personal equation, the precision of combining the visual impression of the observations with the sound of the clock-beats depending much on the age, temperament, and health of the observer. When several individuals, therefore, are employed in an observatory, it becomes a matter of the first importance to determine their personal equations, in order that all observations may be reduced to a standard.

In the chronographic method no listening to the clock is required—the clock may be in another apartment, if necessary—no recording by the observer during the observation is needed, so that the intervals between the wires may be reduced from fifteen to three seconds; the observer's attention can be entirely confined to the observation itself, and is not distracted between observing, listening, and writing, and the precision attainable is at least ten times as great as by the old method. Personal equation is greatly reduced, if not eliminated.

Any one acquainted with the principles of physiology will at once perceive the great superiority of the chronographic registration over the eye-and-ear method. In the latter we have two totally distinct external impressions, the view of the star crossing the field of the instrument, and the sound of the clock-beats which require to be mentally counted at the same time; while in the method now adopted we have only the one external impression—the view of the star. The mental operation involved, in coinciding thus with the touch of the finger on the key, being so rapid as to be almost inappreciable.

Again, the record on the register-paper is permanent, and in case of an error in transcribing, can be afterwards referred to; whereas there is nothing but the memory to fall back upon in case of an erroneous record by the eye-and-ear method. The amount of observing in a given time can be nearly ten times as much, and with very little labor to the observer. In cataloguing stars this becomes a great object.

One clock is sufficient for any number of instruments; and in our Observatory we use the chronograph not only for the transit but for prime, vertical, and other extra meridianal observations, by leading wires from the observing circuit to the different instruments used. Wires are also carried from the Lighthouse, where, by means of a key, observations which are being made for the astronomical ayzmuths of the different trigonometrical stations can be directly recorded on the chronographic paper, so that the otherwise troublesome and often difficult determination becomes as easy and precise as observations made in a fixed observatory.

Considering the benefits derived from the adoption of chronographic registration in our permanent observatory, I was anxious to devise some means by which it could also be adapted to the shifting observatories used in the geodetic survey. Here, large clocks being of course out of the question, the great difficulty was the mechanical arrangement by which the "clock contact" could be made with an ordinary marine chronometer—a difficulty so great that, so far as I am aware, it has not been previously overcome. After several experiments I was enabled to plan an appliance, which has been admirably constructed by a watchmaker at Williamstown, and is found to work perfectly, without interfering with the rate of the chronometer. It consists of an extra wheel, of 60 teeth, which is in the seconds' arbor, the teeth conical, with a slight rake, and, as in the astronomical clock, one tooth is cut out as a minute data. The great delicacy required in adapting contact springs, without producing undue friction, offered the chief obstacle; but by placing the opposing surfaces of the teeth and pallet at the most favorable angle, and arranging so that the slightest lift of the pallet broke contact, instead of making it, the principal difficulty was overcome. The contact here is the reverse of that in the clock; for when the pallet is in the angle between two teeth, the spring *bauks* on a platina stud, and the contact is complete; but each passing tooth lifts it sufficiently to break contact for an instant. This peculiarity would, of course, cause a registering style to make a long stroke and a short space; but the same effect as in the "clock contact" can be attained by a modified relay, or reversed lever in the register.

The success of this appliance to a chronometer at once admits of a perfectly portable chronograph being arranged, and I have had a register constructed to complete the apparatus.

The fillet-paper used in the Observatory, although offering several advantages, would be very inconvenient for a portable chronograph; the plan of the register, therefore, is different altogether to the one in the Observatory.

A metal drum, six inches in diameter, and eight in length, covered with fine cloth, is made to revolve on a horizontal axis in about 35 seconds, by means of a weight and clockwork, regulated by a conical pendulum. A small waggon or carriage is made to traverse smoothly and easily on a railway, in a direction parallel to the axis of the drum: this carriage carries the electro-magnets, levers, and styles, which are so adjusted that when the electro-magnets are brought into action, the styles will impinge on the drum. The movement of the waggon is regulated by the clock-work, and during the working of the apparatus it progresses on the rail about a quarter of an inch for every revolution of the barrel.

In using the apparatus, the drum has to be covered with a proper sheet of paper, which is fitted on damp, the joining edges being gummed together with isinglass. To do this conveniently, the drum is made so that it can be removed from its bearings very readily. When the paper is dry, and all the connections and adjustments made perfect, the instrument is ready for use. On setting the train in motion, the drum will revolve slowly and uniformly on its axis, and the waggon, with its electro-magnets and styles, also moves in the direction of the barrel axis. The two circuits are similar to those in the Observatory, and require no further explanation.

One style punctures the seconds transmitted by the chronometer circuit, the other punctures the observation record; and the two sets of punctures are distinguished by their size. The relative motions of the drum and waggon causes the two series of punctures to assume the form of a spiral line around the cylinder. In order that the styles may not stop the cylinder, if they happen to remain in the paper for a longer time than is required, they are allowed to follow the motion of the cylinder a little, but when they are withdrawn from the paper, by means of a spring, they immediately resume their proper position.

The reading off is performed in a similar manner to that of the fillet register, but it is necessary to remove the paper from the cylinder before this can be done.

In conclusion, I would remark that there is nothing original in the chronographs used at the Observatory, the clock contact being very similar to the one used at Greenwich, and the register is of the most usual form. The portable chronograph, as far as the register is concerned, is a modification of one lately made for the Altona Observatory, the chronometer contact being the only portion which, I believe, has any claim to originality.

Art. VIII.—*Suggestions for the Introduction of Animals and Agricultural Seeds into Victoria.* By W. Lockhart Morton, Esq.

[Read before the Royal Society of Victoria, October 8th, 1860.]

The subject which I have the honor this evening of bringing under the notice of this Society, bears directly upon the material welfare and advancement of this colony; and it is thus invested with more than ordinary interest, claims more than ordinary mention, and deserves that full consideration which I trust it will receive.

For a lengthened period the condition of this country has occupied much of my deepest thought, and I have come to this conclusion, that if lasting prosperity is to be attained at all, it must be through industry applied to the cultivation of the soil, as well as to gold-mining; not indeed for the growth of cereals, to any great extent, because our market is too limited for that; but for the production of all such articles as are valued and cultivated in other lands, and for which a good return could be obtained by exportation now, or by the establishment of manufactures hereafter. Actuated by this conviction, I began to endeavour to find out what seeds and plants are cultivated, and what animals are reared and kept with the greatest amount of profit in other countries of the world. A little inquiry was sufficient to make known that nearly every country is in possession of seeds and animals of great value altogether unknown to the rest of the world. The question next to be settled was, how can this colony obtain the valuable seeds, plants, and animals, of other countries. It occurred to me that the only proper way to accomplish so desirable an end was to suggest the formation of an association for the express purpose; hitherto, however, I have met with no success in this matter. I therefore determined to try a different course, which will be made known and best explained by the following letter, which I addressed to His Excellency the Governor:—

"To His Excellency Sir Henry Barkly, K.C.B., Governor of Victoria, &c.

"Sir,—Knowing how deep an interest you feel in whatever is calculated to benefit the Colony, and Australia generally, I have the honor to lay before Your Excellency the following proposal, bearing upon the introduction of new and valuable seeds, plants, and animals into this colony.

"Every country is in possession of distinct forms of vegetable or animal life, of perhaps great value, yet known only to men of science, whereas, if some means were adopted for their distribution throughout the world, a universal benefit would be conferred upon mankind.

"In order that this object may be attained, for the advantage of the world generally, and this colony particularly, I have the honor to suggest that Your Excellency should forward a request to the Foreign Office, that a circular may be sent, in the name of Your Excellency, to the Ministers of Foreign States, and to the English Consuls at foreign ports, containing a proposal that collections should be made in each country of all its most valuable seeds, and that a portion of each variety should be forwarded to Your Excellency, upon the understanding that this colony will most gladly reciprocate.

"I have the honor of further suggesting, that if a list of questions, such as are hereto attached, were forwarded along with the circular, the most valuable information might be distributed throughout the world, by the answers received.

"I have the honor to be,
"Your Excellency's most obedient servant,
"WILLIAM LOCKHART MORTON."

LIST OF QUESTIONS TO BE ANSWERED.

What animals are esteemed of greatest value in your country, and for what quality are they so esteemed?

Could they be procured, and with what facilities?

What valuable seeds and plants grow in your country; and which are esteemed and cultivated most?

Will you be good enough to state, in reference both to animals and seeds, every particular necessary for the proper management of the former, and what description of soil and climate, and what mode of cultivation, are most suitable for the latter?

Will you please to give immediate instructions to some competent authority to make, without delay, a full collection of all the most valuable seeds grown in your country—inclusive of the most esteemed agricultural seeds generally cultivated for cereal crops, and forward the same (carefully packed to stand the long sea transit) to His Excellency the Governor of Victoria, who will in exchange send to your country a full collection of Australian seeds?

In answer to the above communication, I promptly received the following letter from His Excellency's Private Secretary:

"Private Secretary's Office,
"September 27th, 1860.

"SIR,—I am directed by the Governor to state, with reference to your proposal for the introduction of new and valuable plants, seeds, and animals into this colony, that His Excellency fully concurs with you as to the importance of setting a movement of the sort on foot, but would suggest that you should endeavour to secure the co-operation of the Royal Society of Victoria; in whose name applications might be made with a greater amount of weight, and under whose auspices the best mode of proceeding might be arranged.

The aid also of the Legislature would seem to be needed, as the collection and transmission *even of seeds* would entail considerable trouble and expense, which it would scarcely be sufficient to meet by holding out a prospect of reciprocity hereafter.

"I am, Sir, your obedient servant,

"O. F. Timins, Private Secretary.

"Mr. William Lockhart Morton."

It is only within the last few days that I have learned that in the year 1854 a society was formed in France, and during the past year, one in England, for attaining the same objects as those embodied in the foregoing suggestions. I do not now think that it will be necessary to organize such a society here, if this Society will agree to take the matter up, or form a section for that purpose; in which case immediate communication might be entered into with the French and English societies. But, even if this should be done, I think it would nevertheless be desirable to follow up the suggestions which I had the honour of offering to His Excellency, because they seem to point out the best channel for obtaining the most full information; and, as other existing societies may possibly not have thought of the same means, a vast amount of valuable information may be thereby gathered, for their use as well as for ours.

It may be thought that in Australia there are very few animals or seeds which could be given in exchange for those of other countries; but, if Australian productions are deficient in intrinsic value, they make up for that want in their singularity. There are in Australia more useful plants and animals, however, than common observers are aware of. Throughout tropical and extropical Australia are several plants which may hereafter be regarded as highly valuable for their medicinal virtues. Amongst the feathered tribes, the genus Columba is well represented. Perhaps the largest and smallest varieties of pigeons to be found in the world are natives of this continent. In the Wonga Wonga we have a pigeon nearly equal in size to the common fowl, while there is another sort so small that it resembles the house sparrow. These, and some other varities, as well as a small pheasant, might be domesticated. They could be easily obtained from Rockhampton. There is also to be got the brush turkey, which, like our own lowen, lays its eggs in heaps of sand, mixed with vegetable matter, to produce fermentation, and thereby generate heat. In addition to the many interesting seeds and plants, as well as fruits discovered by Dr. Leichhardt—amongst which may be mentioned the bean of the Mackenzie, which that distinguished explorer considered as a good substitute for coffee, the clustering fig tree, and the seeds producing the same effect as cantharides when applied to the skin; it is now known that on some of the beautiful islands of the north-east coast an excellent ground-nut grows in the utmost profusion. In reference to the advantages that would be secured to this colony by the introduction of seeds and animals from other parts of the world, I would beg leave to mention the field that exists here for the growth of those trees upon which the silk-worm feeds, and for the production of silk. We all know that the castor oil tree, or the *Palma Christi*, grows well in this colony, and it is on the leaves of this tree that the wild Indian silk-worms are fed. But by far the best variety of silk-worms we can obtain is one that can be readily got from the province of Canton, in China. This description of worm feeds upon a species of *Xanthoxylum*, which, on account of its aromatic and pungent properties, is generally called a pepper tree. Its bark and capsular fruit is much used as a remedy for tooth-ache, and also instead of pepper. This tree or shrub, then, would be of value on its own account, but the more so because it yields the proper food for those silk-worms which produce the best Chinese silk, and in such quantity that, in abundance as well as in quality, this species of worm excels all others. But what renders this species particularly valuable for this colony is the circumstance that little attention requires to be bestowed upon the worms. They are wild silk-worms, and do better when left to themselves. Another important fact connected with them is, that the same worm will do equally well on the leaves of the ash tree (which in China is nearly identical with the English ash tree).

I may also allude to an important variety of sheep that might be obtained from Ladakh, or Middle Thibet, a high and rugged country north of the Punjab. This is the Purek sheep; when full grown it is scarcely the size of a South-down lamb of five or six months old, yet in the fineness and weight of its fleece, and in the flavour of its mutton, added to its peculiarities of feeding and constitution, it yields not, says a traveller, in merit to any race of sheep hitherto discovered. It thrives where vegetation is hardly discernible. It gives two lambs within the twelve months, is shorn twice in the same period, and yields on an average three pounds of wool per annum.

The black Astracan sheep is another variety of sheep that might be introduced. This produces wool only inferior to that of Cashmere. It feeds on furze or dry grass. Its flesh is sweet and well-flavoured. It is found in Karakool, a small canton between Bokhara and the Oxus; but it has been alleged that it will thrive in no other place—that it has been transported to Persia and other countries without success.

The Yak (the *bos poephagus* or *poephagus grunniens*) is another valuable animal. This animal, sometimes called the grunting ox, is found in Thibet. It is a first-rate milker. The males make good workers or beasts of burden. It has long pendant hair, of which a kind of coarse cloth is made. The skins, when tanned, form excellent rugs. The skins of the young are curly, very beautiful, and are much esteemed.

I cannot lose the present opportunity of remarking that it is possible to think so much of those things we have not got, that the value of those things we actually have may be overlooked. I think the fine-woolled merino sheep furnishes a case in point. Instead of trying to improve the qualities of this valuable animal, it is about to be displaced by coarse-woolled varieties. The result will be felt in a few years, when, by the increase of this description of stock, without a corresponding augmentation of the population, the fleece must assuredly come to be regarded as of more value than the carcass.

Again, we have already in the colony many things the value of which is known only to the scientific, or not recognized by the practical agriculturist, as of any value whatever. The sunflower, the *Palma Christi,* and the *Agave Americana* are examples of this. All these grow well here. The latter, as the American aloe, is to be seen in our gardens, growing in the utmost vigour and luxuriance, but it is not esteemed as of any value, yet it may be cultivated as a hedge row; the leaves may be used, as they are in Spain, as scouring paper; their essence may be made into a soap that is equally efficient in salt and in fresh water; and from them a valuable medicine also is extracted; whilst an admirable bed can be manufactured from the fibres of the leaves. A sample of this fibre, both in its natural colour and dyed black, is at present on the table. This is an article only recently introduced into the colony, by Mr. White, opposite to the Hospital, and, apparently, is superior to much of the horse-hair now used for the general purposes of the upholsterer.

Art. IX.—*On a Deposit of Diatomaceæ at South Yarra.* By John Coates, M.R.C.S.L., South Yarra.

[Read before the Royal Society of Victoria, October 8th, 1860.]

At the last meeting of the Royal Society, some microscopic organisms were exhibited by my friend, Mr. Ralph, from the mud of a swamp near the Yarra, where the Melbourne and Suburban Railway crosses that river. During the interval that has intervened, this deposit has been the subject of more careful and extensive examination, and in the results which I have the honor to submit to your inspection this evening, it will be shown that in the locality of South Yarra there is a vast and interesting field of infusorial remains, containing a numerous variety of microscopic objects, not less remarkable for their exquisite beauty and delicacy of structure, than for the extreme profusion in which they are to be found. These remains are generally silicious, and the extraordinary preservation which they exhibit is due to this circumstance.

On the southern bank of the river Yarra, where the railway operations are in progress, an embankment has had to be carried across a small swamp to the bridge now in course of erection. This swamp has its termination in the Yarra, at a short distance to the westward of the line of railway, and extends in a south-easterly direction beyond the Gardiner's Creek Road, serving as an outlet to the watershed of a large portion of the municipal district of Prahran. As the material to form the embankment alluded to was thrown upon the surface of the swamp, the weight of the super-incumbent earth, assisted by occasional heavy rains, burst up the soft and spongy matter of the bog, and totally obstructed the drainage, to which a reference has just been made. In order to provide a remedy, the Railway Company have been necessitated to dig up this boggy earth, preparatory to the formation of a permanent outlet to the river; and in the material thus removed have been found those microscopic and other organisms which are now brought under the cognizance of the Society. Several specimens of the deposit are placed upon the table this evening. In some of these, marine shells, more or less perfect, pieces of cuttle-fish bone, and the debris of echini, are obvious to the unassisted vision; and by the aid of a common magnifier, numerous foraminiferous shells are also readily apparent. In other specimens these larger objects become more rare, and their place appears to be supplied by an increased number of microscropic forms of the *Diatomaceæ*, which are occasionally met with in such infinite profusion as to give the semblance of frosted silver to the eye, and to render, in a remarkable degree, the mass in which they are contained specifically lighter than water. In every piece of this mud which has come under observation, these diatoms have been found in greater or less abundance; and from inquiries that have been instituted, it is estimated that the swamp has a depth of not less than sixty feet! How vast has been the extent of life within this limited area, and how immeasurably the results of actual examination of the exquisite beauty and delicate tracing of these minute organisms transcend any ordinary efforts of imagination to conceive, can only be appreciated by the revelations of the microscope.

The great improvements which have been effected during the last few years in the achromatic microscope, the perfection and precision to which it has attained as an instrument of the highest value in the prosecution of scientific research, and the increased and daily increasing numbers of those who resort to its assistance in the pursuit of special branches of study, or particular objects of inquiry, are rapidly enlarging the boundaries of our knowledge in every portion of the world, and in every department of philosophical investigation. It has been well remarked that he who sees with the naked eye only sees but half that world which God has made. Beyond the limit of man's natural vision the microscope has disclosed another world whose first characteristic consists in the minuteness of its organisms; but in the study of those apparently insignificant forms, have been solved some of the highest problems in the history of organization. Hence, the family of the *Diatomaceæ* has many points of peculiar interest. Their presence in almost every running stream, in every little pool of stagnant water, as well as in the lowest depths of the ocean, their use and application, as the severest tests of the excellence and efficiency of our microscopic object-glasses—the inconceivably delicate and minute markings of the silicious coverings of many of their forms—the peculiarities of their structure, development, and reproduction—and the wonderful offices which they perform in the admirable economy of infinite wisdom and intelligence, as "the invisible scavengers of nature," have made them the subjects of delightful and instructive study, wherever the means of their examination by the microscope have extended. "As a group of simple organisms they present us with the first struggles of life against the physical and chemical forces of mere matter; and it is by the observation and determination of these elementary forms that we are enabled to proceed, in the spirit of true philosophy, to the accurate investigation of higher forms of structure; and thus the theory of cell-formation, as carefully elaborated under the scrutiny of the microscope, has become the foundation of all our certain knowledge of vegetable organization."

These objects, then, so apparently trivial to ordinary observers, possess a degree of interest, actual and relative, which is far beyond their nominal position in the scale of scientific arrangement. In the present state of our nomenclature, the family of the *Diatomaceæ* occupies a kind of anomalous situation between the animal and vegetable kingdoms, in exhibiting certain characteristics of both. Ehrenberg and some other microscopists have placed them among the lowest forms of animal life; while the late Professor William Smith, in his laborious monograph of the British Diatomaceæ, Professor Carpenter, and a host of other celebrated observers, have unhesitatingly described them as belonging to the vegetable kingdom. The preponderance of opinion undoubtedly inclines to their vegetable nature, notwithstanding the power of independent locomotion, and the presence of ciliary actions, which some species have been ascertained to exhibit. Whatever doubt may exist on this subject, appears to arise from the difficulty of reconciling the movements which accompany the vital functions of the *Diatomaceæ* with the prevalent conditions of plant life, and of harmonizing their silicious epiderms with the ordinary forms under which cellulose occurs throughout the vegetable kingdom. On the other hand, it will be remembered that most decided movements are present in the *Oscillatoriæ*, and that silica is ever constant in the structure of the epiderm of the *Equisitaceæ* and the *Graminaceæ*. An enlarged consideration of these and other facts, therefore, conduces to the view that the *Diatomaceæ*, with specialities of their own, have intimate alliances with the other orders of Unicellular Algæ, and belong to the vegetable, rather than the animal kingdom.

The forms which these objects present in a living state are exceedingly various. Some are filamentous, and in the early stages of their growth very closely resemble the *Confervæ*. Instead of the usual ochreous brown colour of their cell-contents, a batch of *Melosira*, which I lately found in a brackish pool near the Yarra, exhibited a bright confervoid green in the younger filaments, but gradually passing into the normal brown, as the more perfect orbicular characters of the frustules become developed. Other genera are connected by the angles of their frustules, in a kind of zig-zag chain, disrupted by the slightest touch, from which arises the term of "Brittleworts" in common vernacular language, as descriptive of the whole family. Other forms again are invested with a gelatinous envelope, resembling that which is found to exist in some genera of the *Desmids;* while by far the greater number is composed of single frustules only, becoming duplicate in the process of self-division, which characterizes this and its allied families.

The circumstances attending the remarkable preservation of these minute and delicate organizations are deserving of notice. The silicious epiderm by which they are invested, has served to perpetuate their forms in numerous localities from which they have long since disappeared in a living condition. In several places in the British Islands, in Europe, Africa, America, and the Indies, familiar by name at least to the microscopist, the long-hidden records of infusorial organisms have been disentombed, since the silica of which their frustules is composed forms one of the least perishable materials with which we are acquainted. The city if Richmond, in Virginia, is said by Professor Smith to be built upon a stratum of these remains, eighteen feet in thickness; and extensive tracts, even in the Arctic and Antarctic regions, have been stated to be formed of similar deposits. It is with some degree of satisfaction that the name of South Yarra is now added to the list of these remarkable places, as a rich habitat of the fossil *Diatomaceæ* in Victoria; and with the hope that, while these varied and beautiful objects afford that pleasure which, in scientific pursuits, has its own reward, they may also serve to train the eye and mind to habits of correct and careful observation in our young microscopists, and stimulate to still higher and nobler fields of investigation.

The deposit, when it is recently turned up, has in general a very dark appearance, and the consistence of a soft tenacious clay. After a few days exposure to our warm summer weather, it dries into a greyish coloured substance, and becomes occasionally so light and friable, that the passing breeze will often float away the loosened diatoms from the surface of the specimen under examination. Mixed with other clay, it has been used for making bricks, but during the process of burning, the amount of contraction and distortion which supervened rendered them utterly worthless for economical purposes, but exceedingly interesting and beautiful as opaque microscopic objects. In separating the diatoms, the ordinary routine has been followed, which is described in the *Quarterly Journal of Microscopic Science*. Repeated washings in water will be necessary as a preliminary operation, and then the action of acids and chlorate of potash, to clean the objects from the organic matters which accompany them.

In a former part of this paper allusion has been made to the presence of undoubted marine shells, and of numbers of *Foraminiferæ* in certain portions of this deposit; and it is also worthy of observation, that the clay in which these most abound, is characterised by fewest of the *Diatomaceæ*. It seems therefore an obvious and rational conclusion, that at one time, probably not very remote, the waters of Port Phillip Bay must have covered this locality. Subsequently, as the land became elevated, and the communication with the sea interrupted, but not altogether closed, it is not improbable that here was formed a sort of lagoon, or salt-water marsh, highly favourable to the growth and development of the *Diatomaceæ* in immense myriads. That this period must have been one of considerable duration, seems evident from the large quantities of their silicious shields in particular parts of the deposit; and during the further elevation of the land, it is possible that an interruption of fresh water into this lagoon suddenly destroyed the vitality of the organisms, leaving their remains in exquisite preservation, as a rich legacy to microscopic science.

In the careful examination of this deposit, upwards of fifty different forms of diatoms may be found, in addition to spicula of sponge, and the object known as *Dictyocha*. While some of the forms are exceedingly rare, others are very abundant; among which is the beautiful species of Actinocyclus, to which I have ventured to give the name of His Excellency, the President of this Society.

1. Actinocyclus Barklyi. Valve convex, with central nodule; striæ moniliform, arranged in radiating lines, and diminishing in number towards the centre; no pseudo-marginal

nodule; margin of the valve having fine markings, direct and oblique; diameter of frustule .0111 to .0074.

2. Actinocyclus duodenarius.
3. Coscinodiscus radiatus.
4. Coscinodiscus eccentricus.
5. Campylodiscus clypeus.
6. Campylodiscus cribrosus.
7. Campylodiscus Hodgsonii.
8. Campylodiscus parvulus.
9. Stauroneis pulchella.
10. Stauroneis acuta.
11. Hydrosera triquetra *(rare)*.
12. Navicula elliptica.
13. Navicula ovalis.
14. Navicula Amphisbœna.
15. Navicula tumens.
16. Navicula pusilla.
17. Navicula minutula.
18. Navicula *(new variety)*. Valve elliptical, extremities rounded, striæ transverse in lateral and two narrow central bands, delicate, 34 in. 001″.
19. Pinnularia nobilis.
20. Pinnularia major.
21. Pinnularia stauroneiformis.
22. Pinnularia distans.
23. Pinnularia acuminata.
24. Orthosira marina.
25. Melosira ———
26. Hyalodiscus subtilis. Valve having a central granulated disc, with clear transparent margin, with fine decussating markings; diameter .01 to .0074.
27. Pleurosigma Balticum.
28. Pleurosigma ———
29. Pleurosigma ———
30. Surrirella splendida.
31. Surrirella striatula.
32. Gomphonema lanceolatum.
33. Gomphonema cymbiforme.
34. Epithemia turgida.
35. Epithemia Westernannii.
36. Himantidium arcut.
37. Himantidium undulatum.
38. Himantidium bidens.
39. Himantidium gracile.

40. Achnanthes brevipes.
41. Achnanthes subsessilis.
42. Tryblionella gracilis.
43. Tryblionella marginata.
44. Cyclotella rectangula.
45. Cocconema lanceolatum.
46. Synedra, three forms; Tabellaria, Cymbella, Nitzschia, Cocconeis.

ART. X.—*Manners and Customs of the Australian Natives, in particular of the Port Lincoln District.* By CHARLES WILHELMI, Esq.

[Read before the Royal Society, October 29, 1860.]

ALTHOUGH Australia, for a considerable time already, is known to the world in general, very little, comparatively speaking, has as yet been made known respecting the habits and customs of its aboriginal inhabitants; very few persons indeed have given themselves the trouble to note down what they may have seen or may have been told by these children of nature, in order that those who have not had such opportunities may be enabled to form a correct idea respecting them.

My various botanical journeys, since 1849, have necessarily brought me in frequent contact with them, when it always has been most interesting to me closely to watch the different customs and habits of this race of mankind.

During my two visits to Port Lincoln, I have had many opportunities for making observations respecting the natives there, which were the more interesting, as these people, at that time, had as yet been so little interfered with by civilization.

To the Rev. Mr. Schurmann, however, I am most particularly indebted for his valuable communications on this subject.

This gentleman, in 1840, about twenty-one years ago, had been appointed Protector of the aborigines of Port Lincoln, and has occupied this office for nearly six years. After having then removed to Adelaide and Encounter Bay, in his capacity of missionary, he returned after a few years' absence to his old post at Port Lincoln. Fully conversant with their language, he easily obtained the most complete information as to the living and occupation of the tribes of that particular district. During my stay with him in 1851, twenty-four native children attended his school, and had then made pretty considerable progress in reading, writing, &c., which was rendered the more easy to them by the advantage that all information was by this most excellent man conveyed to them in their own language.

It has been remarked that the population and general condition of the natives of Australia greatly depend on the nature of the locality they occupy; where the country is sterile and unproductive, the natives are found to congregate in small numbers, and to be in a miserable condition; while, on the contrary, in fertile districts they are comparatively numerous, robust, and well made. The correctness of this observation must have been apparent to every one who has had the opportunity of comparing the natives of Port Lincoln with those of the Adelaide and the Murray districts, in particular. The former are less in number, of smaller size, weaker, and less expert, and not of so sociable a disposition as the latter. A Port Lincoln black but very rarely exceeds the height of a middle-sized European, and in reference to bodily strength the comparison is more unfavorable still. Among the Murray tribes, on the contrary, you will find handsome, tall, and well-made men.

Striking peculiarities in the appearance of their body are their miserably thin arms and legs, wide mouths, hollow deep sunken eyes, and flat noses; if the latter are not naturally so formed, they make them so by forcing a bone, a piece of wood, or anything else through the sides of the nose, which causes them to stretch. They generally have a well-arched front, broad shoulders, and a particularly high chest.

The men possess a great deal of natural grace in the carriage of their body, their gait is easy and erect, their gestures are natural under all circumstances in their dances, their fights, and while speaking, and they certainly surpass the European in ease and rapidity of their movements.

With respect to the women we cannot speak so favourably by a great deal; their bodies are generally disfigured by exceedingly thin arms and legs, large bellies, and low hanging breasts, a condition sufficiently accounted for by their early marriages, their insufficient nourishment, their carrying of heavy burdens, and the length of time they suckle their children, for it is by no means uncommon for children to take the breast for three or four years, or even longer.

Although a superficial observer will scarcely be able, on account of the apparently great similarity prevailing among them, to detect any difference in them, a closer intimacy with them will easily trace very considerable varieties, not of countenances and forms of body only, but also of colours and skins even; while the skin of the tribes of the north, which inhabit a rather scrubby country, is darker and drier in appearance, that of the tribes of the south and the westward, in many instances, approaches to what is termed the copper colour. Whether this is attributable to the influence of the climate or the difference of the food, it is difficult to decide. My valued friend, the Rev. Mr. Schurmann, however, is inclined towards the opinion, that upon the whole the best fed and most robust natives are of the lighter colours.

In reference to this subject, Dr. Livingstone makes the following remark in his "Missionary Travels and Researches in South Africa" (page 78) :—"Heat alone does not produce blackness, but heat with moisture seems to insure the deepest hue." He found that tribes living in the desert of Africa were of a lighter colour than those near the rivers.

The covering they generally wear consists of one or two kangaroo skins only, and seldom of rugs made of skins of the wallaby, opossum, and similar animals, and which for this purpose are prepared in the following manner :—The skin, directly after being flayed, is spread—the flesh side upwards—on an even smooth piece of ground, and fastened by small wooden pegs, driven in along the ridges; when dried the small fleshy fibres adhering to the skins are scraped off with a sharp angular piece of quartz, and afterwards the skins are well rubbed over with a coarse-grained stone, for the purpose of making them soft and pliable. Thus prepared, the skins are then sewed together with the sinews of the tail of the kangaroo, a small sharp-pointed bone answering admirably for the purpose. As these skins are never tanned, the natives are required to be very careful in guarding the flesh side against the wet, as it would make them hard and stiff; on this account it is that during the rain the hairy side is turned outside. The best rugs generally belong to the women, and more particularly so if they have young children, as they make them serve for covering both of them, while they carry them on their backs, or while resting they have them on their laps. Those children old enough to walk are decidedly the worst off as regards covering, for they have to run about quite naked, or be satisfied with the remnant of some old used-up rug.

More for ornament than for any imaginable comfort, the men wear a band of yarn round their heads, tying it round several times, so as to leave the crown only uncovered by it. They spin this yarn of human hair, or of that of the opossum, using for the purpose a kind of spindle, about two feet long, and not thicker than a goose quill, with a cross piece at one end, on which they wind up the yarn spun. They turn or roll this spindle on their legs, with their hands spread out flat. If desirous to appear particularly decorated, they will add to the above ornament a bunch of emu feathers, stuck in their hair in front.

The Murray tribes, in the neighbourhood of Swan Hill, in a similar way spin the fibres of the roots of the club rushes *(Typha Shuttleworthii)* to any lengths, and employ it for making their nets.

On occasions of rejoicings and of ceremonies, as, for instance, at the meeting of two different tribes, they add two small pieces of green wood, decorated from one end to the other with very thin shavings, and which have the appearance of a white plume of feathers, and these they stick behind their ears through the above-mentioned band, in such a manner that the upper ends can be joined in front, and thus, at a distance, they have the appearance of two long horns. Mr. Schurmann has seen this latter ornament only with one tribe of the north-west, and it may perhaps be confined to it. This ornament, together with their white and red painted chest and arms, are said to produce quite the impression of untamed savages.

Frequently they attach to the end of their pointed beards the tip of the tail of a wild dog, or a wallaby. A very particular ornament, however, they consider it to wind the entire tail of a wild dog round their head, just above the front.

The natives who come in frequent contact with Europeans, instead of the latter ornament, make use of a rag of white or red cloth, or else of even a piece of paper.

The men always wear round the waist a cord, generally made of their own hair, being first spun, and then twisted into a cord of about a quarter of an inch thick, and which at times is interwoven with emu feathers. If they cannot have one of this description, they will take any kind of cord rather than do without one altogether. They always wear it tight, but tighter if hungry, as they say, in order to allay the painful sensation of hunger. I have seen these cords tied so tightly, that in front they were perfectly hidden from observation.

The means which the natives, both males and females, mostly use and prefer to all others for beautifying themselves, is fat; if well supplied, they rub their entire body over with it; but if short of it, they confine themselves to anointing their faces only. There can be no doubt that this custom has its origin in some sound reasonable motive, and produces with them a feeling of comfort, in hot weather particularly, when the mosquitos and flies are exceedingly troublesome. They will ask for a little fat as pitifully as for a piece of bread. They compare this custom to that of Europeans washing themselves; they never appear in better humour than when the fat is actually dripping from the entire body, from head to foot.

Dr. Livingstone, in his Travels in Africa, page 108, in alluding to the custom of the Griquas and Bechuanas rubbing their bodies with fat or oil, states, that probably this is done "in order to assist in protecting the pores of the skin from the influence of the sun by day, and of the cold by night."

They use three colours in painting themselves, viz.—black, red, and white. The black and red colours are the produce of a soft stone which they draw from a great distance in the north; by rubbing or scraping it they obtain a powder, which they rub into the fat which they have before put on their faces, arms, and breasts; the colors then assume quite a metallic lustre. The white colour is prepared of a soft clay or chalk. It is applied on particular occasions only, among others for dancing, and when in mourning. I shall, hereafter have the opportunity of stating more fully, how, for dancing, they paint themselves with this color. For indicating mourning, the women paint their whole front, a ring round each eye, and a perpendicular line about the stomach; but the men paint the breast by making drawn or punctured streaks down from the shoulders, all verging towards and joining at the navel. The difference in the design of the painting indicates the nearer or more remote degree of the relationship with the deceased. The black colour, in some parts, is also used for mourning, according to what Mr. Schurmann has been able to ascertain, at the death of a relation by marriage, while the white is used at the death of blood relations. It thus becomes evident that the natives do not paint themselves in one and the same manner, but differently, according to the degrees of relationship between them and the deceased, which is expressed by the various designs.

The weapons of the natives of Port Lincoln are by no means so handsome and respectable looking as those of the Adelaide and Murray tribes, but are quite as efficient.

The spears are made of the stems of the young *Leptospermi* (better known as the tea tree), which, hardened in hot ashes, they bend and sharpen. Their usual length is seven feet and upwards, the thickness at the end of the root about that of the thumb; in the upper end they bore with the tooth of the kangaroo a perpendicular hole, in which, for throwing it, they fit the hook of the wooden lever, called "middla;" and in order to protect the edge of the hole against breaking or splitting, they take the precaution to tie it well round with a fine sinew of the kangaroo. Among the number of spears which every adult native carries with him, they generally have two or three of them ready provided with the "barb," and for the others they always have about them sufficient to serve in case of need, and can fasten them on in an instant. These "barbs" are simply a small piece of wood, of about two inches long, and having a knee in the middle, so that in putting one side flat on the spear, the other will project from it in an acute angle; and although it is fastened on with sinews of the kangaroo only, it is so firmly fixed as never to slip off, so that it is quite impossible to draw such a spear out of the body of a person or an animal, and it can only be broken off. On this account it is considered unfair and highly blameable to employ this weapon in any fight or in warfare. Besides this kind of spear, which is always thrown with the so-called "middla," they make use of the "winna," about five feet long, thick and clumsy, but only for the purpose of spearing fish.

The "middla" is a kind of lever, by means of which an increased power is created for propelling the spear with greater force than could be done with the arm by itself. It is about two feet long, two inches broad; the inward side on which the spear rests is scooped out a little, while the outward part is rounded, both sides being usually notched, in order to give a firmer hold. To the upper tapering end is attached, with sinews of the kangaroo and a little gum, a hook or a tooth of the kangaroo, which, when throwing, is placed in the opening at the flat or blunt end of the spear. It is generally made out of a piece of the casuarina or she-oak. In using the "middla," it is held with three fingers, while the thumb and first finger remain disengaged, for holding the spear, and giving it the proper direction.

Another weapon, called "wirra," is made of the stem of young trees, about one and a-half feet long, and barely an inch thick. The thin end, which serves for the handle, is generally notched, while towards the thicker end it is a little bent, somewhat in the shape of a sword. The "wirra" of the Adelaide and Murray tribes have generally a stout knob at the lower end, which adds considerably to their propelling power. This weapon the natives use for killing kangaroo rats and other small animals, and also at the commencement of their fights or battles, until they can afterwards employ their spears.

The "katta" is a cudgel or stick, four or five feet long, and one or two inches thick, the lower end of which, when hardened by fire, is sharpened something in the shape of a chisel. This tool is used for digging up roots; and as this is one of the occupations of the women chiefly, they constantly carry them along with them. The Murray tribes also employ the "katta" for loosening the bark off the eucalypti, which operation they perform remarkably quick.

This bark serves for the building of their canoes, and for their protection against rain. The Murray tribes generally have in their camps a piece of this bark, drying upon it the skins of the smaller animals, the opossums, wallabies, and others required for their rugs, as described above.

The "wadna" is a kind of weapon about three feet long, with a knee in the middle. It is never used as a weapon for fighting, but only for killing large fish; on this account they are but seldom seen with the natives, and then only when they happen to be engaged in fishing.

The most extraordinary tool in use among the Port Lincoln tribes, and (according to Mr. Schurmann's opinion, as it has never been mentioned among any others) confined to them, is the "yuta," being a piece of bark, about 4 to 5 feet long and 8 or 10 inches broad, in the shape of a small trough. It is used for separating a large species of eatable ants. When they open the ant-hills, they find among the refuse the large white maggots and eggs, which alone are eaten; in order to save themselves the trouble of picking them with the hand, they employ the "yuta," as a kind of fan or sieve, the larger and eatable particles remaining back in it. As these maggots are already alive, the natives wrap them in a bunch of dry grass, which they chew and suck until they have extracted all substance. The season of these ants is in September and October, and at this season only of the year will you meet with the "yuta" in their hands.

In confirmation of the above, Mr. Blandowski mentions that the Goulburn tribe also avail themselves of ants' eggs, and clean them in the following manner:—"They throw ants and eggs, &c., into a kangaroo skin, which they shake roughly, by which the eggs, on account of their greater specific gravity, are precipitated to the bottom, and the ants, particles of wood, and other impurities on the surface, being then removed, the eggs are eaten raw, and resemble sago, and possess a very peculiar aroma."

All their weapons and tools, together with various other articles, they collect in their knapsacks, which they carry by means of strings tied over their left shoulder and under the left arm. It consists either of a kangaroo skin only, drawn together with a cord, or of a coarse matting made of the fibres of a certain kind of rush. The articles contained in almost every knapsack are—a small flat shell for drinking, a round flinty stone for bruising the bones of the game, pieces of one or more kinds of colours, a small wooden shovel, which they use for roasting roots, a few pieces of quartz, and the entire skin of some small animal, which answers the purpose of a bag, into which they put the smaller objects they require, such as sinews of kangaroo and pointed bones of various sizes, which answer the purpose of thread and needle, also some bones with sharp edges, for scraping the roots, some spearhooks, &c.

To prevent anything from dropping through the large meshes of the network, they line it with dry grass. In addition to the articles mentioned, they put into their knapsacks, called "nurti," a stock of roots and game, and then on the top they place their weapons, which are kept fast by being twisted between the strings, so that they cannot slip off. The bags of the women, called "nudla," differ from those of the men in being of a larger size, and, if filled and heavy, are carried on the back by means of crossbelts.

I have to mention another instrument, quite different from any of those above, viz.:—the "witarna," a piece of wood 18 inches long, 4 inches broad, ¼ inch thick, which, tied to a long string, they swing round above their heads, and thus produce a low rumbling sound at intervals, ceasing and returning with increased power. To the women and children the "witarna" is carefully hidden, as its sound indicates that the men are engaged in some of their secret ceremonies, and that they are to keep aloof from them.

It has been asserted that the natives eat anything without any distinction whatsoever; this statement, probably, is owing to the fact that they certainly eat many things which to Europeans are disgusting, as, for instance, maggots of various kinds, rotten eggs, the entrails of animals; but, on the other hand, the white people eat many things which to the natives are equally disgusting, such as certain kinds of fish, oysters, shellfish, muscles of all kinds, the common mushroom, the other description of which latter however they are very fond of themselves.

The natives divide all their articles of food into two classes—the "paru" and "mai," the former including all animal, and the latter all vegetable articles of food; of these are the various descriptions of roots—such as the ngamba, ngarruru, and others, all of about the size of a small carrot, and of its shape, of a more or less acrid taste, and which are first roasted in hot ashes, and then peeled for eating. Of the grass-tree, xanthorraea, they eat the lower part of the stem not yet grown above the surface of the ground; it is by no means tasteless, but certainly cannot contain much nourishment; besides these they also eat various kinds of fungi.

Although to Europeans the country offers scarcely any kind of eatable fruit, it yields a pretty good variety of such as affords valuable food to the blacks. The most important and abundant fruit is that of a mesembrianthemum, to which the Europeans have given the somewhat vulgar name of pigfaces, but the natives the more euphonical one of karkalla. Pressing the fruit between their fingers, they drop the luscious juice into the mouth. During the karkalla season, which lasts from January till the end of the summer, the natives lead a comparatively easy life; they are free from any anxiety of hunger, as the plant grows in all parts of the country, and most abundantly on the sandy hills near the sea. The men generally gather only as much as they want for the moment, but the women collect large quantities for eating after supper. The Port Lincoln blacks eat only the fruit of this plant, but those living between the Grampians and the Victoria Ranges, as a substitute for salt with their meat, eat also the leaves of this saline plant. All other edible fruit grow in pods, or in the shape of berries on small bushes. Some of these they allow to ripen, as, for instance, the fruit of the santalum and that of a species of epacris, which, growing on the sea-shore, bears small red sweet berries called "wadnirri." Another plant, "karambi," also growing on the sea-shore, is the *Nitraria billardierii.** Other fruits they collect before they are ripe, and roast them in hot ashes, such as the berries of the pulbullu, and the pods of the menka, and the nundo. The last-mentioned fruits, highly valued by the natives, are of the acacias, growing abundantly on the sandy downs of Sheaford and Coffin's Bay, and by attracting thither a numerous company of blacks, they frequently give occasion for dissension and quarrels. As a proof of the value or consideration attached to this fruit, it may be mentioned that, in order to annoy their adversaries, the Kukata tribe of the north-west, famous for their atrocity and witchcraft, often threaten to burn or otherwise destroy the nundo bushes.

As only few gum-trees grow in Port Lincoln, they have but little of the edible gums upon which the Adelaide tribes live almost exclusively during the summer months; what they get they collect from the acacia trees, which, however, grow but sparingly, yielding very little gum.

Any kind of game, from the kangaroo down to the smallest species of the genus of the marsupials, and every description of birds, without distinction, are welcome as food to the Port Lincoln blacks, nor are snakes and lizards by any means despised by them—the former of which they eat only if killed by

---

* The *Nitraria billardierii* belongs to the order of *Malpighiaceæ*, grows in large quantities on high sandhills along the western sea-coast of Port Lincoln, has a fruit in form and size resembling an olive, is of a dark red color, has a very pleasant taste, and is exceedingly cooling. In December and January the bushes are so full of fruit, that the natives lie down on their backs under them, strip off the fruit with both hands, and do not rise until the whole bush has been cleared of its load. At the time above mentioned I travelled with five natives, who carried my collection of plants and blankets on a very hot day through this arid country; all at once they threw off their loads, ran as quickly as they were able to one of the high sandhills, and disappeared amongst the bushes. Not knowing the meaning of all this, I followed them, and found the whole five, as above described, lying on their backs under the bushes. I could not do better than do so likewise, and when we had refreshed ourselves we continued our journey.

themselves. They are also very fond of lizard eggs, which, dug fresh out of the ground, taste exactly like soft-boiled hen's eggs.

Their usual method of hunting is unobservedly to approach the animal as near as they can, and to spear it. On these occasions they resort to various manœuvres, as for instance—one of the blacks places himself at some distance in an open space of ground or behind some bushes, and makes a slight noise by breaking off some branches, or in any other way, while another black stealthily approaches to within a spear's throw from the opposite side, where, of course, the animal does not suspect the least danger. This is the usual manner for killing kangaroos, emus, wild dogs, &c. If, however, there be assembled a number of natives, and aware of several kangaroos being in the neighbourhood, then they will surround the district, gradually narrowing the circle; the best spearsmen being placed at certain favourable spots, and the others driving the game regularly towards them. If such a chase happens to take place near the sea, the kangaroos will try to escape into it, but to little purpose only, as their pursuers follow them there even, and while swimming surround them. Smaller animals, such as wallabies, kangaroo rats, &c., which live in the lower scrub, they kill by throwing at them (when started) clubs called "wirra." At times, having set on fire entire districts of country, they place themselves before the fire in order to kill the scared animals which try to escape in that direction. The blacks are very expert in the use of this very simple weapon, and practise it from the earliest age, by rolling on the ground, instead of the animal, a dry sponge, throwing the wirra after it. I have frequently seen little boys seven and eight years old, bringing down, in this manner, parrots off the casuarina trees, and the little girls even know well how to handle this tool.

When hunting in the lower scrub, they attach a bunch of feathers to the blunt end of the spear, and on discovering an animal, fix it in the ground as a signal for the others to come near, and surround it to secure the prey. In addition to this they have a variety of signs, unaccompanied by sound, for indicating the different animals they discover; for instance, they stretch out the first finger, moving it as in imitation of the leaping of a kangaroo when not suspecting an enemy, to indicate that such an animal is in sight; again, three fingers stretched out, the second finger a little lower than the others, is for an emu; the thumb alone is raised for an opposum; the whole hand stretched out horizontally for fish, and similar signs for every kind of game.

The opposum and wild cat they hunt when the sky is slightly clouded, saying that with a clear sky the animals can see them, and will escape before they can approach them. When they discover kangaroo rats in the holes of rocks, or under heavy stones, and find that they cannot drive them out with their hands or a stick, they will light a fire at the hole in order to smoke them out.

Having no fish-hooks, they are, with respect to fishing, behind the other tribes of Australia. The larger fish they spear, but the small ones they catch in the following manner:—As they move in swarms, a body of natives, armed with branches of trees, go into the water, regularly surround and draw them together, and then with these branches push them on the shore. When engaged in this occupation they allow no stranger to be near, on account of the idea they have that the fishes would smell them and disappear.

Some fishes are in the night attracted to light, and then easily killed; the blacks, provided with torches, made of long strips of bark, go into the water, and catch them with the hand, striking them or spearing them.

There are great rejoicings with them if they have had good luck in their hunting or fishing expeditions. Quite excited, slapping their stomachs with both hands, every one exclaims—"Ngaitye paru, ngaitye paru," which means "my food, my food," and most liberally bestow their praise upon those whom they are indebted to for the great treat.

They roast all their meat on the fire. The large animals, such as kangaroos and emus, are cut up before cooking, and the former are skinned; but the smaller ones, excepting those of which they want to preserve the skins, are put on the fire with their skins on. They first singe off the hair, and having taken out the entrails, which are generally given to the women and children, they close up the opening with some small wooden pegs, and, thus prepared, place it on the fire for roasting. If connected with more cleanliness, this method of preparing the food might be strongly recommended, for the meat gains a most inviting flavour, and retains all its strength and juice; but the filthiness of these natives is so excessive, that they do not even take the pains to cleanse and wash the entrails, but, having squeezed out their contents only, they roast and eat them.

The superstitious simplicity of these natives is strikingly apparent in their manner of hunting and dividing the game. There have been transmitted to them, by their early ancestors, several short rhymes of two lines, which now are known to the adults only, and these, on pursuing an animal, or when on the point of spearing it, they constantly repeat with great rapidity. The literal meaning of these cabalistic rhymes is totally unknown to them, and they are quite unable to give an explanation of them, but their object, and the power which they faithfully believe them to possess, is either to strike with blindness the animal which they are pursuing, or to create in it such a feeling of security and carelessness, that it cannot perceive its enemies, or so to weaken it that it cannot effect its escape.

The general principle, with regard to the division of the game, is, that the men eat the males, the women the females, and the children the small animals; but since there is no rule without its exception, so also in this case the men claim the right also to eat the females and small animals, while the women and children must abide by the established rules; the common kangaroo rat, however, they are all, without any distinction, allowed to eat.

As a fixed prohibition, the wallaby, in the Parnkalla language called "yarridni," and the two species of bandicoot, "kurkulli" and "yartini," dare not, on any account, be eaten by young lads or girls, as, according to their opinion they would, with the latter, cause premature puberty, and with regard to the former give to their beards a brownish appearance, instead of its becoming a jet-black colour, as it ought to do. Mr. Schurmann has had frequent opportunities to satisfy himself of the strict observance of this law. Lizards are considered the proper food for young girls whose puberty they wish to hasten on, and snakes for women to make them bear children.

A huntsman's life, under any circumstances, is a migratory one, but it becomes the more so in this country where Nature's products are obtainable only according to the season, and in districts far off one from the other.

On this account the Port Lincoln blacks are obliged at times to resort to the seacoast for catching fish, at others to rove over hill and dale in pursuit of game and roots, and during the unproductive months they are forced, for the smaller kinds of game, to roam through the whole country, some parts of which are covered with an almost impenetrable small scrub, and other parts complete deserts, all the time having to contend against a dreadful heat, rendered almost insupportable by the reflection of the rays of the sun, and of the surrounding burning scrub; and being, in addition to all this, deprived of a sufficiency of water. In order then to allay their thirst, they resort to the strange trick of covering their stomachs with earth, in order to cool them, and which, they say, has the desired effect.

The average distance which the blacks travel in a day is 15 to 20 miles; but on one occasion myself, with three natives, and a woman carrying a child, walked 35 miles on an exceedingly hot day.

On their journey the men generally ramble about, but the women and children, under charge of one or two men, proceed in a direct course to their place of rendezvous.

In the morning they are never in a hurry to make a start, and at times it requires a great deal of coaxing and persuasion, on the part of some of the older men, to get them into a regular move.

On arrival at their camp or place of rest, generally a little before sunset, the first thing they do is to kindle a fire for roasting the small game which the men have secured during the day. The larger game they roast on the spot where it has been killed, which renders it anything but desirable to fall in with emus or kangaroos when travelling in company of blacks, if anxious to reach any fixed place at a certain time. The remnants of a large roast they hang upon sticks, and thus carry it to the camp.

After eating their meat, the women hand round the roots and fruits which they have gathered during the day; and after having done with these also, they chat and sing; and if assembled in large numbers, they dance until tired, then lie down for sleep. If there should happen to be a large supply of meat beyond that required for supper, they stay up the whole night to finish it; but if, after all, anything should remain over, they put it into a bag, which they make serve them as a pillow, and, on opening their eyes in the morning, their first move is towards the bag for its contents.

As patiently as they bear up against the cravings of hunger and thirst at times of want, as immoderate also are they when in abundance, when they overload their stomachs almost to bursting, and will not stir from the camp until their stock is exhausted, and hunger almost forces them to move.

The only cases in which they evince any forethought of the future is in their great care for birds' nests, and for water, to secure and protect which against animals they cautiously cover all their springs with stones or branches of trees.

Their habitations are of a very simple and primitive construction. In the summer, and in dry fine weather, they heap up some branches of trees, in the form of a horseshoe, for protection against the winds; in the winter, and in wet weather, however, they make a kind of hut or bower with the branches of the casuarina, in the shape of a deep niche, and erect them as perpendicularly as they can, thereby to facilitate the dripping off of the rain. In those parts of the country where they have gum trees (eucalypti) they peel off the bark, and fix it so well together as to make the roof quite waterproof. In front of these huts they always burn a fire during the night for warming their feet, and in the cold weather every one lies between a small heap of burning coals in front and at the back, for keeping warm the upper part of their body. As the slightest motion must bring them into contact with these burning coals, it naturally occurs that they at times seriously burn themselves.

The time they remain in one spot altogether depends on the locality, and the supply of food obtainable.

In several parts of Port Lincoln there are isolated wells or holes in large rocks, containing a supply of water, while not anywhere else, within 30 miles, a drop of it is to be found; the natives, as long as they remain in that neighbourhood, are, in consequence, obliged to return every night to the same camp. In places favourably situated for fishing they will extend their stay in the same camp for twelve or fourteen days, but never longer.

The habit of constantly changing their places of rest is so great that they cannot overcome it, even if staying where all their wants can be abundantly supplied. A certain longing to revisit this or that spot, for which they have taken a particular fancy, seizes them, and neither promises nor persuasion can induce them to resist it for any time; only in time and by degrees is this feeling likely to give way. As they travel greater distances during the summer months than during winter, they then also more frequently change their places of rest.

Each family has its distinct place, where they live together; and all unmarried men have to sleep by themselves.

All the aborigines in the Port Lincoln district are divided into two separate classes, viz., the "Matteri" and the "Karraru."

This division seems to have been introduced since time immemorial, and with a view to regulate their marriages, as no one is allowed to intermarry in their own castes, but only into the other one—that is, if the man is a matteri, he can choose as his wife a karraru only, and *vice versa*. This distinction is kept up by the arrangement that the children belong to the caste of the mother. There are no instances of two karrarus or two matteris having been married together, and yet connexions of a less virtuous character which take place between members of the same caste do not appear to be considered incestuous. In addition to this general rule, there are certain degress of relationship within which intermarrying is prohibited; yet from the indefinite degree of their relationship by blood, arising from the plurality of wives, and their being cast off at pleasure, &c., it becomes very difficult to trace them exactly. Besides this, friendship among the natives leads to the adoption of forms and names strictly in use among relatives only; thus it becomes totally impossible to make out what are real relations or apparently so.

Marriages among the Port Lincoln blacks are made up in the most simple manner imaginable.

The girls, when young, are betrothed by their parents to a friend of theirs, young or old, married or unmarried, as the case may be, and when grown up for marriage are simply ordered to follow their husband, without any further ceremonies, and without the least regard for their own individual inclinations. To their good luck, however, it does not very seldom occur that an old, jealous matron strongly opposes herself against such a division of her husband's affections between herself and her young rival, and forces him to renounce all claims upon her in favor of some young fellow, who is but too willing to take charge of her. Sometimes, also, a young man, urged on by his passions, or under the idea of a well-founded claim, will, by force, abduct the wife of another, and, if he cannot otherwise gain his object, even kill him without the least compunction.

The marriages of the Goulburn tribe seem nearly to correspond with those in Port Lincoln, as may be seen from an extract from Mr. Blandowski's "Personal Observations in Victoria":—

"The young man who wishes to marry, has first to look out for a wife amongst the girls or lubras of some neighbouring tribe, and having fixed his choice, his next care is to obtain her consent. This being managed, the happy couple straightway elope, and remain together in the bush for two nights and one day, in order to elude the pretended search of the tribe to whom the female belonged. This concludes the ceremony, and the young man then returns with his wife to his own tribe. He is, however, laid under this peculiar injunction—that he must not see his mother-in-law any more; and the following circumstance, connected with this fact, has been related to me by Mr. Grant, an eye-witness. A mother-in-law having been descried approaching, a number of lubras formed a circle around the young man, and he himself covered his face with his hands. This, while it screened the old lady from his sight, served as a warning to her not to approach, as she must never be informed by a third party of the presence of her son-in-law."

The most abominable views and the still more shameless conduct of the natives, with respect to marriages, if the term can be applied to their manner of living together, undoubtedly presents the worst feature of their character.

Although the men are apt to become passionately jealous if they detect their wives transgressing without their consent, yet of their own accord they offer them and send them to other men, or make an exchange for a night with some one of their friends. Of relatives, brothers in particular, it may be said that they possess their wives jointly.

While the former custom of lending their wives out for a night appears to be considered by the blacks themselves as indecorous, yet the other one is an acknowledged custom, which they do not see the least occasion to be ashamed of.

These extraordinary connections have given rise to strange appellations among them. The woman honors the brother of the man to whom she is married with the title also of husband, while the men call their own wives yungaras, and those of their brothers, kartetis.

Although they are married so very young, the women, according to Mr. Schurmann's observations, generally have no children before the age at which they get them in Europe.

The number of children in a family varies considerably; but, upon the whole, it is limited—seldom exceeding four.

If, as it but seldom occurs, children are born in a family quick one after another, the youngest is generally destroyed in some out of the way place, by some woman, accompanied for this purpose by the mother herself. From the excess of male adults alive, it may fairly be presumed that a by far greater number of girls than of boys are done away with in this manner. As an apology for this barbarous custom, the women plead that they cannot suckle and carry two children together. The men clear themselves of all guilt, saying—that they are never present when these deeds are committed, and that therefore all blame rests with the women.

Both sexes are very fond of their children, but yet the mothers are most careless with them, and let them burn themselves dreadfully at times, at their fires, as a consequence of which you seldom meet with a native who has not a trace, more or less disfiguring, of having been so burnt.

In the naming of the children a fixed and very simple rule is followed, according to the number of children born. For instance, the first-born is called Piri, if a boy; and Kartanye, if a girl. The second one is called Warni, or Warrunya. The third one is called Kunni or Kunta; and so on, according to its sex. They have seven or eight such names for each sex. In addition to these names used in familiar intercourse, and answering our Christian names, the child also takes the name of the place of its birth. Both these names they preserve during life, and the males, on attaining the age of manhood, get a third one, under strict observance of many mysterious formalisms which will be described hereafter.

Although living in a salubrious climate and on healthy food, the natives are subject to many diseases. Among those which they suffer most from are sores, diarrhœa, colds, and headache. For removing these, or partially curing them for the time, they apply outward remedies, some of which appear to be effective. The chief ones are—rubbing, pressing, and treading even upon the afflicted parts of the body, in particular the belly and the back; tightening of the belt, and also of the band which they usually wear round the head; bandaging the diseased part; sprinkling or washing it with cold water in case of fever or inflammation. Sores or wounds are generally left to take their course, or the utmost done is to tie something tight round it, or, if inflammation has ensued, to sprinkle cold water upon it. Bleeding of the lower arm they apply in cases of headache. A most extraordinary remedy against headache I saw applied in 1849, in the case of a woman, who submitted to having her head so cut up by another woman with pieces of broken glass, that the blood actually dropped through her thick bushy hair.

The cure by bleeding is confined to the males only, and is frequently applied during the hot season.

They do not allow the blood to run on the ground, but upon the body of some other man, directing the arm in such a manner that the stream forms a number of small cross-lines, in consequence of which the body assumes the appearance of being covered with a tight-fitting network of very small meshes. The object of this custom partly is, as stated above, to act as a cure for headache and inflammation, and partly also to promote the growth of the young people, and to preserve the strength and vigour of the aged ones.

Many proofs might be given of the very slight conception they can form of the relative bearing of cause and effect. For instance, an elderly fellow, who had been kept for two years in jail in Adelaide, had the idea that his beard, having turned grey, had been dyed by the soap with which he had been obliged to wash himself there.

The women may be present at the operation of bleeding. Whenever engaged in this or certain other operations, the "witarna," as above stated, is put in motion, to prevent young unmarried people from unwittingly surprising them.

The natives have also their regular doctors, called mintapas, who pretend to be able to remove, by sucking, sickness out of the body. They put their lips to the pit of the stomach in case of general disease, and to the suffering part where confined to any fixed spot, and, after having sucked for some time, pull out of their mouths a small piece of wood or bone, pretending that this is the body of the disease, which had been communicated by some evil-disposed person, and had now been extracted by them.

So superstitious are these ignorant children of nature, that they have the fullest faith in these absurdities, and passionately defend them against any one expressing the least doubt respecting them, or hinting even that the mintapa might have put the piece of wood or bone into his mouth previously. They further appear to attribute to these mintapas supernatural powers, and to consider them almost as beings of a superior class, to whom they assign after death a place of residence different to that whereto other people are removed, and which they call Pandarri Kurto (heaven's cavern). The souls of these mintapas are supposed to be at full liberty to enter and leave this place, and are said often to appear in the evening in human forms to these natives, bringing with them new songs, and then disappear again.

It is well ascertained that they have among them poets as well as doctors, as has been proved in the case of Maltalla, an old man, who shortly before his death made two songs, which are now recited by his tribe.

The names of common blacks, when dead, are not mentioned for a considerable time, but in the case of Maltalla, and probably all mintapas, they make an exception of this rule.

The dignity of mintapa seem to be hereditary, for, as the blacks used to say, Maltalla's eldest son, although he had not then given any proofs of his aptitude for the office, would assume the functions of a mintapa.

Among the blacks in the immediate neighbourhood of Port Lincoln there are few of these sorcerers, but among the savage Kukata tribes they are said to be numerous.

The natives show strong feelings of commisseration in cases of illness, the women particularly so, who, under an abundance of tears, prove their interest and attention by frequently rubbing and pressing the affected parts; but the sick themselves, in desperate cases even, submit to their sufferings with a surprising stoicism and resignation.

A very peculiar circumstance, not to be met with perhaps in any other uncivilized community, is that these natives have no chief or individual of acknowledged authority among them. All the adult men are quite equal one to the other, a fact so well understood among them, that no one would ever presume to adopt a tone of command to another one, but, by asking and persuasion only, tries to obtain what he wants. The young people, however, show great respect towards the old ones, a tribute to advanced age or to greater experience perhaps; but this, no doubt, is increased and preserved by a superstitious and dreadful horror of certain secret rites known to the grown-up men only, into the knowledge of which the young lads are initiated by degrees.

The three degrees which they have to pass through, constitute three distinct epochs in their lives; during the interval between the rise from one degree to the other, the name of that particular degree last attained serves them for their usual name.

At the age of 14 or 15 years they enter the first degree, which procures them the distinguished name of Warrara.

Mr. Schurmann has never witnessed the performance of these ceremonies, as the natives, apprehensive lest these secrets might be communicated to their wives and children, do not admit any strangers at them, but he has been told a description of it; while closing the eyes of the lads, they pronounce certain mysterious formulas, calling out "Herri, herri, herri," and making a rattling noise with the "pullakalli," an instrument resembling the "witarna," but smaller in size. Two or three months after this ceremony, the lad has to paint his face black, dares not speak aloud, but must express in whispers all his wishes and wants. Any infringement of these laws subjects them to severe reprimands from their seniors, and even more talking than is absolutely necessary is considered highly reproachable.

A few years after this first ceremony the young men advance to the second degree, when they are called Pardnapas, and have to undergo the operation of circumcision. Mr. Edward John Eyre, the well-known explorer, mentions this strange custom in vol. I. p. 212 as follows:—"This extraordinary and inexplicable custom must have a great tendency to prevent the rapid increase of the population; and its adoption may perhaps be a wise ordination of Providence for that purpose, in a country of so desert and arid a character as that which these people occupy." The hair, which while the lad was a Warrara in the first degree had been allowed to grow, is then plaited in a coil, and in the shape of a plate fastened on the crown of the head in a net made of the spun hair of the opossum; his penis is also covered with a kind of fringe or tassel made of the same material. These sacred marks of distinction are worn for several months; and after removal of the net the hair is not cropped, but made to hang down in curls. During this period, without any peculiar ceremony, the operation of the painful mutilating circumcision is performed, the particular object of which Mr. Schurmann has never been able to ascertain; the blacks themselves cannot assign any other reason for it, but that their forefathers had observed the custom, and that they must do the same. To the women and children they pretend that "Midhalla," an imaginary being, and said to be inhabiting some island, is the cause of this cruel mutilation.

The last and most important ceremony takes place at the age of 18 or 20 years, after which the young men are called "Wilyalkinyes." Mr. Schurmann having twice had the opportunity of witnessing its performance, is thereby enabled to give a detailed description of it.

As an introductory step for the grand festivity, the so-called "Indanyanas," a kind of sponsors, are chosen, their duty being to carry out the old established custom relating thereto. Some one clasps his arms, from behind, around the sponsor whom they have fixed upon, and draws him backwards on his lap, after which others collect around him, urging him to accept the office of Indanyana, an honor which he pretends to accept of most reluctantly. (All festivities of the blacks take place during the summer season, when a great number of them are always collected together; and since no one among them possesses any authority of command, it requires no little mutual persuasion and exhortation to move on a large idle body of them; the natural consequence is, the greater part of the day passes on in going through ceremonies for which an hour would be amply sufficient.)

They commence by closing the eyes of the "Wilyalkinyes," and by fetching out of their camps, apparently much against their will, the women, who raise up a general lamentation, far, however, from sincere; in the meantime, the lads have been removed by their sponsors, and are kept at a short distance from the place of encampment. These, then, having placed themselves in a circle, holding for about an hour the eyes of the lads closed with both hands, utter from time to time a long, protracted, melancholy, monotonous tone, sounding somewhat like "Je—e—eh." Then leading the lads a further distance off, they lay them flat on the ground, and cover them up with rugs; after an interval of another hour, two men fetch several green boughs of trees, and the lads having been raised up again, the whole body of those present join together and form a large semicircle round them. The two bearers of the green boughs now step forward, place themselves in the centre of the opening of the circle, vehemently stamp their right feet, and under various gestures of anger and wrath throw the boughs over the heads of the young men, while at the same time the other company make a clatter by striking their various war instruments together, and utter a volley of short, strong, loud sounds, the last of which they prolong each time that any of the boughs fall to the ground—similar, we might say, to "Je-je-je-jeh," while the young initiated are then laid on the carefully-spread boughs, and again covered with rugs. The others quite leisurely set to work preparing the small pieces of quartz for the tattooing operation, and engage in finding out some new names to bestow on them for life hereafter. The latter becomes a rather difficult task, since the name has not only to correspond with their taste and notions of euphony, but also must be quite new, and not have been borne by any other individual alive or dead even. These names generally are derived from the roots of verbs, to which they attach as end-syllables—"alta," "ilti," or "ulta"—according to the last syllable of the word itself. Whether these changes affect the meaning of the word we cannot say, as they are made use of in connection with proper names only. The natives by no means despise any suggestion from the whites in reference to any new name, but yet in the choice of any one proposed they are very particular that it should be quite new and well-suited.

Everything being properly prepared, several of the men open a vein in their lower arm, and make the lads, after having lifted them again, swallow the first drops of this blood; they then make them kneel down and support themselves on their hands, and their backs, thus getting into an horizontal position, are covered over with a thick coating of the blood, and when this has sufficiently congealed, one of the men with his thumb marks out the spots where the incisions are to be made. One is made in the centre of the neck, and a row of them at distances of one-third of an inch, and running from each shoulder down to the hips. These incisions—about an inch long, and in course of time forming a kind of swelling—are called "Manka," and are always considered with great respect, being never alluded to in the presence of the women or children. The other incisions, however, which at an early age are made on the breast and the arms, are merely for ornament, and have no sacred meaning. The more or less decided character of these swellings affords a certain indication of the probable age of a native. During the vigorous age of manhood they are strong and well defined, but get gradually reduced with the advance of age, until, when very old, they can be traced like scars only.

Although each incision made with the blunt rough quartz has to be repeated several times, in order to make them sufficiently deep, and afterwards the flesh has to be drawn asunder carefully, the sufferers, notwithstanding the dreadful pain of such an operation, do not utter a groan, or move a muscle even, in consequence. Mr. Schurmann, however, has seen some of their friends so moved by compassion for their sufferings as to shed tears, and make some attempts—although unsuccessfully, of course—at putting a stop to this cruel process. During the operation as many men as can approach press round the lads, rapidly repeating in a subdued tone the following formula:—

Kannaka kanya, marra marra,
Karndo kanya, marra marra,
Pilberri kanya, marra marra.

The object of this formula, handed down to them from their forefathers, and, as it appears, void of any meaning or sense soever, is to deaden the pain, and to prevent any dangerous effects of this dreadful laceration. The operation being concluded, the young men are raised up and their eyes opened, when the first object they perceive are two men, who, stamping their feet and biting their beards, run towards them hurling the "witarna" with great vehemence, and apparently intending to throw it at their heads, but who, when sufficiently near, satisfy themselves with putting the cord of the instrument round the necks of one after the other.

In commemoration of their having passed through this trial, the Wilyalkinyes are honored with various marks of distinction, as, for instance, they are presented with a belt spun of human hair; they wear a tight bandage round each of their upper arms, also a cord of opossum hair round their neck, the ends dropping down on their back, to be fastened to the belt; further, a bunch of green leaves fastened above their part virilis, and at last they blacken their faces, arms, and breasts.

As a wind up, all present press once more around them in order to give their last good advice for their future conduct, the chief drift of which, as far as Mr. Schurmann has been able to make out, consists in the following—to avoid quarrels and disputes, not to indulge in talking loud, and to keep off from the women. The two last of these injunctions are strictly followed, and for this purpose they live day and night separated from the other blacks, and talk in a subdued tone only until after the expiration of four or five months, when they are relieved from this constraint. This absolution is effected by tearing off from the necks of the Wilyalkinyes the opossum cord, the symbol of taciturnity, and sprinkling the upper body with blood in the manner which has been described above. They are henceforth considered as initiated into all the secrets, and fit to be admitted to the enjoyment of all the privileges of grown-up men.

William von Blandowski, late curator of the Melbourne Museum of Natural History, mentions in his "Personal Observations of Victoria," p. 23, a custom of the Goulburn tribe which is interesting enough to give in full. "Upon a youth arriving at manhood, he is conducted by three of the leaders of his tribe into the recesses of the woods, where he remains *two days* and *one night*. Being furnished with a piece of wood, he knocks out two of the teeth of his upper front jaw, and on returning to the camp carefully consigns them to his mother; the youth then again retires into the forest, and remains absent *two nights* and *one day*, during which his mother, having selected a young gum tree, inserts the teeth in the bark in the front of two of the topmost branches. This tree is made known only to certain persons of the tribe, and is strictly kept from the knowledge of the youth himself. In case the person to whom the tree is thus dedicated dies, the foot of it is stripped of its bark, and it is killed by the application of fire, thus becoming a monument of the deceased. Hence, we need no longer be surprised at so frequently finding groups of dead trees in healthy and verdant forests, and surrounded by luxuriant vegetation."

A similar custom Dr. Livingstone found in the Babimpe tribe in Africa, they knocking out both upper and lower fronting teeth as a distinction.

As stated above, the women and children are not allowed to attend any of these ceremonies. Their camps even on these occasions are then so placed that their view is fully obstructed by bush or hills. If, however, any woman's or child's business—to fetch water or wood, for instance—should lead them within sight of the place of these ceremonies, they are required to cover their heads with their rug, and to move on in a stooping position. Any improper curiosity, according to ancient custom, is liable to be punished with death.

As a proof of the significance they attach to these strange rites and customs, it may be instanced that it is considered insulting if one of a higher degree taunts his adversary with the lower degree he still occupies; thus—"Warrara purro," meaning a warrara only (still in the first degree), and "Pardnapa purro" (a pardnapa only), or still in the second degree, are used as offensive terms.

The views of the natives in reference to supernatural beings or influences are very peculiar and remarkable. They have as clear a conception of the unsubstantiality and immortality of the soul as might be expected of them. In order to express the former quality, they represent the soul as being so small that it might pass through a chink; and in reference to the latter, they state that after the death of the body the soul retires to an island as so small an atom as to be able to dispense with further nourishment of any kind. Some represent that island as being in the east, others in the west; therefore, either not agreeing as to the exact locality, or believing in the existence of several such islands whereto the departed souls resort. On its journey to this island the soul is accompanied by a redbill, a kind of sea-bird, notorious for its piercing shrill voice, audible during the night. It appears that since they have found out the existence of the race of white people, they have adopted the notion that their souls will hereafter appear in the bodies of such white people. Whatever be the cause, at present this is their belief, and they look upon the whites as being only the embodied souls of their forefathers. It may be instanced as a proof of how firmly they do believe, or rather have believed this, that in the idea they had recognised in some of the settlers natives long ago departed from life, they actually gave them the names which these had gone by when alive. This notion is not confined to the Port Lincoln blacks, but prevails also with those of Adelaide and Victoria. To Mr. Blandowski, one of our Australian travellers, it has occurred that an old lubra (black woman), supposing him to be her former husband resuscitated, has most tenderly embraced and kissed him.

The last words of a young Port Lincoln native, hanged in Adelaide a few years ago, were to the effect that in course of time he would become a white man, and yet this man had by Europeans been taught more correct views.

These apparently conflicting two ideas—one, that an island is the receptacle of the soul; the other, that they re-appear in bodies of white people—may, perhaps, be reconciled by the assumption of the natives that the island is the place of residence for a certain period only. This is the more probable, as they decidedly believe in a change of the souls, and assign to them this island as an intermediate place of residence.

We can scarcely assume that the natives have originally had any conception of future reward or punishment for good or evil acts committed in this life, but yet they seem to think that the fate of man depends on his own conduct, as may be illustrated by the following anecdote:—

It had been reported that in the neighborhood of Streaky Bay a blackfellow had been shot by the crew of a whaler, because he had speared one of their dogs which had furiously attacked him. Some time afterwards the crew of a stranded whaler landed in the neighborhood, and on expressing a supposition that they might be the same men who had killed the blackfellow, their misfortune was ascribed as the consequence of their former cruel deed.

Among the superstitious notions of the Port Lincoln blacks, their belief in the existence of a demon monster is most remarkable. It is called "Marralye," and is represented as a man of the Kukata tribe, assuming, in order to fly through the air, the form of a bird. It is dreaded at night time particularly, during which it attacks its victims while asleep, implanting in them the germ of death, or inflicting on them some other grievous harm. It, however, takes good care not to leave behind any visible traces of its misdeeds, so that his nightly visits can only be discovered by their pernicious effects, such as pain, disease, &c. To him the death of children and loss of eyes are attributed, if no other obvious cause for them can be made out.

It is to be mentioned that the Marralye does not exist substantially, but that it is only a mask assumed by wicked men to enable them to carry out their depraved designs. The Purkabidnies are another species of fabulous beings, whose number is without limit. They are depicted as men of a gigantic size, who, destitute of all clothing, roam through the country, armed solely with clubs. Although thirsting for blood, and giving themselves up to murder, still they are by no means so dangerous as the Marralye, as by science of arms and courage they are to be resisted, and even overcome. The aborigines never think of leaving their camp during the night time without taking a spear in their hand to protect themselves against these assassins, who might be lurking in the neighbourhood. Some of the natives go so far as to boast that they have killed Purkabidnies, but it is to be presumed that in their superstitious fright they have mistaken black stumps of trees, or even other aborigines, for these terrible monsters. Mr. Schurmann tells us that two natives whom he had with him once showed him, in the middle of a thickly wooded region, at a distance of not more than a hundred paces, a dark object, which certainly bore resemblance to a black man in a stooping position. They were convinced that it was a Purkabidnie, and not only did they refuse to accompany Mr. Schurmann, but they even endeavoured to dissuade him from attempting to examine the object in question. Upon Mr. Schurmann approaching the object, he found it to be a charred stump of a tree, and when he laid his hand upon it, the natives burst into a loud laugh, and for this once acknowledged that they were in error, but, nevertheless, they remained steadfastly convinced that there were such spectral beings, and that they had without doubt seen them upon other occasions. That isolated natives, who have wandered too far into the territory of a strange tribe, are taken for Punkabidnies, is not improbable, and the following circumstance gives a tint of truth to this belief. Two young blacks of the Murrumbidgee tribe, who left Mr. Eyre in the middle of his journey from Adelaide to King George's Sound, after murdering his overseer, were, in their turn, while proceeding homewards, killed by a western tribe, in the belief that they were the redoubted Punkabidnies. The worst kind of superstition, and which in proportion causes as much mischief among the native tribes as the belief in witchcraft formerly did in Europe, is the notion that any one, out of hatred or other motives, can kill any person inimical to him during his sleep, and that this is done by boring the enemy with the fingers in the side in a peculiar way. The consequences of this proceeding are said to be gradual loss of health, and finally death. The guilty wretch is generally discovered by the evidence of the dying person. The aborigines have habituated themselves to the belief that in all cases of death which cannot be accounted for, as proceeding from old age, wounds, and other palpable causes, knavish and malicious means have been resorted to. They are not content even when the cause of death is sufficiently clear, but seek to find a hidden cause, as the following event relative to the point will show. A woman, while clearing out a well, was bitten in the thumb by a black snake. It began to swell immediately, and in the short space of twenty-four hours the woman was a corpse. Still it was asserted that it was not an accident, but that the deceased had pointed out a certain aborigine as her murderer. Upon this evidence, which was heightened by the circumstance that no blood flowed from the wound, the woman's husband and his friends challenged the accused and his friends to combat. Peace, however, in the meantime was made, and upon the offensive side it was acknowledged that the woman was in error with regard to the guilty person. But still not satisfied that the snake bite should have been the cause of the death, another individual was suddenly discovered, and accused of being the author of the mishap. Thereupon war was declared upon him and his party, but at last the affair was borne with and forgotten. From this and other similar cases, it seems to stand forth clearly as much revenge as superstition is at the bottom of these infamous accusations. Considering that the aborigines are unacquainted with Him in whose hands are life and death, that they are little given to reflection, ready to sacrifice their friends in obedience to a blind fate, capable, however, of deep grief, and being superstitious at the same time; considering all these points, it is not so much to be wondered at that they should seek for the cause without the region of human influences. The aborigines have many other superstitious ideas, and although not possessing such a dangerous tendency as the one above quoted, still such take hold of the imagination with a pernicious and undue strength. It is asserted that far distant tribes, viz., Kukatas, have the power to produce strong rain, intolerable heat, and barrenness, in consequence of which famine arises, and causes the other tribes to be snatched from this life *en masse.* It is worthy of remark that from the north-west, where the Kukatas camp, come in winter the most severe rain and in summer the terrible hot winds which make the ground arid and dries up all vegetation. A comet, or any other atmospheric meteor, is looked upon as a sure sign of death. Upon the appearance of the great comet in 1843 they were so overcome by fright and consternation, that they sought refuge in caves. The inhabitants of Port Lincoln have a mass of superstitions, inherited from their forefathers, in the highest degree improbable and monstrous, as we shall perceive from a few cases before us.

Pulyalanna was a great man, who died many years ago, and who had benefited his successors by having given names to the southern and western parts of the land, names they still retain at the present time. It happened unfortunately for him, however, that his two wives ran away from him, a circumstance that in no wise improved his temper. After a long and fruitless search he discovered their trail, and, following it up, he overtook them near Cape Catastrophe, and murdered them both, together with their children. They were then transformed into stone, and are to be seen at the present time in the middle of the sea, in the shape of islands and rocks. Their sighs can also be heard in a hollow rock through which the waves sometimes beat. Pulyalanna himself was, later on, taken near Point Isaac into the air, or into heaven, where he still remains in an angry mood. When he is excited, he raves and storms in the clouds, and produces thunder. He has been depicted as armed with clubs, with which he especially hits the pardnapas, and often with so true an aim, that he severs them in twain, and legs and bodies fly in different directions. Some of the old aborigines once prayed him to spare the pardnapas, and to destroy instead the she-oaks, which to this day bear the marks of his clubs and thunderbolts. They go so far as to say that lightning is the creation of Pulyalanna, caused by his stretching his legs widely apart during one of his fits of rage.

The large red species of kangaroo, which is often seen in the north, is not found in the Port Lincoln district, and to judge from the following fable, one of these animals must have wandered to this place. Kupirri, so this animal was named, is said to have been of such enormous size, that he swallowed each and all who endeavoured to kill him with their spears. His aspect alone filled the natives with such fright, that they lost all presence of mind, and flung the wooden sling, middla, as well as the spear, which of course caused the latter to lose its effect.

At last two expert hunters were found equal to combat this monster. They were called Pilla and Idnya, who discovered his track in the ranges running north of Port Lincoln. They traced them for about thirty miles from Port Lincoln, came up to him at Mount Nilawo; finding the beast asleep, they immediately attacked it, but before they were aware of it, their spears became blunted, which difficulty must have been most inopportune for them. They fell into a violent dispute, and Pilla wounded his antagonist in several parts of the body with the blunted spear, receiving at the same time a cut across the nose from his adversary's middla. They soon, however, made peace and killed the Kupirri, and great was their astonishment, upon opening the animal, to find in his belly several of their swallowed comrades; but being as expert doctors as hunters, they brought the unfortunate natives to life again, and all made preparations to broil and eat the monster. After the meal was finished, and after they had smeared themselves with the fat of the animal, they set out to communicate to the sorrowing wives the happy issue of their adventure. The two heroes were later transformed into two species of animal, the opossum and the wild cat, which have not alone their origin from them, but which bear at the present day the names and the marks of the wounds they had given each other, by the opossum, in the shape of a furrow running from the head to the tip of the nose, and the wild cat in the form of spots over the whole of the skin.

Between Coffin and Sleaford bays I remarked an immense quantity of sandhills of great size, which on Capt. Flinders map were falsely represented as white cliffs. These mountains of drift-sand have been heaped up by the west winds, and constantly change their shape and position. According to the tradition of the aborigines they were raised by two of their ancestors, named Marnpi and Jadda. A large fire proceeding from the sea spread itself far and near along the coast, seeming about to envelope the whole land in flames; during the consultation how to meet such a misfortune, these two persons suddenly thought that the best means to extinguish the fire was by heaping earth on it. They set, therefore, to work, and raised the sandhills as a lasting monument of the same.

An aboriginal named Welu, celebrated for being a furious warrior, as also a great woman lover, made the horrible resolution of exterminating the whole tribe of Nauos or Nawos. He succeeded in killing all the males, by throwing one spear through all of them as they stood in a single file. Two young men, however, escaped, having sought refuge in the top of a tree; Welu followed them to kill them likewise, but a lucky stratagem saved them from his ire; they broke the branch upon which their enemy had climbed, he fell to the ground, and was attacked and torn to pieces by a tame dog. Thereupon Welu was changed into a bird, called in English the "Curlew," and the youths who had escaped his wrath were transformed into little lizards, the male of which is called Ibirri, and the female Waka; this is said to have occasioned the distinction between the human sex. This procedure did not seem to have been approved of by the aborigines, as each sex formed a fruitless hatred against the opposite sex of this little animal, the men amidst jokes and laughter striving to kill the Waka, and the women the Ibirri.

Ghost stories are not wanting amongst the aborigines. They say there is a rock on the south side of Port Lincoln full of deep holes, an occurrence not uncommon in the limestone formations of this region, inhabited by a race of dead men, who come out in the night to eat ants' eggs (this is a favourite food of the aborigines), but who during the day remained concealed in the above-mentioned holes. No one seems to have seen these night birds, but the natives say they have sometimes heard them calling to one another, whereupon the former are filled with horror, and take to their heels. They possess a number of such like tales, but these which have been already mentioned serve but to show the foolishness, improbability, and the monstrosity of the same.

Singing and dancing are the favorite and almost the sole amusements of the aborigines of this region. They are in the possession of a number of songs, each one consisting of two, or at most three lines, of one such songs the following is a specimen:—

La pirra mirrána. Iyurá tyurra tyurráru
Iyíndo Katutyála. Paltá paltá paltárni
Kauwirrá wirrána. Ninna kutyu nyang-káli.

In the singing of this and other songs of the same kind, each verse is repeated twice, and when the last line is finished they begin again at the first. They do not seem to give much attention to the meaning of the words, so long as the necessary measure and the proper number of the accented syllables are observed. The greater number of these kind of songs would seem to belong to other far removed tribes, for they are not acquainted with the meaning of any of the words, nor do they think it worth while to make any investigation regarding them. Every question as to the origin of such verses or words is replied to by the convenient and simple answer that it is a kuri, or song. Their songs are in different measures, some being slow and serious, others quick and lively. These songs, however, do not offend the ear, but they are monotonous, and require that the voice should be raised and lowered with regularity. The natives are exceedingly accurate as regards the time, and, to prevent any mistake in this respect, they beat the time with their clubs. The end of the song is indicated by singing the last line in a low tone, sinking the voice gradually so that the last note is scarcely audible.

The aborigines generally choose the mild summer evenings for their dancing. If there should be a moon, so much the better; but should her silver light be wanting, they make up for it by bright burning fires. Any one wishing to take part in the dance adorns himself beforehand in the following manner. From each shoulder are drawn two white parallel lines down to the waist, in such a manner however that the four lines meet at the waist. They paint a white ring round each eye, a broad stripe down the nose, and about six or eight whitish lines, two and two, on the upper part of the arm; and, to put the finishing touch to their ball costume, they bind a tuft of green leaves round the legs above the knee. Should they be possessors of white birds' down, they make a wreath to go round the head, beginning at one ear and encircling the brow, close to the roots of the hair, to the other ear, so that it has some slight resemblance to a lady's nightcap. They have different kinds of dances, but the favorite and most practised consists in a number of jumps from side to side, and also forwards and backwards, holding the one hand to the side to which they jump, while the other hangs down by the body. The dancers place themselves in an irregular line, and at such a distance from each other as to leave sufficient room. They advance slowly until they stand before the singers, and then step again to the background. A dance, as the rule, lasts scarcely more than eight or ten minutes, for the movements of the body are so violent, and require so much exertion, that the dancers even in this short time are fully exhausted. Although the women are prominent in the singing, they take but little part in the dance; and, when they do, never more than two or three at a time. Still even this small amount of interest on the side of the women never fails to excite the men to greater exertions. At the end of the dance the men sit down forty or fifty paces from the singers. Being rested for about a minute, they come forward dancing one after the other, and one of the female dancers meets them half-way, and accompanies them in step up to the singers. At that point where the woman meets them they make a pause, and, later on, they repeat it two or three times, stamping with the feet on the ground, perhaps as a sort of ball-room courtesy towards the lady.

These evening amusements often last till long past midnight, especially should the number of dancers be great, or should two different tribes grace this aboriginal ball. Then they do their best to amuse each other by the number and different kinds of dances; on these occasions joy and cheerfulness are depicted on each countenance, and it can scarcely be credited that these good-natured faces could assume the distorted traits of deep and powerful anger, and that the wild gestures incident to the dance should change into wilder passions.

This, alas, happens but too often, especially during the hot portion of the year, when they disclose an amount of irritability of which in the cooler periods of the year they could not be supposed capable.

Their wars can be divided into two classes, viz., the one beginning suddenly, and arising from some paltry cause; the other being the fruit of deep premeditation, and proceeding from an earnest, sometimes from a true, and still oftener from an imaginary cause. Although the behaviour of the aborigines towards each other is generally characterised by good-nature, mildness, and even politeness, still it often happens that friends engage in sanguinary strife with quondam friends. The most common motives of discord are attributable to the facts, firstly, that the women do not always deport themselves as is becoming to their sex; and, secondly, that the children quarrel among themselves, and do each other bodily injury, which involves the parents and relations in sometimes a bitter contest; or again, that one or other of the men is neglected or forgotten in the distribution of the necessaries of life.

The custom of dividing their food amongst each other is so common, that he who fails to observe this rule is branded as a sort of miser. An angry word, or an offensive action in respect of any of the before-named cases, acts like an electric spark. Each one springs up, grasps his weapons, and is ready to retaliate upon any verbal or actual insult offered to himself or to his friends. Although abuse made use of by the women seldom carries any bad effect along with it, still should it drop from the mouths of males, a fight is sure to be the result. The friends of the insulted person often endeavour to appease him, and even have resort to force in order to hold him back, but they generally fail in their object. Clubs are first thrown, and then they rush upon each other like tigers, beating each other with the middla, which instrument inflicts such severe wounds that the blood flows in streams, and the injured person falls senseless to the ground. Should the fight become still more furious, they have recourse to their spears; thereupon the women and children take to flight, and watch at a distance the terrible play of the men's fierce passions. They give vent to their feelings in a sort of monotonous song, drawing the last syllable of each word out to a great lengh, and suffering the voice to sink at the end of each sentence; they do this with a view perhaps of making themselves heard amid the confused noise and clatter, perhaps in order to give more force and energy to their invectives. Should one of the combatants fall dangerously wounded, the groans and lamentations in which his friends and the women indulge put an end to the predominant noise, and gradually to the fight as well. After peace has been restored, each one seems sorry for having caused the momentary interruption; and should any one have wounded his antagonist severely, he feels for him as truly and as sincerely as any of the others. Should loss of life or serious hurt be the result of the combat, it often happens that these must be expiated by again renewing the contest. On the other hand, if little damage has been done nothing more is said about it, and the parties that yesterday fell upon each other with rage and fury are to-day the best possible friends. Those wars which are the fruit of premeditation and deliberation are known to the natives weeks, and even months, before they take place. A suitable place is pitched upon by the one side, and they then send heralds to the enemy to invite them to the contest. The causes of such a war are seduction, murder, or an attempt of the same. The last of these has for its ground the superstitious idea which prevails, that any one who has died within a short period has been deprived of life by wicked means. The next of kin to the murdered or dead man chooses some of his friends, and with them traverses the country, with the firm resolution to kill the suspected person wherever they may discover him. In earlier years two fights took place here, one on account of a murder committed, the other on account of an attempt to take away life. In the first case the murderer and the brother of the murdered man were aided and seconded by their respective friends. They were unanimous that the last-named person, as the avenger of the foul deed, should throw two spears at the perpetrator, and that if he should fail to hit his mark the quarrel should be forgotten. To judge from the violent and wild gestures of the warriors, the running about, the jumping, the biting of the beards and the weapons, the noise and the grimaces, a sanguinary combat was expected. But such was not the case. The antagonists trod from their own side into the foreground, and the avenger threw a spear most skilfully, but which was parried as ably as it was thrown. Whereupon this combat was brought to a close. The second fight, on account of attempted murder, took place in Port Lincoln, and the party about to be attacked were invited by heralds to attend the combat. The natives upon their arrival were painted with a white colour, and wore little peeled sticks which looked like plumes in their hair. They marched in long line, three deep, making now and then a halt, and with one voice poured forth loud cries. As soon as they had completed these evolutions, the other party, who were rather surprised, set to work to answer the salutation. After having hastily painted themselves, and arranging themselves in single file, they marched in a regular quick short step towards the enemy, who had in the meantime formed a camp. After they had thus once or twice marched round the enemy's camp, they formed themselves into a dense mass, bowed their heads, and uttered a piercing cry. They repeated these movements two or three times, and then returned to their own camp in the same order they had observed upon leaving it. That evening and the greater part of the night were spent in singing and dancing, but with sunrise of the next day the fight commenced. Eight men advanced from each side, making use of mimical gestures, although the most profound silence was observed. They formed into a row, two deep, about twenty paces from each other, so that they came to stand two to two. Each warrior stretched his legs apart, and planted his feet firmly on the ground, holding a spear and sling in the right hand, and their katta, or grubbing-stick, together with other spears, in the left. They pushed forward their chests, and moved their bodies from side to side, as a sort of challenge. Each one fixed his eyes upon his especial antagonist, and seemed to have no concern about any of the others, as if he had nothing to fear at their hands. Not a sound was audible. Many spears were thrown on either side, and were avoided by moving the upper part of the body to one side, or were parried by giving the spears a blow with the katta or other spears held in the left hand. Thus the spears of the opponents failed to reach their mark. At length some of the party who sent the challenge went over into the ranks of the enemy, to show that they wished to put an end to the combat. One quarrelsome old man, who had struck the first blow, did not seem to be content to stay his arm without having spilled a drop of blood. He stood opposed to a young man of not more than twenty years of age, and he threw several spears at him after the youth had ceased fighting. The old rascal made use of the most insulting and provoking language, and was paid back however in his own coin. At length some of the old man's friends interposed, and sought to intimidate him, but finding they could not succeed in this, they made a point of striking up his throwing-stick as often as he placed a spear on it, thus causing the weapon to fall useless on the ground.

The skilful manner in which the aborigines avoid or parry the spears is truly astonishing. Mr. Schurmann, who was an eye-witness of the last-mentioned affair, tells us that the old man, who was renowned as a good marksman, took such good aim that it seemed almost a certainty that he would hit his adversary; nevertheless, each spear was met, and glided off the young man's katta, and shot over his shoulder, passing in close proximity to his ear. This can only be accomplished by a sure eye and a firm glance, which are amongst the aborigines looked upon as the highest virtues of which they can boast, and of which they are the most proud. It has been said that the aborigines of the country are possessed of a cowardly disposition, and it may be that, when opposed to the whites, who are better armed and generally mounted, they have been found wanting in courage. But it is impossible for any one who has been an eye-witness to one of their own fights, to form such an opinion; on the contrary, he will be forced to confess that, when stirred up by passion, they will brave any danger. They are extremely sensitive upon this point, and look upon being called a coward as the greatest insult that can be offered. That little blood is spilled in these aboriginal contests, is to be ascribed either to their skill, or to the fact that they are by no means bloodthirsty. Although, on the one side, they possess a fierce and hostile spirit, still, on the other, it must be observed that they are capable of the more noble feelings of pity and compassion. This is called forth by a dangerous wound, as also by a severe sickness, but still clearer is it observed at and after the death of a friend. On such occasions they are accustomed, and particularly the female sex, to assemble and to weep bitterly. The loud lamentations to which they give vent upon the death of a relation or friend may perhaps be a custom inherited from their forefathers, for they always weep together, and at the same time. They also employ foreign means to produce tears. They rub the eyes and scratch the nose, if their own frame of mind should not be sufficiently sorrowful, or if the example of others should fail to produce genuine tears. Their weeping and groans at the commencement of a lamentation seem to be somewhat formal and forced, and thus the suspicion arises that they seem more sorrowful than is warranted by their true feelings. Nevertheless, the Rev. Mr. Schurmann believes that the aborigines feel deeply and mourn heartily the death of a friend, upon the following grounds, viz.:— For weeks and months they bemoan their deaths, especially at eventime, when they are assembled for rest, and when their hearts and minds are open to the influences of sorrow and grief for the departed friend. One of them is accustomed to break out suddenly into a long, protracted, plaintive tone, and gradually his example is followed by the others. After this lamentation, a profound silence is observed, and in truth their behaviour is such as belongs to persons oppressed by great grief. For years after the death of a friend, on no occasion whatever do they pronounce his name. This, as one might suppose, does not proceed from superstition, but from the simple reason that they do not wish again to awake their slumbering feelings, or, to use their own expression, *that they do not wish to weep so much.* Should it be absolutely necessary to name a deceased person, it is done in the following manner:—I am a widow, fatherless, brotherless, &c., as the case may be, instead of saying my father or my brother is dead. The last ground on which Mr. Schurmann bases the sincerity of their grief is, that they risk their lives to revenge their deceased friend, if suspecting their death to have been caused by foul means.

Although at the interment of the dead certain rites and customs are generally observed, these are at times dispensed with, as was instanced in the case of an old man. After having dug a hole five feet deep and four feet long, and spread some dry grass in the bottom, they lowered the corpse into it, with the legs bent upwards, as the hole was too short to receive it in its proper position. The head, as is invariably done, was placed at the west end, from the notion that the departed souls all reside in an island situated eastward. The body was then covered with a kangaroo skin, and sticks having been driven immediately above it lengthwise into the sides of the grave, leaving a vacant space above it, the whole was then filled up with earth. As the last of this simple proceeding, some branches or bushes are collected round the grave, with the view, as I should think, of preventing stray cattle and horses from trampling upon it.

In the immediate neighbourhood only of European settlements, where they can obtain the necessary tools, are they able to dig such deep graves. Further up in the interior, however, where they are confined to the yam sticks for the operation of digging, the graves are made only sufficiently deep to admit the body, the sticks being driven in immediately above it. This custom is always observed, very probably in order to prevent the wild dogs from scraping up the body.

During my stay, in 1851, of a few weeks at a station forty or fifty miles north of Port Lincoln, I had the opportunity of witnessing a rather premature act of these natives. A woman had fallen ill, and one of the men on the second day having called at the station for the loan of a spade to dig the grave with, I went on the following day to see where she had been buried, when, to my astonishment, I found her recovered, and quite well. The sight of the grave, however, which was prepared for her, cannot, at all events, have been accompanied with pleasing impressions.

The natives inhabiting the triangular peninsula of Port Lincoln are divided into several tribes, two of which are in daily intercourse with the Europeans, viz.—the Nauo or Nawo, and the Parnkalla. In addition to these, the natives mention three other tribes, as known to them, viz.—the Pukunnas, in the N.E.; the Kukatas, in the N.W.; and the Ngannityddis, in the N.; the latter occupying the territory between those of the two other tribes, some of which do occasionally visit the European settlements.

All these tribes seem upon the whole to entertain a friendly intercourse with each other; at least, apparently, there is not so much quarrelling going on among them as among the natives living more to the eastward.

The natives, in coming in contact with others of a different tribe, are very shy at their first meeting. They try to avoid each other, and do not speak together, unless unavoidably obliged to do so, or induced by a mutual friend.

Every attempt at estimating the number of these natives is made at a hazard, as all the members of a tribe never meet together. The general opinion is that an estimate at an average of 300 individuals for each tribe is by far below the actual number.

The chief difference of the various tribes consists in their language and dialects. This, however, causes no great inconvenience to those living on the borders of their territories, as each native understands, at least, the language of the adjoining district; thus, they frequently keep up their conversations in two different languages, in the same manner as if a German and Englishman were to talk together, each in his own language, but both understanding that of the other party. This peculiarity frequently occurs in families intermarrying in the neighbouring tribe, for none of the members ever think of attempting to speak the language of the other party.

In conclusion, I would state that every opportunity should be taken by every one coming in contact with our aborigines to collect as much knowledge as possible of their manners and customs before it is too late; and I may quote Mr. Moffat's words, which, although referring to the Africans, apply also to our aborigines.

He writes:—"I have traversed those regions in which, according to the testimony of the farmers, thousands once dwelt, drinking at their own fountains, and killing their own game; but now, alas, scarcely is a family to be seen! It is impossible to look over those now uninhabited plains and mountain glens without feeling the deepest melancholy, whilst the winds moaning in the vale seem to echo back the sound, "Where are they?"

[While the foregoing sheets were going through the press, intelligence having reached Melbourne of the value, as an edible seed, of the *Marsileæ hirsuta* (or Nardo), as found so useful in the Victorian Expedition, and which was the means of saving the lives of King, the sole survivor of Burke's party, as well as those of Lyons and M'Pherson, who had been sent with despatches to Mr. Burke, it has occurred to me that it would be well to mention that I found the same plant growing in Dumby Bay, Port Lincoln; but I did not observe that the natives had ever made any use of it as an article of food.]

Art. XI.—*Description of a New Species of Plumatella.* By P. H. McGillivray, A.M., M.R.C.S.

[Read before the Society, October 29th, 1860.]

The study of the fresh water polyzoa has been so completely neglected by naturalists, except in Europe and North America, that at the date of publication of Professor Allman's great monograph, no species were known to occur south of the north temperate zone. Since that time a new form—*Hislopia lacustris*—has been described from Nagpoor, in Central India, by Mr. H. J. Carter, who has also found in the tanks at Bombay a species of *Lophopus* and a *Plumatella*, identical with *P. stricta*, Allm.* With these exceptions I believe that no addition to the geographical range has been made since the appearance of Allman's work.

Having long been familiar with the extreme richness of our fauna in marine polyzoa, I was satisfied that fresh water forms required only to be looked for to be found; and Mr. Aplin, of the geological survey, to whom I expressed this opinion, at once commenced the search. The result has

* Annals and Magazine of Natural History, March 1858, and May 1859.

been the discovery of a species of Plumatella in great abundance, in the quarries at Richmond, and I have no doubt that many others will ere long be added to the list.

Plumatella Aplinii, n. sp.

Cænæcium dichotomously or irregularly branched, creeping, cells expanded upwards, mouth oblique, oval, with the anterior lip pointed; a strong ridge running along the front of the cænæcium, and extending entirely or partly up the cells; no furrow; tentacles, sixty; statoblasts elongated.

Locality: On stones in old quarries at Richmond, on timber in the lagoon in the Survey Paddock, and on a stump in the lagoon in the Botanic Gardens.—C. D'Oyley H. Aplin, Esq.

This beautiful polyzoon occurs in masses of various extent, in some specimens covering several square inches. The cænæcium is irregulary branched, sometimes leaving wide interspaces, at other times densely covering the object to which it is attached. It is usually closely adherent, but occasionally the extremities of the branches are free and semi-erect. On the front of the branches of the cænæcium there is a continuous prominent keel or ridge, which also extends up the cells. The cells are short, expanding towards the orifice, so as to be in some cases almost funnel-shaped; the mouth is oblique, oval, and frequently, from the continuation of the ridge, pointed anteriorly. There is no groove. Only free stato-blasts have been observed; they are of an oblong elliptical form, with a wide annulus.

The characters presented by this species are so well marked, that it may at once be readily distinguished from all previously known. Its nearest ally is probably *P. emarginata*, Allm., with which it agrees in the presence of a ridge, and in the elongated stato-blasts; but differs in the form of the cell, and in the absence of the furrow at the cell-mouth, and in the number of the tentacles.

Art. XII.—*Indigenous Fibrous Plants.* By F. A. Corbett, Esq.

[Read before the Royal Society, December 17th, 1860.]

In the report from the Exploring Expedition under the command of Mr. Burke, dated 30th October, 1860, we are informed that the mallow grows in remarkable luxuriance in the barren country beyond the Darling. Mr. Wills, the astronomer and surveyor of the party, says, "It clothes the banks of Wonaminta Creek, and grows to an immense size on nearly all the creeks out here." This statement has suggested to me the submission to the meeting of specimens of oakum and rope made of the fibres of the mallow, also of specimens of paper, oakum and rope manufactured from another indigenous plant, which, it will be observed, is a description of rush or flag. At any time it would be interesting to contemplate the possibility of a tract of the interior of this continent, at present little better than a desert, possessing valuable natural resources in the way of vegetable production, but it is peculiarly so at the present moment, when an inquiry relative to our indigenous fibrous substances is being conducted by a committee of this Society at the instance of the Imperial Government.

The fibrous properties of the mallow, as well as those of the *Lepidosperma gladiata*, the other plant alluded to, were first made known to Europeans by Mr. Alexander Tolmer, of Adelaide. It appeared, however, in the course of some discussions which took place in the Legislative Council of South Australia, on an application made for leave to bring in a Bill to secure to that gentleman a patent right in his discovery, that the aborigines were acquainted with some of the useful properties of these plants. They were, in fact, used by them in making baskets and fishing-lines, and, on this account, it seems that a select committee, to whom the matter was referred, could not agree to recommend the grant to Mr. Tolmer of the exclusive right of using, manufacturing, and exporting these plants. The justice of this refusal has been questioned by the friends of Mr. Tolmer, who hold that a discovery was undoubtedly made by him, inasmuch as he went beyond the blacks in the application of the properties of the plants, and in ascertaining by experiment their fitness for the manufacture of paper, pasteboard, papier mache, oakum and rope, all articles of great commercial importance.

Before exhibiting these specimens to the Society, I thought it proper to bring them under the notice of our eminent botanist, Dr. Mueller, more especially with the view of ascertaining whether there existed in these colonies an indigenous plant resembling, yet differing from, the common English marsh-mallow, or whether the plant in question was identical with that growing about Melbourne, because it would be a very singular fact if valuable properties, existing in a plant so familiar to the scientific men of Europe, remained altogether undiscovered. Moreover, it seemed to me that, if the plant experimented on by Mr. Tolmer were identical with the European, grave doubts might be entertained as to the value of his discovery. Unfortunately, in consequence of my not being in a position to submit a leaf of the plant, a positive statement could not be hazarded by Dr. Mueller, but it is almost sufficient to be able to state that he has little doubt of its being the *Lavatera plebeja*, a native plant, extending from South Australia, through Victoria, into New South Wales, and resembling the genuine English marsh-mallow. The latter, it appears, has not yet immigrated into Australia, the plant usually found here being the British dwarf mallow.

Dr. Mueller also informs me that the *Lavatera plebeja* is perennial, and may be obtained in considerable quantity along the Murray and many of its tributaries, being besides scattered over other parts of the colony. A perennial plant, it may be observed, provided its growth is rapid, and admits of a large crop being annually removed, appears to have its relative advantages in a country possessing abundance of land, and where tillage will in all probability be costly for a long period to come. Moreover, the luxuriant growth of the mallow in tracts of country which appear to be comparatively useless for other purposes, but which nevertheless possess the advantage of being adjacent to our greatest navigable rivers, ought to be an inducement to test its value, directing special attention to the quality and quantity of fibre of a year's growth, investigating the cultivable qualities of the plant and its action on the soil; also ascertaining how far the exhaustion occasioned by annual cropping may be supplied by inundations or other available means of restoration. These are important considerations; for articles of which the consumption is great, such as paper and rope, cannot be sufficiently and uniformly supplied by the spontaneous action of nature; neither could a shrub, or a tree, which takes a long time to arrive at maturity, yielding a small supply of material in proportion to the area under plantation, ever fully answer our requirements in the way of fibrous substances.

As regards the preparation of the mallow for use, Mr. Tolmer thus describes his process :—" The *Hibiscus* (erroneously so called by him) may be pulled up by the roots, and hung up in bundles to dry. When sufficiently dry, I cut them up in a suitable machine—an ordinary chaff-cutting machine will answer the purpose. They are then to be boiled in a diluted solution of caustic alkali, and afterwards bleached by chloride of lime, or any of the well known processes. It is of importance that the gummy matter should be extracted. The material will now be in a fit state to be manufactured into paper, and I would remark that the manufacture of paper will now be carried on as if the paper were being made of rags. In using it for other purposes (oakum, rope, &c.), the system ordinarily adopted will be applied."

Respecting the *Lepidosperma gladiata*, we are furnished with more positive information. A manufacturer in England who has tried its paper-making qualities, reports that there is no doubt whatever of its making good paper, adding, however, that the price, exact loss of weight, &c., can only be determined by a continuous working of some quantity. As the nearest calculation he could form from the experience of one trial, he estimates the cost of chemicals to make one ton of paper at £3 10s., and fuel £1 10s., English prices. He further adds that half the rush is waste. Referring to the exportation of the plant to England, supposing it not to be divested of its gummy matter, he recommends it to be cut in short lengths, half an inch or three or four inches long, in order to its being packed closely for the purpose of diminishing the freight; or, in order to avoid the expense of bags or canvas covers, he advises to cut, lay the flag, and bind it up very closely in bundles or sheaves like wheat.

As to manufacturing in the colonies, he states that the supply of material and the power of the mill should be equal to produce six tons of paper per week, as the same number of hands would be necessary to make three as six tons, and the cost of apparatus the same, without much difference in other things. The estimated cost, in England, of delivering the manufactured paper at market, embracing every expense, including duty, making, carriage, fuel, and chemicals, dating the calculation from the deposit of the raw material in the mill, would be £25 per ton of paper, the value of which would be from £50 to £60. This leaves a margin for all expenses attendant on providing the raw material, moving it from the place of its growth in Australia to the mill in England, together with all charges and profits thereon, of £25 at least, on the quantity required for the manufacture of one ton of paper; or, half being reckoned as waste, makes the value of one ton of the plant at the mill in England, £12 10s.

The *Lepidosperma gladiata* grows in great abundance on the coasts of New Holland and Tasmania, and is of that character that it may be cut down annually, and will spring year after year from the same roots. With reference to this, Mr. Tolmer says—"I cut the plant away from the bottom of the stem, without injury to the root, leaving that to shoot out again." And, as regards his mode of dealing with the rush so cut away, he adds—"It is allowed to remain on the ground ten or fifteen days, exposed to the action of the night dews, and to the hot sun in the day, occasionally being turned over; and by this exposure the plant will become partially bleached."

Turning to economical considerations, it may be observed that, even if these plants can be produced here at a low cost, their great bulk is undoubtedly a serious drawback on their exportation to Europe, but that, on the other hand, this very circumstance offers an inducement—a natural protection—to the manufacture of the article on the spot. I would further remark that the constantly increasing number of uses to which paper is applied holds out very great encouragement for local manufacture. The invention of bitumenized paper drainage pipes, for which a factory has been erected in Melbourne, is an event which ought to lead to inquiry into the value of our indigenous plants suitable for paper making, inasmuch as there would be a great consumption of any substance which would enable the drainage pipes to be furnished at a reduced price. The agriculturist would benefit by a new object of cultivation, for which there would be ready sale; while success in production would cheapen the means of drainage and irrigation—two of his greatest wants, and each of nearly equal importance in this country.

I may, in conclusion, add that Mr. Tolmer, taking advantage of our legislation, secured a patent for this colony; and it is to be hoped that if it should be proved that these plants are valuable, either for local use or for exportation, the toil, labor, and expenditure of that gentleman may be rewarded.

Art. XIII.—*Remarks on Professor McCoy's Commentary.* By Rev. W. B. Clarke, M.A., F.G.S., &c., &c.

[Read before the Royal Society of Victoria, December 10th, 1860.]

I was not aware, till I perused Professor McCoy's "Commentary" on my letter, that I had offered any grounds of offence in it; and I deem it only right to express my sincere regret that, if so, I should have unknowingly made his Excellency the President the medium of anything so unbecoming my own intention. I had, however, stated that I did not "wish to speak disrespectfully of Professor McCoy's judgment and learning," and if he has not followed my example, it is my misfortune, and not my fault.

The preceding letter was too hastily penned to bear the construction of a deliberate memoir; and though I certainly sanctioned its being made use of, I did not suppose that it would have attracted the weight of Mr. McCoy's unkindest criticism.

In a little work*, recently published, I have given a concise account of the carboniferous formation of New South Wales, and also a brief statement of the controversy respecting it. I have, therein, given full credit to the fact alleged that the plant lately found in Victoria is a Tæniopteris. But I must observe that, except in His Excellency's letter, to which the above was a reply, I have never heard a syllable, either from Mr. McCoy nor any one else, about the plant. There could, therefore, be no denial of Mr. McCoy's assertions, for I have never seen anything that he has said or written on the subject, save the above "Commentary."

My remarks, therefore, were those of one who, having his own views upon a question, naturally required evidence before he submitted that question to a decision which opposed those views. Hence, I entered into a defence of my views, and gave a definition of the genus by way of *inquiry*, which was the only course open to me at this distance.

In the third paragraph of the "Commentary," Mr. McCoy attempts to show that my reference to *six* should have been *twenty-three* species. But if he will read my letter again, he

* Researches in the Southern Gold-fields of New South Wales, chapter xiv.

will find that I allude only in that number to Tæniopteris, and to no other genus; whereas he includes the other genera, to which I did not then allude.

His *third* remark, in the third paragraph, does not appear to me to settle the question in reference to Virginia; for the coal-field of Virginia is, as respects zoological fossils, exactly in the condition of the coal-field of New South Wales; and, therefore, so far they are certainly parallel; but neither can be proved to be oolitic, except by the plants; and Mr. Bunbury distinctly points out that the evidence of the Virginian plants is *ambiguous,* and he concludes that the Richmond coal-field might as well be referred to the triassic or to the jurassic series*.

In the fourth paragraph, Mr. McCoy assumes that I have used the word *formation* in the sense of *bed.* That I presume would be unnecessary to reply to. But when I wrote that passage, I wrote from memory. I have since found Mr. Oldham's letter (which I place for reference in the hands of His Excellency the President), and I find he mentions *five* distinct *groups,* all unconformable. He says, that in the lowest beds he finds Glossopteris Browniana Vertebraria, as in Australia; and he adds, "we have Glossopteris in the higher beds also, but not the same species." I understand Mr. Oldham to speak of the higher and the lower beds in reference to the whole mass of the coal-bearing rocks, which he has separated into five groups.

Now, Mr. McCoy says the Glossopteris, &c., accompany Ammonites in India, and therefore, are oolitic. But he did not mean, surely, to say this of Bengal. He must have alluded to cutch, where no doubt such plants as Ptilophylum, Lycopodites, Codites, Equisetites, &c., occur with *upper* oolitic shells. I did not know, however, that there was any authority "twenty years ago" for affirming, as Mr. McCoy does, that the genera Tæniopteris and Glossopteris are, even in cutch, associated with the fossils named. Nor have we any reason to believe that it is the case now; for Mr. Oldham distinctly refers the cutch beds, not to the oolites, but to the wealden. If so, they cannot contain, as Mr. McCoy says, "the *lower* oolitic fossils of the clear sections of Europe."

Respecting Africa, I am quite aware that Glossopteris occurs in the Dicynodon beds; but I am also aware that Mr.

* Q. J. iii., 287—8.

Morris has determined a series of plants from the Dicynodon strata to be either *triassic* or *jurassic.*

So thoroughly indistinct is the settlement of the question in all quarters, as refers to the occurrence of those plants which Mr. McCoy asserts cannot be here otherwise than oolitic. What Mr. Morris says of the Dicynodon strata plants, Mr. Bunbury says of the Richmond plants; and, therefore, I consider that, even if my own ideas be altogether erroneous, the question is not necessarily settled, as the "Commentary" would have it.

I am next assailed on the ground of my allusion to Mr. Jukes, who, if not a "Palæontologist," is the author of an excellent manual, in which he follows Brown. Both, Mr. McCoy considers mistaken; the places I am very sarcastically referred to in Mr. Jukes' book were all marked down in my own copy, and I had ticked off, as references, the respective pages one against the other; I was, therefore, aware of all the Professor mentions; but, nevertheless, I considered myself justified in quoting Brown, Mr. Jukes' references to whom I have verified.

I am much obliged for Mr. McCoy's "better list of the distribution of clearly ascertained species of Tæniopteris;" and only regret that he had not given the information without calling in question any other person's sagacity.

"In the next paragraph," Mr. McCoy criticises what I say of Phillips' Geology of Yorkshire, and accuses me of misstating a fact, viz., that in his book there is no figure of Tæniopteris.

If Mr. McCoy had the figure of *T. vittata* in Phillips' book, then it is not *in my* (*2nd* 1835) *edition;* for the figure t. 8, f. 5, is therein named "*Scolopendrium solitarium,*" and I have mentioned that, though Morris classes this as *T. vittata,* Göppert calls it an "*Aspidites.*" Certainly, as my knowledge has not yet extended to the rejection of Göppert's determinations by "all more modern writers," Mr. McCoy might have saved himself the trouble of wrongly accusing me of a misquotation.

But Mr. McCoy himself has (I hope unwittingly) made an incorrect statement in his version of the fifth paragraph of my letter; for Mr. Dana did not visit the Australian localities *since* Mr. McCoy wrote his paper on my fossils, but *eight or ten years before,* in 1839; consequently his getting *more fossils without altering Mr. McCoy's views,* was simply an *impossibility*. I was with Mr. Dana when he procured some of them, and therefore know the facts.

Again, there is another mistake in what Mr. McCoy calls the *most disagreeable part of his task,* and he quite mistakes in that all I contend for.

Mr. McCoy decried at first any *coal beds* but those of oolitic age. (See his own quotation in the Commentary.) I forwarded a fossil to England by the late Admiral King, which, he says, is a species of Lepidodendron, to prove that there was a coal formation *not oolitic;* there was no intention whatever of alluding to any individual beds, such as Mr. McCoy now imagines; for my view was all along, that the divisions (which are now defined in my book) were parts of one formation, and therefore I considered the fossil in question good evidence. Singular, however, to say, Professor Edward Forbes says that, in all probability it was *not* a Lepidodendron (Lectures on Gold, page 53). The specimen was not given to me "*by an unscientific friend,*" nor did it come "*from a geologically unknown locality in Queensland;*" it was brought down by the late Dr. Leichhardt, who was an admirable botanist, and an excellent geologist, and the locality was on the Manilla River, in New South Wales, where that fossil abounds. As to what Mr. McCoy says about *tardiness of admission* as to the locality whence the Lepidodendron sent to England came, he has an advantage over me. I have no recollection of any such tardiness beyond that which was necessary in answering a correspondence between New South Wales and England—in those days an affair of many months. If Mr. McCoy wrote to me, I doubt not that I replied to his letter. But I remember sending home a cast of another Lepidodendron, which Mr. Templer found at Pine Ridge, Wellington Valley, respecting which I never got any information, nor reply to my letter, nor do I know what became of either. To the best of my recollection, I never received from Mr. McCoy, whilst he was in England, more than two short letters in my life.

"*The vague baseless supposition,*" mentioned next, is, I am happy to say, that of Mr. Morris, and, in adopting that supposition, I am willing to suffer the reproof which I share in such good company.

As to the specimen of Lepidodendron from Gipps Land, in the Melbourne Museum, it was not "pointed out to me." I visited the Museum for the first time alone, and saw it there to my entire satisfaction, but wished it had not been in a corner.

Respecting the New South Wales plant which I showed Mr. McCoy, in his room at the Museum, from below the coal seams interpolating beds with mountain limestone fossils, I repudiate his history of what was said at the time, and am astonished at his making out something like an attempt to impose incorrect evidence upon him.

Nor do I understand what he means about the sections. I had no drawings of any sections with me, I could not, therefore, exhibit any. And, if the sections be taken to mean not a drawing, but an account, of beds in succession, I can only reply that I believe Mr. McCoy has had explained to him long before that there is nowhere in New South Wales an uninterrupted series from the top to the bottom of the carboniferous rocks in any one section, and therefore it was easy to answer any question put in the negative, without involving any contradiction to Professor McCoy, as I thought it would give him pleasure; and it is a sorry return for my civility, to find them used in this strange manner against me.

No doubt I was asked, nay "pressed," as to *whether I got it myself*, and *if it could not have fallen in*, &c., &c., which I really thought quite unnecessary, and not a dignified way of treating me; but I gave the only answer I could give consistent with truth—that, though a stone could fall to the bottom of a shaft, this specimen could not, for the Newcastle seams do not exist there at all above the upper beds, which are those of Mr. McCoy's carboniferous rocks, and I relied on the authority of the gentleman who sent it. As to the upper beds at the shaft, I speak from my own knowledge of the locality, having been there, though Mr. McCoy asserts not. But I have not been down the shaft. Mr. McCoy will recollect a specimen I asked him to name, sent from Sydney. That came from the top beds of the shaft section. As the story stands in the "Commentary," it helps to make up an item against *me;* but it does not affect the truth, that, though I did not find the fossil myself in the shaft, I relied upon the testimony I had. And now I may explain that the Honorable Bourne Russell, member of the Legislative Council of New South Wales, having opened pits near Stony Creek, in the mountain limestone beds (from which he sent me specimens of the whole series of the beds from top to bottom) below all the fossiliferous beds and coal seams, came upon the bed from which he sent me *a large slab*, on which the fossil was marked, and of which I carried a small brittle portion to Melbourne, with an abundance of other fossils from different portions of the colony, for the sole purpose of exhibiting them, and I have no doubt that Mr. Russell will be able to prove whether the slab came from the bottom or the top of the shaft, if any one is anxious to inquire.

To sum up all, I may here state that, though it is very easy to make the "worst appear the better reason," I have no object in any controversy on this question but truth. Having, since my acquaintance with the whole of the facts, always found a difficulty in reconciling the idea of *two epochs* in the formation of the deposits including our coal-beds, in consequence of the apparent continuous succession of those deposits, and the occurrence of coal throughout, together with the absence of oolitic zoological, and the presence of palæozoic zoological forms, I have not seen fit to renounce the opinion which is shared by others as well as by myself, because at present we have no grounds to do so; but it is easy to gather from this paper, as well as from other evidences of my own, that I am quite ready to admit, when proved, that some of the beds are younger than my fourth division or Mr. McCoy's base of the carboniferous system, and may, with the example of India before us, be even younger than oolite; but, with the idea of one succession, I must renounce the idea of all above the base being oolitic.

If sufficient evidence be produced to prove my opinions to be erroneous, I will readily renounce them; only, I shall take the liberty of expressing my deep regret if anything I happen to say excite feelings and expressions which are unbecoming the philosophy of a civilized era.

Art. XIV.—*Note on the Rev. Mr. Clarke's "Remarks," &c.* By Professor McCoy.

[Read before the Royal Society, Dec. 10th, 1860.]

I wish to avoid all irrelevant matter, and to re-direct attention to the real point at issue, namely:—Mr. Clarke holds and has always held that the "*Glossopteris beds*" associated with the coal of New South Wales are palæozoic, and belong to the same geological epoch as the underlying marine beds containing lower carboniferous animal remains. I hold and have always held that the aforesaid "Glossopteris beds" are *mesozoic,* and that there is a great geological interval separating them from the carboniferous or mountain limestone series of marine fossiliferous beds below them.

Mr. Clarke admits the identity I have dwelt upon between the "Glossopteris beds" of New South Wales, India, Africa, and Virginia. Baron de Zigno has drawn, in the present year, the relation much closer than before between all these and the plant beds of the oolitic series of the Venetian Alps and Yorkshire; *and not one of the references of Mr. Clarke gives the slightest color to his view of their being palæozoic.*

I should wish to stop here, but am constrained to touch the points in Mr. Clarke's "Remarks" in the order given.

1st. The remark that his reference to 6 instead of 23 species of plants in the *Glossopteris* beds of New South Wales alluded only to *Tæniopteris,* may be compared with the original passage, bearing in mind that there are not six species of fossil Australian *Tæniopteris* to refer to, but only one, and that disputed by him.

2nd. The remark on the absence of oolitic animal fossils in Virginia, overlooks the circumstance that I pointed out the fact in answer to his objection that we could not have oolitic plants in Australia, where no animal fossils of that age had been found, the age of the Virginian (Richmond) coal-beds being determined by the plants. The argumentative way in which Mr. Bunbury's saying "that the Richmond coal-field might as well be referred to the triassic as to the jurassic series" is put forth here, would seem to imply that the triassic was a palæozoic formation; it is, of course, unnecessary for me to say that this is not the case. Several triassic species of plants are jurassic also, and both formations are equally mesozoic, and not palæozoic, as would be requisite to help Mr. Clarke's argument.

3rd. I am glad to see that, as I supposed, Mr. Oldham's observations are not so opposed to those of every one else as they at first seemed, and there is nothing in his remarks now quoted, confirmatory of Mr. Clarke's belief of the *Glossopteris* and *Vertebraria* beds being palæozoic. I do not feel called upon to give here any account of the labors of geologists among the mesozoic rocks of India, containing lower oolitic shells and plants; but neither they nor I referred to Cutch, and the question to be settled was whether the New South Wales *Glossopteris* beds were palæozoic or not.

4th. As to Morris's saying the African "*Dicynodon* beds" with *Glossopteris* may be either triassic or jurassic, I have only to repeat that both these are of the mesozoic age, for which I contend, and neither of them of the palæozoic age, for which Mr. Clarke contends.

5th. I did not "assail" Mr. Clarke for his quotation from Jukes' Manual, but I gave him a number of others from the same book, to show that the one he used was wrong; but now that Mr. Clarke says that he was aware of all these references, he does not explain how it was he came to recommend to the notice of this Society the single incorrect one, which he now shows he was fully aware only seemed to favor his side of the argument by the accidental error of the compiler.

6th. I did not accuse Mr. Clarke of misquoting Phillips' Geology of Yorkshire. I quoted a figure in it, and he wrote to deny its existence. I then laid the work with figure on the table, for the inspection of members, but bowed, of course, to the Rev. Mr. Clarke's positive assertion that that to which I referred had no existence. His remarks on the synonomy show that he has not had time nor opportunity to acquaint himself with the literature of the subject. A little study will, I have no doubt, enable him to perceive that what is now called *Tæniopteris vittata,* was first figured by Phillips under another name, not used by subsequent writers for his plant.

7th. I should have said that Mr. Dana *published* (instead of *got*) several more fossils beyond those known to me or previous writers, *after* I had published my paper "On the Zoology and Botany of the Rocks associated with the Coal-fields of Australia," without altering my views. A reference to Dana's papers on the subject, in Selliman's American Journal of Science (about twelve or fourteen years ago) will show the numerous additional fossils which he got, all with the same geological significance, as I stated, though said to be simply an impossibility by Mr. Clarke.

8th. The matter of the Lepidodendron from the Manilla river (but not, as it should be for the argument, from the *Glossopteris* beds) will be well understood from my former "Commentary." On communicating, two days ago, with Mr. Selwyn, he reiterates his possitive assertion that he told Mr. Clarke of the Gipps Land *Lepidodendron* in our Museum, and brought him to the case, and pointed it out to him; the insinuation of Mr. Clarke was that he discovered an important fossil in our national collection, of the nature of which we were ignorant. Mr. Selwyn is aware that I determined its true nature at the first glance, some years before, and that he expressly pointed it out and explained it to Mr. Clarke. Further, Mr. Selwyn (who was present) again authorises me to say that the account I have given in the "Commentary" exactly coincides with the distinct impression he received from Mr. Clarke's account of the coalpits at Stoney Creek; he remembers perfectly, as I do, the sections drawn with a pencil, by Mr. Clarke, illustrating his statement—that the pit was sunk through the plant beds near the surface into the marine beds, and that he had not been there, and had no evidence that the plant specimen had actually been *in situ* below the marine beds.

ART. XV.—*On the Multisection of an Angle by means of the Cycloid.* By the Hon. DAVID ELLIOT WILKIE, M.D., M.L.C.

[With a Plate.]

[Read before the Royal Society of Victoria, 25th June, 1860.]

THE writer of this paper feels that he owes some apology for venturing to offer a new illustration of the trisection or multisection of an angle. He has devoted very little time to mathematical studies, and his attention was directed, quite accidentally, to the subject of this paper.

It is well known that there is no mode by which this problem can be solved by pure Geometry, that is, by circles and straight lines.

There are several other curves, however, by means of which an angle may be trisected, but these curves are difficult to be described, as the hyperbola, trisectrix, quadratrix, &c. The trisection of an angle, therefore, by means of these curves, possesses little practical interest.

The object of the writer is to point out that the properties of the cycloid afford a ready means of trisecting or multisecting any angle. The cycloid differs from the other curves above-mentioned in the comparative facility with which a perfectly accurate figure may be obtained. Indeed there is no reason why, by a simple mechanism, the cycloid may not be figured with as much mathematical precision as the circle itself.

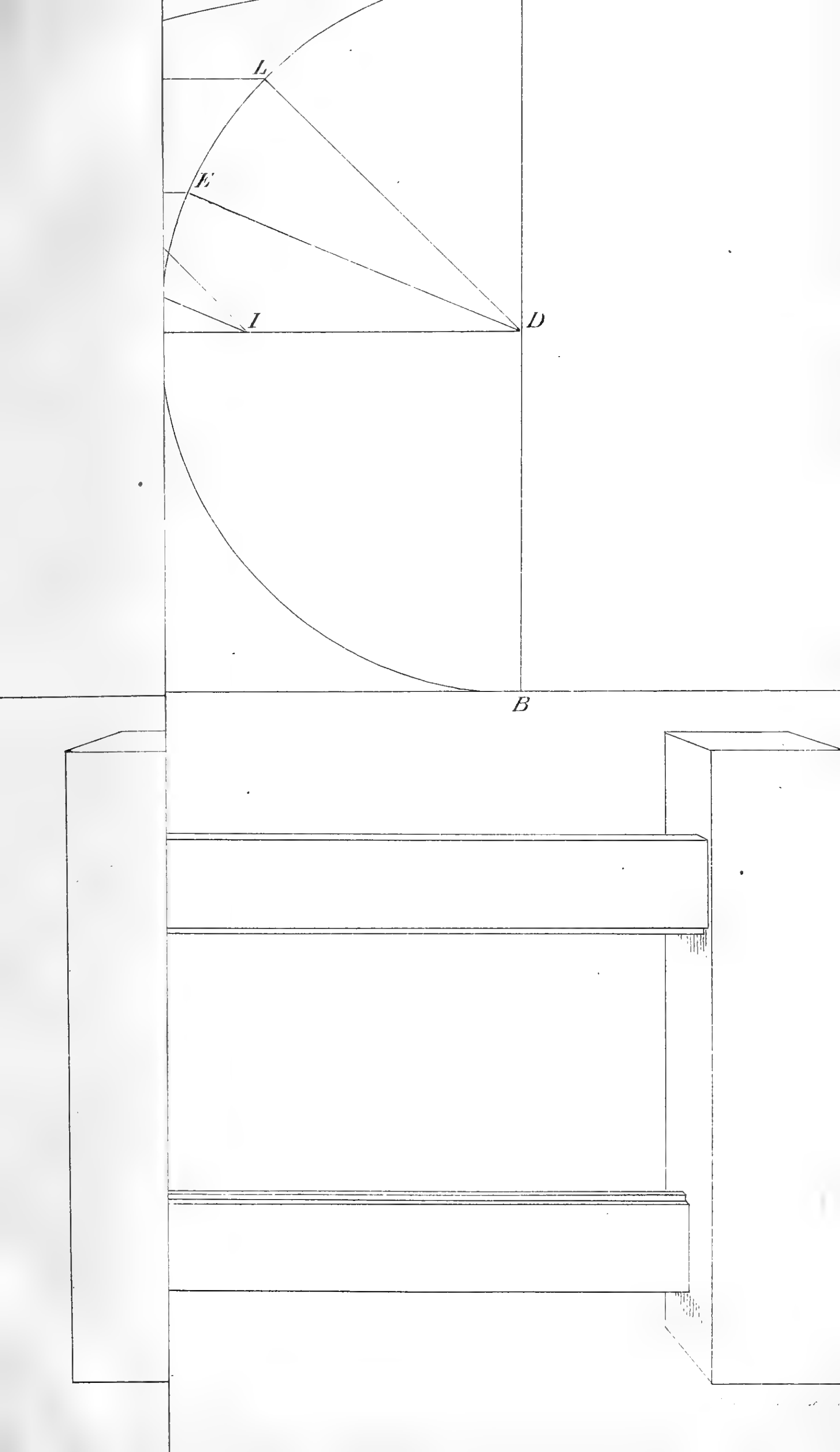
The cycloid, also, is a curve which is nearly allied to the circle, and its properties, which are derived from this relation, are readily understood. There is another property of the cycloid which the writer has not seen noticed before, viz., that there is a point in the curve where its cord becomes a tangent of the generating circle, and is exactly equal to the arc of the circle contained between this point and the base of the cycloid, which becomes the opposite tangent. At this point, therefore, two tangents of the generating circle are each equal to the arc of the circle, which they enclose, that is, each tangent is equal to twice its own arc.

This property of the cycloid appeared to the writer to offer some clue to a geometrical quadrature of the circle. In this expectation he was disappointed. It was, however, in directing his attention to the possible solution of this problem by means of the cycloid, that he discovered that property of this curve by which any angle may be readily divided into any number of equal parts.

In order to obtain a perfectly accurate figure of the cycloid, the writer has designed a simple instrument, which is figured in the accompanying plate. It consists of two wheels, of different sizes, attached together by the same pivot, and confined between two parallel bars, on one of which each wheel rolls. A lead point, to describe the curve, is fixed in the flange of the larger wheel, exactly opposite its rolling edge.

The two wheels are in contact with each other, and, when in motion, rotate in opposite directions. The upper bar is in a different plane from the lower, to receive the smaller wheel.

The side pieces of the instrument are at right angles to the


L
E
I
D
B

parallel bars, and project beyond them. They are intended to rest on the paper, or plain surface, on which the curve is to be figured. The bars are tongued to receive the wheels, which are grooved to retain them in their true position.

The larger wheel rolls on the lower bar, and exactly corresponds with it, and, when the instrument is used, there is just sufficient space between the large wheel and the paper to allow free motion to the marking point. The parallel bars are so placed in contact with the wheels as to prevent any sliding motion. The instrument, as figured in the plate, is reduced one half. The curve itself was figured by the instrument, and has not been reduced.

PROBLEM.

To trisect an angle by means of the cycloid.

Let AB be the axis, BC the base, and AC the curve of a semi-cycloid; let D be the centre of the generating circle, and let ADE be any angle which it is proposed to trisect.

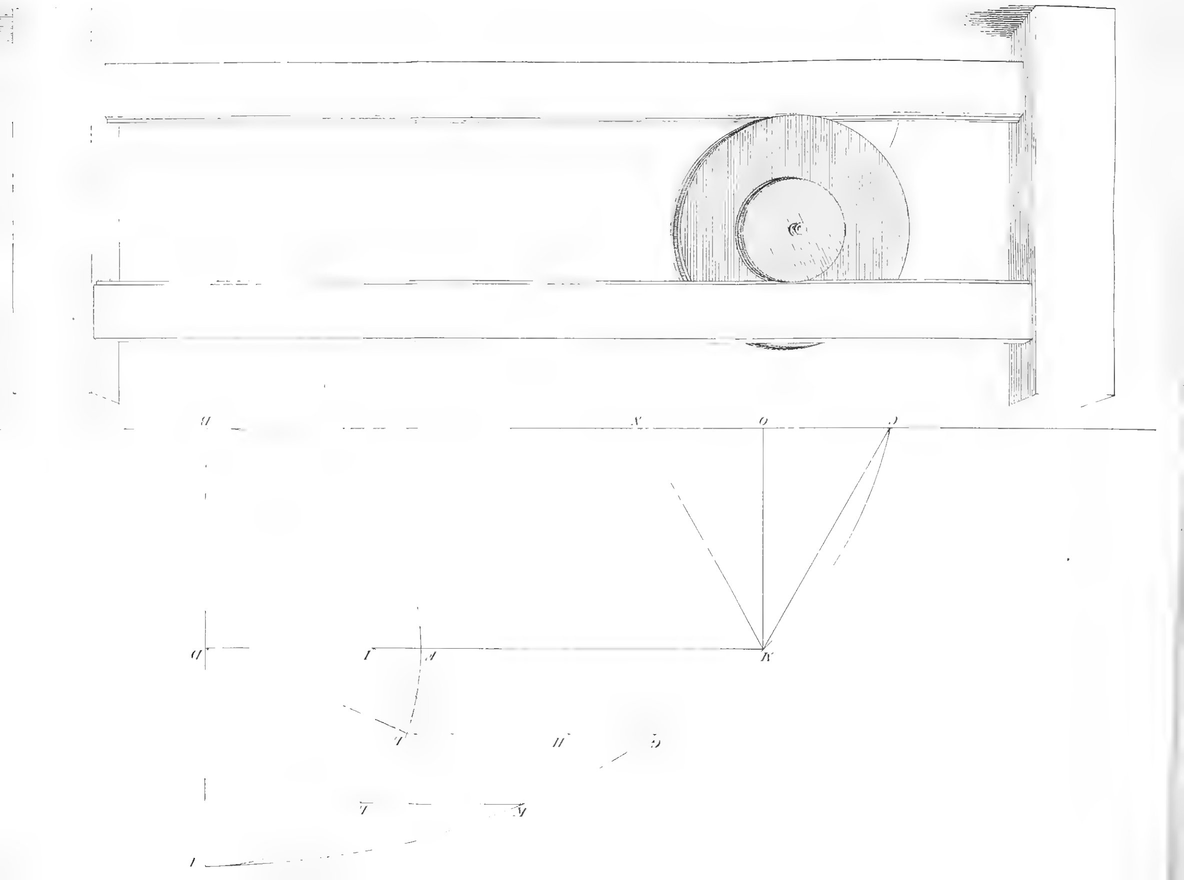
Through D draw DM parallel to BC and intersecting the circumference of the circle at F. Through E, draw EG parallel to BC and intersecting the curve of the cycloid at G. Take EH, equal to two-thirds of EG (VI. 9. Euc.), and take DI = EH, join IH.

Then, because EH is parallel and equal to DI, IH is parallel and equal to DE (I. 33. Euc.).

Upon I as a centre, through H describe an arc of a circle HK, intersecting the cycloid curve at K, join IK and draw DL parallel to IK, and intersecting the circle AFB, at L join LK. Then since DL is equal and parallel to IK, LK is equal to DI, is equal to EH, is equal to two-thirds of EG. But EG is equal to the arc AE, and LK is equal to the arc AL. Therefore the arc AL equals two-thirds of the arc AE, which is therefore trisected at L.

In the same way any angle may be divided into any other number of equal parts.

Note.—It is perhaps worthy of notice that the cycloid curve affords a very near approximation to a true quadrature of the circle. When the generating circle advances from the point C at the extremity of the base through one-fourth of a revolution, the generating point comes to M and the angle CMO = 29° 43′, which is so near to 30° that the triangle CMN is very nearly an equilateral triangle. On this supposi-



tion CN would be equal to twice the tangent of 30°, and together with BN would be equal to AFB, the semicircumference of the generating circle. But BC = DM + OC, and FM = the arc AF = $\frac{1}{4}$ of the circumference, ∴ DF + OC = $\frac{1}{4}$ of the circumference, ∴ BN = 2DF = the axis BA. Thus, on the supposition that the angle CMO = 30°, the base BC would be equal to twice the radius, and twice the tangent of 30°, and would be equal to 3.15470 instead of 3.14159.

PROCEEDINGS.

PROCEEDINGS.

Anniversary Meeting of the Royal Society of Victoria, held in the Society's Hall, Victoria Street, Melbourne.

6th March, 1860.

The President, Dr. Ferdinand Mueller, in the chair.

The minutes of the previous Special Meeting were read and confirmed.

The business of this meeting was to elect the office bearers for the ensuing year, and the Chairman read the names of the candidates for the various offices.

Mr. Morrison (Scotch College) moved—"That the attendance list of the Council should be read; and as it had not been printed, that the number of attendances of each member of Council should be placed on the black board." This was seconded by Mr. Clarson.

The Rev. C. P. M. Bardon moved, as an amendment, the previous question, which was seconded by Mr. Farewell. The original motion was carried.

The Rev. Mr. Higginson moved—"That this meeting requests the Council, previous to future anniversary meetings, to prepare and have printed for the use of members balloting lists, containing the names of all candidates, with the names of their proposers and seconders. Also, the number of Council meetings held during the previous year; and the number of attendances of each member of Council."

This was seconded and carried.

Dr. Macadam moved—"That His Excellency Sir Henry Barkly, K.C.B., &c., &c., be elected President of the Royal Society of Victoria, during its inaugural year."

This was seconded by Dr. Becker.

Professor Irving withdrew the name of Professor Wilson, who had been nominated, and it was announced that the Hon. Dr. Wilkie, M.L.C., had refused to permit himself to be nominated under the circumstances.

His Excellency was then elected President for 1860, unanimously and by acclamation.

The following gentlemen were nominated as candidates for the office of Vice-President :—

Richard Eades, Esq., M.D., proposed by Dr. Macadam.
Professor Irving, proposed by Dr. Macadam.
A. R. C. Selwyn, Esq., proposed by Professor Irving.
Dr. Macadam, proposed by Rev. J. I. Bleasdale.
Professor Neumayer, proposed by Mr. Acheson.
C. W. Ligar, Esq., proposed by Hon. Dr. Wilkie.

Professor Irving and Dr. Macadam requested permission to withdraw their names.

The result of the ballot was—

Dr. Eades	35
Professor Neumayer	26
C. W. Ligar, Esq.	15
A. R. C. Selwyn, Esq.	7

The two first were declared duly elected.

The following gentlemen were nominated for the office of Treasurer, viz. :—

Professor Irving, who declined the office.
Rev. J. I. Bleasdale, proposed by Professor Irving.
Dr. Mackenna, proposed by Mr. Acheson.
H. F. Eaton, Esq., proposed by Dr. Macadam.

The Rev. Mr. Bleasdale was declared duly elected, the numbers being—

Rev. J. I. Bleasdale	21
H. F. Eaton, Esq.	16
Dr. Mackenna	1

Professor Irving and Dr. Macadam were nominated for the office of Secretary. The former by Rev. J. I. Bleasdale, and the latter for re-election, by Mr. Acheson. The votes were—

Dr. Macadam	32
Professor Irving	15

The former was then declared duly elected.

Nineteen gentlemen were nominated for the six vacancies in the Council. The following were elected :—

Dr. Mueller	30
Professor Irving	19
J. W. Osborne, Esq.	19
Hon. Dr. Wilkie	14
Dr. Iffla	14
Professor M'Coy	12

The Society then separated.

Signed, HENRY BARKLY.

Ordinary Meeting of the Royal Society.

Monday, 23rd April, 1860.

His Excellency Sir Henry Barkly, K.C.B., President, in the chair.

The minutes of the anniversary meeting were read and confirmed.

The Secretary read the names of eighteen gentlemen as candidates for ordinary membership, to be ballotted for at the next ordinary meeting.

The following gentlemen were duly elected ordinary members of the society. Drs. Eades and Mueller acted as scrutineers:—

Thomas Shearman Ralph, Esq., M.R.C.S.L., Associate of the Linnæan Society of London.
George Millar, Esq., Rokeby Hall, Collingwood.
Jonathan B. Were, Esq., Danish Consul, Melbourne.
Angus M'Millan, Esq., M.L.A.
Eugene Von Guerard, Esq., artist, Melbourne.
Alfred Scurry, Esq., Melbourne.
Alexander Russell, Esq., M.L.A., surgeon.

The following gentlemen were candidates for the vacancy in the Council, caused by the election of Professor Neumayer to the office of Vice-President, viz:—

James Smith, Esq., "Punch" Office ...	2
Frederick Acheson, Esq., C.E.	4
Martin Gardiner, Esq., C.E.	4
Rev. Henry Higginson	3
R. L. J. Ellery, Esq.	4
H. F. Eaton, Esq.	6

On proceeding to the ballot, H. F. Eaton, Esq., was declared duly elected. Drs. Mueller and Eades officiated as scrutineers of the ballot. The number of votes obtained by each, opposite to their names.

The Secretary laid upon the table the following contributions:—"Fiji and the Fijians"—by the Rev. Thomas Williams, presented by the author. "Papers and Proceedings of the Royal Society of Tasmania, Vol. III., part II., for 1859," and "Report of the Royal Society of Tasmania, for 1858"—presented by the Society. "The Hobarton Directory"—by Hugh Munro Hull, Esq. "The Royal Kalendar and Guide to Tasmania, for 1860"—by Hugh Munro Hull, Esq., F.R.S.T. and M.P.I. of South Australia, —presented by the Author. Part III., No. 59, of XV. of the "Quarterly Journal of the Geological Society of London"—presented by the Society. Part I., Vol. X., of the "Transactions of the Cambridge Philosophical Society"—presented by the Society. "Dog Fish and Globe Fish, Hobson's Bay; Small Bat, Cape Shank;

Spider Crab, St. Kilda"—presented by Thomas E. Rawlinson, Esq., C.E. No. XI. of "Fragmenta Phytographiæ Australiæ"—presented by the author, Dr. Mueller. Part III., Vol. V. of the "Transactions of the Royal Scottish Society of Arts"—presented by the Society. 850 copies of the "Report upon the Resources of the Colony, by the Royal Society of Victoria"—presented by the Government. "Parcel of Cocoa Leaves"—presented by Charles Ledger, Esq. "Map of the Leichhardt and Port Curtis districts, mounted upon myall wood; also, specimen of Tomahawk Handle, made from the Bricklow Acacia"—presented by W. Lockhart Morton, Esq. (the compiler).

Dr. Mueller, as Chairman of the "Resource Committee," brought up the report of that Committee upon the Resources of the Colony, which was unanimously adopted.

Frederick Acheson, Esq., C.E., read a paper, entitled—"On a New System of Ventilation." A long discussion ensued, in which a number of the members took part. It being late, the further consideration of the paper was postponed until the next ordinary meeting.

Mr. Martin Gardiner's paper was also postponed.

The Society then separated.

Signed, HENRY BARKLY.

ORDINARY MEETING OF THE ROYAL SOCIETY OF VICTORIA.

Monday, 14th May, 1860.

His Excellency Sir Henry Barkly, K.C.B., President, in the chair.

The minutes of the previous ordinary meeting were read and confirmed, and members present for the first time were introduced to the Society by the President.

The Secretary read the name of one gentleman as a candidate for honorary membership, and the names of four gentlemen as candidates for ordinary membership, to be ballotted for at the ensuing ordinary meeting.

The following gentlemen were duly elected ordinary members of the Society, Drs. Mueller and Eades acting as scrutineers of the ballot :—

William Fairfax, Esq., Printer and Publisher, Collins-street east.
Thomas Embling, Esq., M.L.A., Surgeon, Gore-street, Collingwood.
Joseph Reed, Esq., Architect, Elizabeth-street.
S. H. Marsh, Esq., Professor of Music, Messrs. Baillie and Co., 49 Collins-street west.

Ramsay Thomson, Esq., C.E., Melbourne.
William Thomson, Esq., C.E., Melbourne.
C. J. Hodgson, Esq., Metallurgist, Melbourne.
The Rev. Thomas Williams, late Missionary in Fiji.
Archibald Michie, Esq., M.L.A.
The Hon. J. D. Wood, M.L.A., Attorney-General.
H. M. Wright, Esq., Barrister, 72 Chancery-lane.
Thomas Loader, Esq., M.L.A.
The Hon. William Nicholson, M.L.A., Chief Secretary.
J. Proeschel, Esq., Map Compiler, Carrington-street, Collingwood.
C. G. Robertson, Esq., Clerk, Registrar-General's Office.
J. J. Feldheim, Esq., Merchant, Queen-street.
R. Bowie, Esq., Surgeon-Superintendent, Yarra Bend.
Henry H. Hayter, Esq., Registrar-General's Office.

The following contributions were laid upon the table :—Maps I. to IV. of the "Geological Survey of Victoria"—presented by the Government Geologist. "Australian Essays"—by James Norton, Esq., Sen., M.L.C., of New South Wales, presented by the author, through Hugh Chambers, Esq. Vol. XV., Part IV., of the "Quarterly Journal of the Geological Society of London"—presented by the Society. Vol. XXIII., Part I., of the "Journal of the Statistical Society of London"—by the Society. Nos. 9, 10, and 11 "Mining Surveyors' Reports"—by the Board of Science. Eighth Annual Report of the Committee of Management of the Geelong Infirmary and Benevolent Asylum for 1859." No. 16, Vol. II., of the *Standard*—by the Editors. Three Mineralogical Specimens—presented by W. E. Stanbridge, Esq., per favor of Dr. Mackenna.

The Secretary read a communication from the principal Librarian of the Cambridge University Library, acknowledging the receipt of Vol. III. of the "Transactions," and desiring a continuation of the future volumes. The "Transactions" from the commencement were ordered to be transmitted.

The discussion on Mr. Acheson's paper on "Ventilation" was resumed by Mr. Knight, Drs. Mackenna and Macadam, Professor M'Coy, the Rev. Mr. Jarrett, Messrs. Millar and Osborne, and several other members. Mr. Knight also described the "method" adopted by him in ventilating the Houses of Parliament and promised a paper on the same subject on some future occasion.

Mr. Gardiner's paper was postponed until the ensuing meeting.

Professor M'Coy exhibited specimens of "Aluminium," and the substances by means from which it is prepared, and also gave a description of the latest method of obtaining the metal from the mineral "Cryolyte."

The Society then separated.

Signed, FREDERICK MCCOY, Chairman.

Ordinary Meeting of the Royal Society of Victoria.

Monday, 4th June, 1860.

Professor McCoy in the chair.

The minutes of the previous meeting were read and confirmed, and several members present for the first time were introduced to the Society by the Chairman.

The Secretary read the names of eight gentlemen as candidates for ordinary membership.

Edward Wilson, Esq., was elected an honorary member of the Society, and the following four gentlemen as ordinary members:—

Matthew Combe, Esq., L.L.D., Temple Court.
James Stewart Johnston, Esq., M.L.A., St. Kilda.
Thomas Reed, Esq., Collins-street east.
The Rev. Mr. Dale, Vice-President of St. Patrick's College.

The following contributions were laid upon the table:—No. 12 of the "Fragmenta"—presented by the author, Dr. Mueller. Part XII. of the Mining Surveyors' Reports—presented by the Board of Science.

His Excellency the Governor arrived at this stage of the proceedings, and took the chair, which was vacated by Professor McCoy.

A discussion ensued concerning "Sections," in which several members took part and Mr. Rawlinson moved "That on the requisition of two (2) members the council declare the section to be formed. This was seconded by Professor Irving. Dr. Macadam moved as an amendment, "That on the requisition of ten (10) members the council declare the section to be formed, and that five (5) of these members form a quorum. This was seconded by A. K. Smith, Esq., C.E., and carried.

The Secretary intimated that copies of His Excellency the Governor's "Inaugural Address" as President for 1860, were ready for distribution amongst the members.

Martin Gardiner, Esq., C.E., read a paper entitled "Analogous Solution to the Section of Ratio," "Section of Space," and "Determinate Section" of Apollonius, with their generating problem, &c.

J. G. Knight, Esq., architect, offered some suggestions in favor of holding an "Australian Exhibition" in the course of the ensuing year, in anticipation of the exhibition proposed to be held in London, in 1862. A discussion ensued, and a requisition desiring the council to call a special meeting upon the subject was signed by a number of the members present.

E. G. Fitzgibbon, Esq., exhibited specimens obtained from two masses of malleable iron, lying in the vicinity of Cranbourne, Western Port district, as also a moiety of a third, but much smaller mass, found in the same locality. He said that the existence of these deposits had been known for several years, and that a specimen from one of them, in the shape of a neatly wrought and polished horse shoe, had been placed in the exhibition held in Melbourne in 1854, anticipatory of the French international exhibition of the following year, and which specimen he now produced. His attention had been called to the subject whilst acting as a delegate of the City of Melbourne in a conference respecting the desirability of constructing a railway from Melbourne to the reputed coal-fields of Cape Patterson. Portions of these metallic masses had been brought up by Mr. Cameron, a resident at Cranbourne, a district through which the railway, if constructed, would pass, and who believed the deposits in question to be portion of a series of stratum extending through the locality for a distance of some five miles, in sufficient quantity to constitute one of the commercial inducements to the formation of a railway.

To satisfy himself on this point the exhibitor had visited Cranbourne, and found that whilst the outlying rocks of the district were ferruginous, the deposits of apparently pure iron existing there, to some extent *in situ*, were only two:—

1st. A mass lying on the land of a Mr. McKay, on Section 39, parish of Sherwood, distant about three and a half miles in a southerly direction from the township of Cranbourne. It presents a tabular face nearly level with the surface of the land, and somewhat of a triangular shape, the edges measuring respectively about 31, 33, and 38 inches. A trench excavated around it has revealed its sides to an average depth of about 30 inches, the bulk of the mass becoming greater as the depth increases, inducing a belief that the weight of the portion visible amounts to about four tons. The upper surface is studded with apparently oxidised blisters, which are easily detached in scales, and which in some instances contain a non-magnetic metallic substance approaching to the character of black lead. The sides are thickly oxidised, the coat being in some places nearly half an inch in thickness, and mixed with the contiguous earth with which it is found in close adhesion.

2nd. A mass similarly bedded in land belonging to a Mr. Laneham, section 39, parish of Cranbourne, distant about two miles eastward from the township, and about four miles north-eastward from the mass just described, similar to it in its general characteristics, but apparently not more than one half of its bulk.

He had also obtained, and now exhibited, a portion of a third and very much smaller deposit of a similar description, which had been found in the same neighbourhood, and which weighed about twelve or fifteen pounds. The portion exhibited formed about one-half of the mass, but was not in its normal state; the block had been used for some years as an andiron on the hearth of a farm-house, and had its surface affected by the action of the fire, and to some extent impregnated with foreign substances. Whilst so used it had got broken into nearly equal parts—that now produced, and another which had been lost.

He had had the honor of showing these specimens to his Excellency the President of this Society, who had expressed a wish that the Society's attention should be drawn to them; this suggestion he now acted upon with a view of inducing inquiry and experiment for the purpose of deciding whether the deposits are native iron, and bear affinity to the local formation, or whether they are of meteoric origin, which appears more probable from their general resemblance to ærolites known to have fallen in other parts of the world, and which have been carefully analysed and described.

Professor McCoy exhibited some specimens of European meteoric iron, and also brought forward a new specimen of "Tæniopteris" from the coal works of the Bass River, in support of the oolitic age of certain Victorian coal strata. Professor McCoy exhibited some fragments of rock from the Bass River, collected by Mr. Daintree, of the Geological Survey, in which portions of the frond of a fossil fern appeared, which Professor McCoy showed to belong to the genus "Tæniopteris." The characters of the genus were drawn attention to in the fossil, particularly the strong mid-rib, with some simple and some forked secondary nerves perpendicular to it. The species was said most nearly to resemble the "Tæniopteris Vittato," of Brongniart, figured from the Whitty Oolites, in Phillips' Geology of Yorkshire, plate 8, fig. 5, and their respective differences were illustrated by sketches on the black board. The new species was named *T. Daintreei*. Professor McCoy mentioned that the Rev. Mr. Clarke, of Sydney, who differed with him in the opinion that the coal beds of Australia were of mesozoic age, had pointedly said when they last met that no "Tæniopteris" had been found in the Australian beds, which might be expected if Professor McCoy's views were correct, and now he had the pleasure of bringing the first recorded Australian occurrence of the genus before the Royal Society, in support of the oolitic age of the Cape Paterson Coal Beds. A discussion ensued concerning the above interesting specimens, in which Mr. Fitzgibbon, Professor McCoy, Mr. Selwyn, Mr. Osborne, and other members took part.

Copies of His Excellency the Governor's "Inaugural Address," as President for 1860, were distributed to the members present.

The Society then separated.

Signed, Henry Barkly, Chairman.

Ordinary Meeting of the Royal Society of Victoria.

Monday, 25th June, 1860.

His Excellency Sir Henry Barkly, K.C.B., in the chair.

The minutes of the former meeting were read and confirmed, and several members present for the first time were introduced to the Society by the President.

The Secretary read the names of two gentlemen as candidates for ordinary membership, to be ballotted for at the ensuing meeting.

The following gentlemen were ballotted for as ordinary members of the Society, Messrs. Eades and Irving acting as scrutineers of the ballot:—

Charles Mayes, Esq., C.E., Government Railway Department.
S. Rentsch, Esq., Swiss Consul.
The Hon. J. F. Martley, Esq., M.L.A., Solicitor-General.
Professor Charles Damm, Principal, German College.
John Hadden, Esq., M.D., Collingwood.
John Menzies, Esq., Teacher, Model Schools.
John Walker, Esq., Architect, Queen-street and Royal-terrace.
George Gordon McCrae, Esq., No. 3 Caspar-place, Richmond.

The following contributions were laid upon the table by the Secretary:—No. 12 of the Mining Surveyors' Reports, April, 1860—by the Board of Science. Geological Map of Hesse Darmstadt and parts of the surrounding countries—by Lieutenant Colonel Frederick Becker, Chief of the General Staff, from surveys made by him. Also a pamphlet entitled "Geognostische Skizze des Grossherzogthums Hessen." Three masses of quartz from Doctor's Creek, Pleasant Creek—by Messrs. E. and W. Grant.

Dr. Macadam intimated that Part II. of Vol. IV. was ready for distribution among the members. He called attention to the fact that the Transactions would in future appear as the Transactions of the Royal Society of Victoria.

Professor McCoy made a few remarks on the fossil-like marking on the masses of quartz, stating that they were not vegetable impressions, but merely jettings of mineral matter.

Sir Henry Barkly requested the Secretary to read a communication from the Rev. W. B. Clarke on Professor McCoy's new *Tæniopteris*, from the coal-bearing rocks of the Cape Paterson district in particular, and on the evidence bearing on the question of the age of Australian coal beds in general, after which Professor McCoy read a Commentary on the same.

A discussion ensued, in which Sir Henry Barkly, Mr. Selwyn, and other members took part.

The Hon. Dr. Wilkie read a paper entitled "On the Quadrature of the Circle;" a discussion ensued, in which His Excellency, the author of the paper, and Professor Irving took part.

The Hon. John O'Shanassy, M.L.A., made some remarks on a sample of cotton from Queensland, which he laid on the table. He stated that the sample was grown in the vicinity of Moreton Bay, in the Botanical Gardens of Brisbane, that the average yield was about 356 lbs. to the acre, and that it was valued at about two shillings per lb. The cotton was exhibited under microscopes by the Rev. J. I. Bleasdale and Dr. Ralph.

The Rev. William Jarrett gave notice of his intention to move at the next meeting "That the council be requested to reprint the first volume of the Transactions of the Philosophical Institute of Victoria," so as to complete the sets of Members, as also a detailed index of the contents of the four volumes.

(Signed) RICHARD EADES, Chairman.

ORDINARY MEETING OF THE ROYAL SOCIETY OF VICTORIA.

Monday, 16th July, 1860.

Dr. Eades, Vice-President, in the chair.

The minutes of the last meeting were read and confirmed, and several members present, for the first time, were introduced to the meeting by the Vice-President.

The following gentlemen were ballotted for as ordinary members of Society, Messrs. Eaton and Irving acting as scrutineers, and duly elected:—

Hon. Charles Vaughan, M.L.C., Fitzroy.
George Lewis, Esq., Pharmaceutical Chemist and Druggist, Collins-street.

The Secretary, Dr. Macadam, laid the following contributions on the table:—No. XIII. of the Mining Surveyors' Reports, May, 1860—by the Board of Science. Contributions to Vital Statistics, by F. G. P. Neilson, Esq., F.L.S.—presented by W. H. Archer, Esq., Registrar-General, Melbourne. Dr. Macadam read a letter from the Duke of Newcastle in reply to the letter of thanks from this Society, in acknowledgment of her Majesty's gracious kindness in conferring on this Society its new and distinguishing title of "Royal Society."

The Rev. W. Jarrett moved—"That the First Volume of the Transactions of the Philosophical Institute, together with a detailed Index of the four volumes, be printed. Seconded by W. H. Archer, Esq.—Carried.

The Hon. Secretary also read a letter from Professor Von Hardinge, K.M.T., Director-General of the Geological Survey of Austria, and President of the Imperial Royal Geological Institute of Austria, containing a diploma transmitted to Dr. Macadam, as Honorary Secretary of the Society, conferring upon him the title of Corresponding Member of the Institute. He stated that he did not consider the diploma as a personal distinction conferred upon him, or that he was entitled to such a distinction. He looked upon it as a tribute to the

Society made through him as the Secretary. It would be in the recollection of members that at one of their meetings, during the session of 1849, the President of the Imperial Royal Institute of Austria was elected an honorary member of the Philosophical Institute of Victoria, and he supposed the present honour might have been conferred upon him in acknowledgment of that circumstance. He hoped the Society would receive the honor in that spirit, as in that spirit he laid it on the table. The Vice-President said he was gratified to find that the Royal Society of Victoria was becoming known and recognised in Europe, and he congratulated his friend, the Hon. Secretary, on the diploma he had received.

Francis A. Corbett, Esq., read a paper on Statistics, entitled—"On the Conjugal Condition of the People of Victoria, considered in relation to the Laws of Divorce." No discussion followed.

Sizar Elliott, Esq., read a paper on certain modifications of useful tools, as supplied by English and American manufacturers. He pointed out in detail the difference between several farming implements, such as spades, shovels, dungforks, axes, &c., and commented on the superior finish of the American compared with the British goods. He then called attention to certain carpenters' tools, such as chisels, augurs, hammers, &c., &c., and stated the particulars in which they were to be regarded as superior to the British goods. He next introduced some enamel-ware, which he stated was solely supplied by Great Britain, and he pointed out the gradual improvements that had been made until they reached their present perfection. Mr. Elliot concluded by apologising for bringing a subject before the Society that might seem to be more suitable for a Mechanics' Institute, and stated that his object was to induce British manufacturers to pay more attention to the finish of their goods, or they would be very liable to be superseded in this market. W. Wade, Esq., of Kew, took exception to several of Mr. Elliott's remarks, and stated his experience had led him to prefer the British manufactured goods—although in some cases they might be less sightly, they were more durable and useful. In illustration of these views he instanced some farm implements he had purchased, of American make, and which proved to be very inferior to the British. He stated that his men had so great a preference for British goods, that they would rather purchase their own tools than use those supplied to them, if they were American. Dr. Becker made a few remarks on the same subject, and after a short reply from Mr. Elliott, the discussion closed.

Dr. Macadam called the attention of members to some samples of iron manufactured by Messrs. Cairns and Co., of the rolling mills, Dudley-street, out of scrap iron, which had been forwarded for inspection by Thomas Loader, Esq., as he was anxious to draw attention to the matter as one of interest to the colony, these mills being the first of the kind in it.

(Signed) NEUMAYER, Chairman.

Ordinary Meeting of the Royal Society of Victoria.

August 6th, 1860.

Professor Neumayer (Vice-President) in the Chair.

The minutes of the previous meeting were read and confirmed.

Letters were read from Dr. Mueller, the President, and Mr. Ellery (Government Astronomer), excusing their absence on account of illness.

The following contributions were laid on the table:—No. XIV. of the "Mining Surveyors' Reports for June"—by Henri J. Hart, Esq. "Results of the Magnetical, Nautical, and Meteorological Observations made and collected at the Flagstaff Observatory, Melbourne"—by Professor Neumayer. "Cabinet d'Antiquities Americaines a Copenhague." "The Northmen in Iceland"—by the Royal Society of Northern Antiquaries, through J. B. Were, Esq., Danish Consul. Leg-bones of the Moa Bird, found in New Zealand—by Captain Thomas Robertson. Specimens of Iron manufactured from Scrap Iron, at the Rolling Mills, Spencer-street, Melbourne—by Thomas Loader, Esq. No. XIII. of the "Fragmenta Phytographiæ Australiæ"—by Dr. Mueller.

Papers that were to have been read by the following gentlemen:—R. L. J. Ellery, Esq., F.R.A.S. (Government Astronomer), Arthur Dobree, Esq., J. Pittman, Esq., and W. Lockhart Morton, Esq., were postponed to the ensuing meeting.

The Chairman suggested that a communication from the Hon. Secretary should be sent to the widow of the late Hon. Major Hodgson, expressive of the sympathy of the Society with her in her bereavement. A Lithographed Portrait of the deceased gentleman was presented by the Secretary, Dr. Macadam.

Mr. J. G. Knight moved his resolutions on the subject of holding an Australian Exhibition in the ensuing year, and was supported by the Rev. J. I. Bleasdale, Dr. Macadam, and W. Lockhart Morton, Esq. The gentlemen here named, together with Hon. J. H. Brooke, M.L.A., Mr. E. G. Fitzgibbon, and Mr. A. K. Smith, were appointed a deputation to wait upon the Chief Secretary, with a view to ascertain what support the Government are willing to accord to their undertaking.

An exquisite plaster model of a seal for the Society, designed by Dr. Becker, and executed by Mr. Charles Sumner, of Collins-street, was laid on the table, being a present from the Sculptor. It is about four inches in diameter, is framed and glazed, and represents Art and Science advancing to the invitation of Australia (in the person of a nearly nude aboriginal), followed by Philosophy, and distributing light and civilisation through the known, and, it is to be hoped, unknown parts of this Continent.

The samples of Iron from the Spencer-street Rolling Mills were of a superior description, and the tenacity of the metal was evidenced by the pieces being twisted into every variety of shape while perfectly cold.

The Society then separated.

Special Meeting of the Royal Society of Victoria.

August 18*th*, 1860.

Richard Eades, Esq., V.P., &c., in the chair.

BUSINESS.

1. To receive W. Lockhart Morton, Esq.'s paper on the Geography of the District lying between the Darling and the Lachlan.
2. To take leave of the Exploring Party.

Mr. Morton having been called upon to read his paper, proceeded to do so, and, after the reading, C. W. Ligar, Esq., Surveyor-General, moved a vote of thanks to Mr. Morton for his paper, and Sir W. F. Stawell, Chief Justice and Chairman of the Committee, seconded the motion, which was carried by acclamation.

Dr. Eades, as Chairman of the Meeting, Vice-President of the Society, and Mayor of Melbourne, then called the members of the Exploration party forward, and the following agreement was read and signed, viz. :—

Memorandum of Agreement made the eighteenth day of August, in the year of our Lord one thousand eight hundred and sixty, between the Honorable David Elliott Wilkie, as Treasurer of the Exploration Committee of the Royal Society, Melbourne, of the one part, and the several other persons whose names are hereto subscribed of the other part; the said persons, forming an Expedition about to explore the interior of Australia under Robert O'Hara Burke, hereby agree with the said David Elliott Wilkie faithfully to discharge the special duties described opposite their respective names, and also generally to perform whatever in the opinion of the said Robert O'Hara Burke, as Leader, or, in the event of his death, in the opinion of the Leader for the time being, may be necessary to promote the success of the Expedition. And they hereby further agree to place themselves unreservedly under the orders of the Leader, recognising George James Landells as second, and William John Wills as third, and their right of succession in the order thus stated. In consideration of the above services being efficiently discharged, the said David Elliott Wilkie, as Treasurer and on behalf of the said Committee, hereby agrees to pay the said persons the salaries at the respective rates set opposite their names, such salaries to be paid by monthly instalments, not exceeding one half the amount then due, on a certificate from the Leader that the services have been efficiently performed up to the date, and the remainder on and rateably up to the day of the return of the Expedition to Melbourne, and no more. And each of the said persons hereby lastly agrees, on failure on his part fully to perform this agreement, that his salary shall be forfeited, and that he shall abide all consequences, the power of discharge resting with the Leader, and the power of dismissal and forfeiture of salary resting on the recommendation of the Leader with the said David Elliott Wilkie, acting with the consent of the said Committee; in witness whereof the said parties have hereunto set their hands the day and year above written.

	Name.	At the rate per annum of	Special Duties.
1	George James Landells	£600	Charge of Camels.
2	William John Wills	£300	As Surveyor and Astronomical Observer.
3	Dr. Herman Beckler	£300	Medical Officer and Botanist.
4	Ludwig Becker	£300	As Artist, Naturalist, and Geologist.
5	Charles D. Ferguson	£200	Foreman.
6	Thos. F. McDonough	£120	Assistant.
7	William Patten	£120	Do.
8	Patrick Langan	£120	Do.
9	Owen Cowen	£120	Do.
10	William Brahe	£120	Do.
11	Robert Fletcher	£120	Do.
12	John King	£120	Do.
13	Henry Creber	£120	Do.
14	John Drakeford	£120	Do.
15	——	£120	Do.

Signed by all the above in the presence of
ROBERT DICKSON.

JOHN MACADAM, M.D., Hon. Sec.,
Exploration Committee, Royal Society of Victoria.

Sir William F. Stawell, as Chairman of the Committee, briefly addressed the men on the importance of the enterprise in which they had embarked.

Dr. Eades, as Vice-President of the Society and Mayor of Melbourne, bid the party God speed, and after a short speech, passed round the party, shaking each man heartily by the hand and wishing him a prosperous journey.

The Society then separated.

ORDINARY MEETING OF THE ROYAL SOCIETY OF VICTORIA.

Monday, 27th August, 1860.

His Excellency Sir Henry Barkly, K.C.B., &c., President, in the chair.

The minutes of the last ordinary meeting, held on the 6th August, were read and confirmed, and several members present for the first time were introduced to the members by the President.

The Secretary read the name of one gentleman as a candidate for ordinary membership, and the following gentlemen were duly elected by ballot ordinary members of the Society, viz.:—

James W. Fawcett, Esq., Melbourne
John Blair, Esq., Surgeon, M.R.C.S.L., Northcote
Dr. Coates, Surgeon, South Yarra
Dr. Henry Wooldridge, South Yarra
John Donaghy, Esq., St. Francis School
Michael John Page Hennify, Esq., Myrtle Cottage, Lennox-street, Richmond

The Secretary read communications from the Leader of the Exploration Party, and from the Royal Society of London, the Athenæum, London, and from the Librarian, Trinity College, Dublin, acknowledging the receipt of "Transactions" from the Society.

The Secretary laid upon the table the following contributions, viz.:—The "Atlantis," by the Editor. Several numbers of the "Statistical Society of London." "Statistical Notes of the Progress of Victoria from the Foundation of the Colony (1853-1860)"—by William H. Archer, Esq., Registrar-General, 1 vol. "Report on Central American Affairs," 3 vols. "Report on Finances, U.S.," 2 vols. "Report on Commerce and Navigation," 1 vol. "Report of Commissioners for Settlement of Claims," 1 vol. "Messages and Documents of United States Government, 1854-5," 1 vol. "Correspondence Relative to Perry's Expedition to Japan," 3 vols. "Reports of the Governors of Alms Houses of New York"—by Henri J. Hart, Esq. "A Treatise on Collisions at Sea"—by Captain C. J. Perry, dedicated by permission to His Excellency Sir Henry Barkly, K.C.B.

Dr. Macadam laid upon the table a specimen of native zinc, found at Creswick.

R. L. J. Ellery, Esq., Government Astronomer, read a paper entitled, "On the Application of Galvanic Electricity and Practical Astronomy." The paper was illustrated by apparatus.

Arthur Dobree, Esq., read a paper entitled "On the Nidification of the Coach-whip Bird *(Psophodes Crepitans)*, and White-fronted Epthianura *(Epthianura Albifrons)*, with some general remarks on interesting forms of Nidification of Australian Birds. The paper was illustrated by numerous specimens of nests, eggs, &c.

Charles James C. Perry, Esq., Master Mariner, gave an oral description of his patent Anti-Collision Dial and Shipwreck Preventer, illustrated by the dial itself.

The Secretary read a note from J. Pittman, Esq., withdrawing for the present his paper entitled "On a new application of Photographic Art to assist Engravers in their operations, with remarks on the various processes of Photo-Lithography."

The Society then separated.

(Signed) RICHARD EADES, Vice-President.

ORDINARY MEETING OF THE ROYAL SOCIETY OF VICTORIA.

Monday, 17th Sept., 1860.

Richard Eades, Esq., M.D., Vice-President, in the Chair, in the unavoidable absence of His Excellency the President.

The minutes of the former meeting were read and confirmed, and on the suggestion of the Chairman, the presentation of newly-elected members to the meeting was postponed till another meeting, when His Excellency the President could perform that duty.

The Hon. Secretary read the names of four gentlemen as candidates for ordinary membership to be ballotted for at the ensuing meeting:—

Dr. C. J. Kenworthy, President of the Horticultural Society, Ballarat, &c., was elected by ballot an ordinary member.

The following contributions were laid upon the table, viz.:— "Proceedings of the Agricultural and Horticultural Society of Madras"—presented by Dr. Mueller. Nos. I. to VIII. inclusive of the "Victorian Farmers' Journal"—by the publishers. Three snakes (preserved in spirits of wine)—presented by Dr. Sommaur, Swan Hill, transmitted by Dr. Ludwig Becker.

The Secretary read communications from the Exploring party, and laid upon the table five sketches taken by Dr. Becker, during the journey of the Expedition from Melbourne to Swan Hill.

The Secretary read a communication forwarded to the Society by the private secretary of His Excellency the Governor, and enclosing a circular from His Grace the Duke of Newcastle, requesting information as to the materials collected and works published descriptive of the Natural History of the Colony of Victoria.

On the standing orders being suspended, the following committee was appointed to draw up a report on the subject so entrusted to the Society, viz:—

A. R. C. Selwyn, Esq., Government Geologist.
Rev. Julian Edmond Woods, Penola, S. A.
Professor Neumayer, Government Meteorologist.
Wm. H. Archer, Esq., Registrar-General.
R. L. J. Ellery, Esq., Government Astronomer.
A. B. Orlebar, Esq. Inspector of National Schools.
Dr. F. Mueller, Government Botanist.
Dr. T. S. Ralph,
Professor McCoy.
And Dr. McGillivray.

On behalf of the Council the Secretary moved, in pursuance of notice of motion, "That a distinct section for Medical Science, including physiology and pathology, be established, to be named section H, and that section D be proceeded with as a microscopical section exclusively." This was carried.

The contingent notices of motion affecting Rule LIX, were then carried, viz. :—1st, That the words after section D on to section E be struck out, and the following words substituted, viz :—"The Microscope and its Applications." 2nd, after "Architecture" insert the words "Section H—Medical Science, including Physiology and Pathology."

The Society then resolved itself into a *conversazione* of the microscopical section, and several members exhibited interesting objects under their microscopes.

The members then separated.

(Signed) Richard Eades, Vice-President.

Ordinary Meeting of the Royal Society of Victoria.

Monday, 8th October, 1860.

Richard Eades, Esq. M.D., in the Chair.

The minutes of the previous meeting were read and confirmed.

The Hon. Secretary read the names of three gentlemen as candidates for ordinary membership, to be ballotted for at the ensuing ordinary meeting.

The Secretary read communications from the Exploring party, &c.

The following gentlemen were duly elected ordinary members of the Society, by ballot, viz. :—

William Crooke, Esq., M.R.C.S.
F. J. Maguire, Esq., Consul, United States of America.
William R. Pugh, Esq., M.D., Collins-street.
J. S. Woolcott, Esq., solicitor, Church-street, Richmond.

The Secretary laid on the table the following contributions :—

A cabinet of fossils, shells, &c., a glass case of fossils, &c., several small cases of curiosities, drawings, books, bottles, with specimens of natural history, &c., being the contents of Mr. Becker's museum—presented by subscription. A list of foreign correspondents of the Smithsonian Institution, Washington—presented by the Institution. "Clarke's Southern Goldfields"—presented by the author, Rev. W. B. Clarke, M.A. Complete sets of the "Monatsbericht der Königlich Preuss. Akademie der Wissenchaften zu Berlin," from 1856 to 1859—presented by the Academy.

Dr. Coates read a paper entitled "On a Deposit of Fossil Diatomaceæ at South Yarra;" the paper was supplemented by verbal observations by Dr. Ralph, who had been associated with Dr. Coates in conducting the researches alluded to in the paper read. The paper was illustrated by drawings, executed under the Camera Lucida, by Dr. Ralph, and numerous preparations of the objects obtained from the deposit were also exhibited by means of the microscope.

W. Lockhart Morton, Esq., read a paper entitled "Suggestions for the Introduction of Animals and Agricultural Seeds."

W. Lockhart Morton, Esq., gave notice of motion—"That at the next meeting of the Society a committee be appointed to take into consideration and report upon the best means for procuring the introduction of new animals and the importation of new agricultural seeds into the colony.

(Signed) Henry Barkly, Chairman.

Ordinary Meeting of the Royal Society of Victoria.

Monday, 29th October, 1860.

His Excellency Sir Henry Barkly, K.C.B., &c., &c., President, in the chair.

The minutes of the previous meeting were read and confirmed. His Excellency introduced Mr. Charles Ledger to the Society, as the introducer of the Alpaca to Australia. The Hon. Secretary read a communication from Mr. Wills, of the Exploring party, accompanying his observations determining the camps of the party. The Secretary read the name of one gentleman as a candidate for ordinary membership. The Hon. Secretary read a communication from His Excellency, accompanying the letter from the Colonial Under-Secretary of State :—

"Downing-street, August 3rd, 1860.

"Sir,—The extreme want felt by the manufacturing interest of Great Britain of raw materials for the production of textile fabrics, has induced an application to the Committee of the General Association for the Australian Colonies, for the purpose of discovering the existence, if any, of some fibrous product in the Australian Continent which might tend to remove the difficulty, and at the same time prove a sufficiently valuable article of commerce to insure its being successfully and profitably cultivated.

"2nd. In compliance with the request of a deputation of the Australian Committee, who waited upon the Secretary of State, I have to draw your attention to the great importance of this subject, and to the probability of there being some fibrous grasses of a valuable kind indigenous to the Colony under your Government.

"3rd. It would be very desirable that these grasses should be collected, if possible by the Government botanist, and sent to England, consigned to the Colonial Agent, for the purpose of having their value tested in such a manner as may best secure the object in view.

"4th. In the event of its being found practicable to comply with this application, Mr. Bazley, M.P., has offered to place the Committee of the Australian Association in communication with several leading manufacturers, who will gratuitously test the value of the several consignments.

"I have, &c.,
(Signed) "G. C. Lewis."

His Excellency stated that he had already received a very valuable report from Dr. Mueller, the Government Botanist, on the subject of the fibrous productions of the Colony. He had no doubt Dr. Mueller would be happy to lay a copy before the Society.

Dr. Macadam then gave notice that at the next meeting he would move "That a Committee be appointed to carry out the object of the communication, and to report on the grasses of the Colony."

The Hon. Secretary then laid the following contributions on the table:—Mining Surveyors' Reports, No. 8, December, 1859, and No. 16, August, 1860, presented by the Board of Science; Vol. XVI., part II., No. 52, for May, of the Quarterly Journal of the Geological Society, presented by the Society; a segment of ball iron ore, presented by W. Lockhart Morton, Esq.

The following gentlemen were duly elected ordinary members of the Society:—

J. J. Blanche, Esq., schoolmaster, Tarraville.
Rev. Evan Macdonald, Kyneton.
Dr. M'Millan, Kyneton.

W. Lockhart Morton, Esq., moved "That a Committee be appointed to inquire into and report upon the best means for procuring the introduction of new animals, and the importation of new agricultural seeds into the Colony."

Dr. Eades seconded the motion, which was carried, as was also the following contingent motion—"That the following gentlemen be appointed members of the said Committee, with power to add to their number:—

John Macadam, Esq., M.D.
Dr. Ferdinand Mueller.
Rev. John I. Bleasdale.
Frederick Acheson, Esq.
John Walter Osborne, Esq., and
The Mover."

P. H. McGillivray, Esq., read a description of a new Australian species of Plumatella, and at the conclusion of the meeting exhibited the animal alive under the microscope.

Dr. Macadam, for Charles Wilhelmi, Esq., Assistant Government Botanist, read a paper by that gentleman on the "Manners and Customs of the Australian Natives, in particular those residing in the Port Lincoln District."

At the request of Mr. Lockhart Morton, the reading of his paper was postponed.

The Society then separated.

(Signed) Richard Eades, Vice-President.

Ordinary Meeting of the Royal Society of Victoria.

Monday, November 19th, 1860.

Dr. Richard Eades, Vice-President, in the Chair.

The minutes of the last meeting were read and confirmed.

William Lyall, Esq., M.L.A., was duly elected an ordinary member of the Society.

The Secretary laid on the table the following contributions, viz :—"Transactions of the Royal Society of Arts and Sciences of Mauritius"—presented by the Society. "Der Meteorit von Braunau am 14. Juli 1847;" "Bemerkungen über die Phyllopoden, nebst einer Uebersicht ihrer Gattungen und Arten;" "Ueber die Würmer-Entwickelung in den Pflanzen, deren Gefrieren und die Schutzmittel gegen dasselbe;" "Denkschrift zur Feier des 50jährigen Bestehens der Schlesischen Gesellschaft für vaterländische Kultur;" "Verzeichniss sämmtlicher Mitglieder der Schlesischen Gesellschaft für vaterländische Kultur;" "Bericht über die Thätigkeit der allgemeinen naturwissenschaftlichen Section der Schlesischen Gesellschaft im Jahre 1859 (2 copies);" "Das Erdbeben vom 15. Januar 1858, mit besonderer Berücksichtigung seiner Ausbreitung in der Provinz Preussisch-Schlesien;" "Botanische Mittheilungen;" "Actonien, Echinodermen und Würmer des Adriatischen und Mittelmeers;" "Grundzüge der Schlesischen Klimatologie;" "Drei und dreissigster, vier und dreissigster, fünf und dreissigster und sechs und dreissigster Jahres-Bericht der Schlesischen Gesellschaft für vaterländische Kultur—presented by Geh. Med. Rath Prof. Dr. H. R. Goppert Part XIV. of the "Fragmenta Phytographiæ Australiæ"—by Dr. Mueller.

Frederick Acheson, Esq., made some inquiries respecting the terms on which Mr. Landells had been engaged by the Exploration Committee.

The Hon. Secretary replied by reading the correspondence that had passed between Mr. Landells and the Committee on the subject.

Mr. Acheson considered the reply very satisfactory. Dr. Eades made a few remarks expressing his approval of the course Mr. Burke had pursued.

The Hon. Secretary read two short dispatches from the party. Dr. Macadam moved "That a Committee be appointed to inquire into the grasses of the colony," the Committee to consist of Dr. Mueller, Dr. Ralph, and W. Lockhart Morton, Esq. Rev. J. I. Bleasdale seconded the motion, which was carried. The bringing up of the reports of Committees was postponed to that day fortnight (Monday, December 3rd), to which day the present meeting was adjourned.

W. Lockhart Morton, Esq., read a paper entitled "Proposals for the formation of a new Colony in Northern Australia."

The reading of Mr. Wilhelmi's paper was postponed to that day fortnight.

The Society then separated.

(Signed) RICHARD EADES, Vice President.

ORDINARY MEETING OF THE ROYAL SOCIETY OF VICTORIA.

Monday, 10*th December*, 1860.

Dr. Richard Eades, Vice-President, in the chair.

The minutes of the preceding meeting were read and confirmed.

The Hon. Secretary read a letter from his Excellency the President, expressing his regret at not being able to be present.

The Secretary stated that he had received dispatches from Mr. Becker, but as they did not contain any matter of special interest that had not been already published, he would only read them, and lay on the table the sketches he had received.

The Secretary laid on the table the following contributions, viz., "Journal of the Statistical Society of London," Vol. XXIII., Part 3—by the Society. "Quarterly Journal of the Geological Society." "Essays on the Plants collected by Mr. Eugene Fitzallan, during Lieutenant Smith's Expedition to the Estuary of the Burdekin"—by Dr. Ferdinand Mueller.

Mr. Wilhelmi consented to the postponement of his paper.

The Hon. Secretary read a paper from the Rev. W. B. Clarke, entitled "Remarks on Professor McCoy's Paper."

Professor McCoy read a paper entitled "Notes on the Rev. W. B. Clarke's Paper."

Mr. Wilhelmi's paper was laid on the table for the perusal of members.

The Secretary mentioned that notices for motions for the alteration of laws would have to be given at this meeting, it being the last of the year previous to the annual general meeting.

(Signed) HENRY BARKLY, Chairman.

ANNUAL GENERAL MEETING OF THE ROYAL SOCIETY OF VICTORIA.

December 17*th*, 1860.

His Excellency Sir Henry Barkly, President, in the chair.

The Honorary Secretary laid the following contributions on the table, viz.:—"Astronomical Observations made at the Observatory, Sydney, in the Year 1859"—presented by W. Scott, Esq., M.A., Astronomer for New South Wales. "No. 18 of the Mining Surveyors' Reports"—presented by the Government. A valuable contribution had also been received too late to be duly announced in the notice paper, viz., "A Catalogue of 3,735 Circumpolar Stars observed at Red Hill in the Years 1854-5-6"—presented by R. C. Carrington, Esq., Fellow and Secretary of the Royal Astronomical Society of London. Accompanying the above, a letter was read announcing the arrival of seven volumes of the Geological Institute of Vienna. A letter was also read which had been received from the Honorary Secretary of the Literary and Philosophical Society of Manchester, proposing a regular exchange of publications with the Royal Society of Victoria. On the motion of the Honorary Secretary, the proposal was unanimously agreed to.

W. Lockhart Morton, Esq., presented for examination some fibre prepared from the flax grown at the Experimental Farm.

Francis A. Corbett, Esq., exhibited some specimens of a fibrous plant, a species of mallow, which grows in great abundance on the Darling; he also showed some paper manufactured from the fibre. He likewise exhibited specimens of a fibrous rush, a paper from which had also been manufactured, and read a short paper on the subject.

Dr. Coates read a paper entitled "Notes of some recent Microscopical Researches Relating to Adulteration of Articles of Food."

The Annual Report, and the Report on Prize Essays, were postponed to Saturday, the 22nd inst., to be read at an adjourned meeting then to be held.

The following alterations in the Laws were carried, viz.:—

1st, Moved by F. Acheson, Esq.; seconded by Richard Eades, Esq., M.B.V.P., &c., &c.:—

"That wherever the words 'Philosophical Institute of Victoria' occur, the words 'Royal Society of Victoria' be substituted, and wherever the word 'Institute' occurs, the word 'Society' be substituted." Carried.

2nd, Moved by J. W. Osborne, Esq.; seconded by F. A. Corbett Esq.

"That the following addition be made to Rule XVII.:—That any member of Council (the President excepted) absenting himself from three (3) consecutive ordinary meetings of Council without having obtained leave of absence from the Council, shall be considered to have vacated his office, and the election of an officer to fill his place shall be proceeded with at the next ordinary meeting of members, in accordance with Law XIII." Carried unanimously.

3rd, Dr. Gillbee moved, and Richard Eades, Esq., M.B.V.P., &c., &c., seconded:—

"That at the first ordinary meeting, after the Anniversary Meeting in March, the newly-elected President shall read his inaugural address at a conversazione, to be held in the hall of the Royal Society."

After a short discussion, His Excellency the President suggested that the object would be gained by substituting the words "annual conversazione" for the words "annual dinner," in Law XI., and Law XIII. to be altered in the same manner.

This suggestion was adopted, and the motion carried unanimously.

Dr. Thomas Sharman Ralph, as Secretary of the Microscopic Section D, reported that the first meeting would be held on Friday, the 22d inst., at Eight o'clock p.m., in the hall of the Royal Society.

The meeting was then adjourned to Saturday, the 22nd inst., at one o'clock, to receive the several reports.

Adjourned Annual General Meeting.

December 22nd, 1860.

Dr. Eades, Vice-President in the chair.

BUSINESS.

To consider and receive sundry reports.

The Auditor laid the Treasurer's Report on the table, which was adopted after a short discussion.

The reports of the Prize Essay judges were severally read by the Hon. Secretary, and adopted.

The report of the Committee appointed to inquire into the Indigenous Fibrous Plants of the Colony was considered, and, after a short discussion, adopted.

The Annual Report was read by the Hon. Secretary, and, after a conversational discussion, adopted. The Society then separated.

ANNUAL REPORT FOR 1860.

In submitting the first Annual Report of your Society, since its designation has been changed from that of the Philosophical Institute of Victoria to that of the Royal Society of Victoria, it is the pleasing duty of your Council to announce that during the past year fifty-six new members have been elected, of whom two were honorary and fifty-four ordinary members.

The roll of membership, as furnished by your Treasurer, contains one hundred and fifty-three paying members for the year 1860, not including those whom it has been deemed desirable to retain on the suspense list.

Your Treasurer's Report shows a balance of only £10 9s. 4d.; but, in laying this statement before you, it is important to bear in mind the large amount of business transacted by the Society, and the important interests that have been entrusted to its administration as well as the increased size of the volume and the number of illustrations in your "Transactions," the publication of which has cost the sum of £264 9s. 3d., of which £53 9s. 9d. yet remains unpaid.

It is the duty of your Council to call the attention of members to the importance of paying up their subscriptions at the commencement of the year, and thereby place the Treasurer in funds to meet the necessary expenditure for carrying on the business of the Society. The very large number now on the suspense list have been placed there most reluctantly, but the deficit in the funds was so considerable, that your Council, at a meeting held December 12th, unanimously passed the following resolution :—

"That the names of all members whose subscriptions are for 1860 unpaid (except those elected in 1860), and whose membership is already forfeited, according to Rule XXV., be placed on a Suspense List, and a notice sent to each, that if the subscriptions be not paid by the 31st day of the present month, their names shall be struck from the roll of membership."

The Council sincerely trusts that it will not be necessary to resort to so unpleasant a duty as erasing a single name from the list when the members have been duly reminded of their neglect.

The Council has also to remind the Society that the funds have not been supplemented during the past year with any aid from Government, but there is reason to hope that a sum of £1000 to £1500 will be placed on the estimates in aid of your operations during next year. The importance and number of the duties that were devolved on the Society during the past year, justify the expectation that Government and the Legislature will favourably entertain the application for the larger of the sums mentioned.

The quantity of manuscript now in the hands of your Council for publication, including the several reports of committees, will involve an outlay fully equal to the expenditure of the last year for publishing your "Transactions."

During the present session, besides the anniversary Meeting, two special, one adjourned, and twelve ordinary meetings have been held. At these meetings sixteen papers have been read, and several subjects of much interest have been discussed. Of the papers, your Council has selected fifteen for publication.

The Society now numbers among its correspondents one hundred and thirteen (113) kindred societies, and several eminent scientific and literary gentlemen in Europe, America, and other parts of the globe.

The public business entrusted to the Society by the Government during the year has been of more than usual importance. Early in the session the Society was requested to administer the funds subscribed for the Exploration of the Interior, and to superintend the expenditure of the sum voted by the Legislature for that purpose. The discharge of these trusts has not only involved great responsibility, but some expense and much anxiety. The greater number of the members of the Committee being also active members of the Society, the time required by the frequent meetings has been no inconsiderable tax on the several members. These labors and sacrifices have, however, been cheerfully borne, and the various duties they entailed have been zealously performed. It is therefore with great satisfaction your Council congratulates the Society on the success that has hitherto attended the efforts made to secure the objects of the Exploring Expedition.

The Society has also had confided to it a series of queries, involving matters of scientific interest and economic importance, relating to the Natural History of the British Colonies. These queries have been responded to by several gentlemen, members of your Society, appointed for that purpose, in a manner that displays much care, and it is confidently expected they will prove of great value in promoting the objects contemplated by the Imperial Government.

Your Council had likewise committed to it the distribution of the sum of six hundred pounds (£600) voted by the Legislature for "Prize Essays," and the reports now given in by the Judges appointed by your Council, and approved by the Government, will demonstrate the care and diligence with which that delicate and onerous duty has been performed.

The Society has further been requested to furnish a report, for the Imperial Government, "On the Fibrous Products of the Colony capable of being made useful for Textile Fabrics." In reply to which a valuble report has been furnished, and laid on your table at the last meeting.

The Microscopical Section (D), and the Chemical Section (B), have been declared established, and a temporary convener appointed to officiate during the recess, until the formal appointment of the usual officers in March, in accordance with Law LXIV.

Your Council has had under consideration the subject of an Industrial Exhibition during 1861, in anticipation of the one to be held in the British Metropolis, in 1862. And, with a view to the accomplishment of this object, a deputation, consisting of Dr. Eades and Dr. Macadam, waited on the late Chief Secretary to urge the importance of the subject, and the sum of £6000 was promised to be placed on the estimates for that purpose. The recent political changes have interrupted the completion of these arrangements, but there can be no doubt so important an object will not be overlooked by the present Government, and, in the event of such arrangements being completed, your Council will be fully prepared to carry out the business with promptitude and diligence, if entrusted with the details.

It must be obvious that so great a variety of laborious duties have not been completed without much valuable time having been occupied, as well as anxious thought bestowed on the several subjects requiring investigation and administration. And, in concluding this report, your Council would call especial attention to the want of committee rooms. This deficiency has been a serious inconvenience during the past year, and, in some instances, has impeded the progress of business. It is therefore on public grounds that the assistance of the Legislature and Government is sought to provide the requisite accommodation for conducting inquiries and furnishing such information of matters of interest to the general welfare of the empire as may be required by the Imperial or Colonial Governments. These rooms will also serve to accommodate the Sections, as by mutual arrangement they can be made available for different meetings on the several days of the week.

The claims of your Society might also be urged on the ground of public economy, as, by the duties gratuitously undertaken from time to time by the various committees, much valuable public time is saved and the public service advanced. Besides, the advantage to the colony at large as well as the Government of having a public body unfettered by party ties and unaffected by political changes, to which questions of social interest may be referred for investigation, must be obvious to every intelligent member of the community, and hence the importance of maintaining such a body in a state of efficiency for prosecuting its important and interesting labors.

In closing the session of 1860, your Council looks back with pleasure to the unbroken harmony that has characterised all its proceedings, and reflects with much gratification on the results of the year, so far as relates to the steady progress of your Society in usefulness and efficiency. The one drawback to unmixed satisfaction it is deemed necessary to notice is the low state of your funds, but it may surely be hoped that it is only necessary to make this fact public, and the needful supplies will be at once furnished, so as to enable the Society to not only occupy the spheres of usefulness it has already filled, but to extend its operations into others of even greater importance to the material interests of the community, which are daily opening before us and inviting our co-operation.

The following gentlemen retire from office, but are eligible for re-election :—The President, His Excellency Sir Henry Barkly, K.C.B. ; the Vice-Presidents, Dr. Eades and Professor Neumayer ; the Treasurer, Rev. J. I. Bleasdale ; the Honorary Secretary, Dr. Macadam ; C. W. Ligar, Esq., C.E. ; Clement Hodgkinson, Esq., C.E. ; John Millar, Esq., C.E., F.S.A. ; Dr. Gillbee ; Thomas E. Rawlinson, Esq. ; H. F. Eaton, Esq.

M. H. IRVING, ESQ., TREASURER, IN ACCOUNT WITH THE PHILOSOPHICAL INSTITUTE OF VICTORIA.

Dr.

To Subscriptions for 1860—		
64 annual, at £2 2s.	£134 8 0	
14 annual, at £1 1s.	14 14 0	
		£149 2 0
To Subscriptions for 1859—		
2 annual, at £2 2s.		4 4 0
		£153 6 0
To Sale of Transactions to J. E. Rawlinson		1 0 6
		£154 6 6
To Balance in hand, as per last balance sheet	£180 11 1	
Less petty cash	0 16 6	
		179 14 7
		£334 1 1
Deduct*		19 19 0
Subscriptions credited to Royal Society		£314 2 1

* Among the subscriptions acknowledged in Block Book appear £19 19s. under the names of Pitman, Waugh, Bosisto, Rydes, Watson, Mackie, Robertson, Higginson, Symonds, and Corbett. These did not require to be transferred.

Cr.

By Expenses of Management—		
Treasurer	£5 0 0	
Secretary	5 0 0	
		£10 0 0
By Hall and Grounds—		
Picture Frame	£30 0 0	
Matting	16 2 0	
Shelves	3 1 0	
Timber	2 15 6	
Glass	1 0 0	
Gas Rod	0 10 6	
Cartage	1 0 0	
Gate	1 18 0	
		56 7 0
By Transactions, Vol. IV., Part II.—		
Printing	£49 9 9	
Detmold, Binding	12 10 0	
		61 19 9
		£128 6 9
Balance transferred by M. H. Irving		185 15 4
		£314 2 1
		19 19 0
		£334 1 1

M. H. IRVING, EX-TREASURER.

Audited and found correct, WILLIAM CLARSON, CHARLES FAREWELL, } AUDITORS.

JOHN I. BLEASDALE, ESQ., IN ACCOUNT WITH THE ROYAL SOCIETY OF VICTORIA.

Dr. — Cr.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
To Balance transferred from Philosophical Institute, as per Balance Sheet attached	£185	15	4	Grant for Clerical Assistance to Secretary	£120	0	0
To Subsciptions for 1860	116	10	6	Postages	21	0	0
To Subscriptions of 17 new Members, @ £2 2s.	35	14	0	Treasurer:—Postage and Petty Expenses	10	0	0
To 34 Entrance Fees, @ £2 2s.	71	8	0	Printing Circulars and Envelopes	14	3	6
To Bank Interest	1	7	0	Improvement of Grounds	35	0	0
To Petty Receipts	0	4	6	Drainage and Pipes	15	0	0
				Publications of "Transactions":—			
				Mason & Co.	80	0	0
				Lithographs	49	0	0
				Binding	20	0	0
				Elliott—Cabinet	10	0	0
				Door Scrapers	2	11	6
				Sands & Kenny	3	14	3
				Gas	1	1	0
				Hickinbotham	6	11	0
				Gas	7	8	9
				Insurance	5	0	0
				Cash in hand	10	9	4
	£410	19	4		£410	19	4

We have audited the Accounts, and found them correct.

CHARLES FAREWELL,
WILLIAM CLARSON,
} AUDITORS.

REPORTS OF COMMITTEES.

PROGRESS REPORT OF EXPLORATION COMMITTEE.

DRAWN UP BY DRS. MUELLER, WILKIE, AND MACADAM.

In the Report presented by your Committee for 1859, you were congratulated upon the successful accomplishment of the laborious undertaking to raise the sum of £2000 by private subscription, in order to secure the munificent donation of £1000, promised by an anonymous donor, on that condition, for the purpose of organising a party to explore the interior of Australia.

Your Committee also expressed a hope that the Legislature would supplement these amounts with a vote of £6000. This sum was promptly appropriated by Government and duly voted by the Legislature, for the purpose, and placed at the disposal of your Committee, by the Hon. William Nicholson, Chief Secretary.

The importance of taking advantage of the winter season to penetrate the arid regions of the interior was not overlooked by your Committee, but as a sum of £3000 had been forwarded by Government to India, to purchase camels for this express object, it was deemed, after careful consideration, to be better to await the arrival of these "ships of the desert," rather than hasten the departure of the Expedition before they arrived. A light party, to reconnoitre the vicinity of Cooper's Creek, was at one time seriously thought of, but no advantage seemed likely to be gained by such a proceeding, that would compensate for the large additional outlay it would entail.

The camels, twenty-five in number, arrived in Hobson's Bay June 25th, in good order and condition, under the care of Mr. George James Landells, on board the "Chinsurah," Captain Gisborne, and immediate arrangements were made to have them safely landed and properly housed. Your Committee has gratefully to acknowledge the ready co-operation of the Government in securing these important objects.

The important duty of selecting a Leader for the Expedition was the next and most anxious duty that devolved on your Committee. The names of several highly eligible gentlemen were submitted for consideration, but, after mature deliberation, it was resolved to announce that the appointment was open, and candidates were invited to offer their services.

In reply to this invitation a number of gentlemen, of various qualifications, presented their credentials, and sought the arduous but honorable post. The difficulty your Committee experienced in making a selection was increased by the number of apparently suitable candidates that offered their services. After much anxious inquiry and careful deliberation, your Committee selected Robert O'Hara Burke, Esq., Superintendent of Police in the Castlemaine district, and formerly a cavalry officer in the Austrian service, whose appointment to this onerous office was duly endorsed by the Government.

Your Committee, feeling strongly that it was of the first importance the Leader of so difficult an undertaking as traversing the wilds of an unknown region should have the free and uncontrolled selection of his officers and men, conceded to Mr. Burke at once the entire management of the organization of his party. Accordingly the whole number of applicants were invited to meet the leader at the Hall of the Royal Society, when out of about 700 candidates the following were selected, after personal interviews and careful inquiries:—

George James Landells, second in command
William John Wills, Surveyor and Astronomer
Herman Beckler, Medical Officer and Botanist
Ludwig Becker, Artist and Naturalist, &c.
Charles D. Ferguson, Assistant and Foreman
William Patten, Assistant
Patrick Langan, do.
Owen Cowen, do.
Robert Fletcher, do.
Henry Creber, do.
William Brahe, do.
John Drakeford, do.
John King, do.
Thos. F. McDonough, do.

These men, after a careful examination by Dr. William Gillbee, on behalf of the Committee, were pronounced by him free from physical defect and disease.

The final selection of the route was the next subject of anxious consideration demanding the attention of your Committee.

There were three principal routes proposed for selection, namely,— 1st. Port Augusta, at the head of Spencer's Gulf, and thence to the north. 2nd. Blunder Bay, at the mouth of the Victoria, on the north-west coast, and thence across the country to the South. 3rd. Across the country by the most direct route to Cooper's Creek, in lat. 27° 37′ 8″, long. 141° 5′, where the party would be on the verge of the unexplored country, and on a spot where permanent water could be had, and a depot formed, whence excursions could be made to the north or north-west as might be deemed desirable, and upon which the party could at any time fall back for supplies in case of necessity.

The vital importance of the selection to be made gave your Committee much anxiety, in which the grave responsibility resting on every member of it was sensibly felt. The reasons for each of these routes were carefully and calmly weighed, and after a full and earnest debate, the route by Cooper's Creek was finally selected, as possessing the greatest number of advantages that could be secured consistently with the successful prosecution of the objects of the enterprise.

The preparations for the long journey were, in the meantime, rapidly progressing, and the outfit, as suggested by the Committee and Leader, was approved of by the Government, and furnished for the most part by the Government Storekeeper. (The list is printed in Appendix I.)

The expedition being fully equipped and prepared, took its departure from the Royal Park, August 20th, 1860, in the presence of a vast concourse of the inhabitants of Melbourne, who enthusiastically cheered the caravan as it started on its perilous and interesting journey; Dr. Richard Eades, Mayor of Melbourne, and Vice-President of the Society, on behalf of the people, wishing Mr. Burke and his companions God-speed.

Your Committee has only further to state that notwithstanding some changes in the party, satisfactory progress has been made, and the latest intelligence confirms the opinion that the efficiency of the Expedition has been improved by the alterations and reductions that have been effected.

Your Committee refrains from making any comments on the secession of some officers, and other events of minor importance which have been placed before the public from time to time; and in closing this report, earnestly commends the interests of the Expedition and the fair fame of the gallant leader, with all his devoted officers and brave companions, to the proverbial candour of all honorable men, and the warm sympathy of the Royal Society.

REPORT OF THE COMMITTEE ON THE INTRODUCTION OF NEW ANIMALS AND AGRICULTURAL SEEDS.

YOUR Committee has carefully considered the matter entrusted to it, and has now the honour of reporting as follows:—

The first important step seems to consist in collecting information respecting the most valuable seeds and animals to be found in other countries; it has therefore drawn up a circular embodying a number of questions, which circular your Committee would recommend should be submitted to His Excellency the Governor, with a request, that His Excellency would be pleased to transmit the same to the English Consuls at foreign ports, and to the Ministers of foreign States, with the view of obtaining full answers to the questions therein embodied.

Your Committee would further recommend that the Zoological Committee, the Port Phillip Farmers' Society, the Board of Agriculture, and all other public bodies, as well as private individuals, interested in such matters, should be invited to co-operate with this Society, in thus endeavouring to advance the best material interests of this colony.

It would also suggest that a copy of the afore-mentioned circular should be forwarded to the English and the French Societies for the Acclimatisation of Animals, and to all other kindred societies, soliciting their co-operation in obtaining information.

WILLIAM LOCKART MORTON, Chairman.

DRAFT OF CIRCULAR REFERRED TO.

Sir—The Royal Society of Victoria, being anxious to obtain the most authentic information respecting foreign Agricultural Seeds and useful Animals, with the view of aiding in their introduction into Australia, has the honor to request that you will kindly furnish it with information on the following subjects, as far as convenience may permit.

1. What animals are most esteemed in your country for draught or burthen?

2. What varieties of animals are kept for the growth of wool or hair? What is the average weight and the market value of the fleece of each kind respectively? To what purpose is each material applied? Is the flesh of such animals much esteemed as human food? What is the value of the skins of each sort, and for what manufacture or other purposes are they employed?

3. What is the respective average weight of such animals when fit for slaughter? What is the character of the pastures upon which they thrive best, and are they easily kept or otherwise?

4. What animals do you keep for dairy purposes? What average quantity of milk or butter do they yield? What is the character of the pasture upon which they are kept?

5. To what average weight do your larger animals devoted to slaughter attain when fat? To what purposes respectively are the hides, horns, and bones of such animals applied?

6. What animals more immediately useful, but still in a wild state, are found in your country? Are there any that might be profitably domesticated? Are such of any value in a wild state? Could they be advantageously kept in a semi-domesticated state? or, could they be rendered useful by acclimatisation, in other countries, in a wild state?

7. What varieties of fowls or other birds have you in a domesticated state, and what are their superior qualities?

8. Have you any superior kinds of fresh or salt water fish; if so, please state their average size, and mention the character of the waters they live in?

9. Does your country produce any other animals not belonging to the afore-mentioned categories, and which of all the animals you possess would you recommend for acclimatisation in other parts of the globe?

10. With what facilities could any of such animals be procured, and at what probable cost?

11. What agricultural or other valuable seeds are sown in your country?

12. What is the yield per acre of your best varieties of grain?

13. What is the character of the soil and climate best adapted to your agricultural plants respectively, and what is the mode of cultivation practised?

14. What cereals, pulse, roots, &c., are cultivated for human food, and what varieties are grown for feeding or fattening stock?

15. Can you give the results of any experiments to illustrate the fattening qualities of articles grown expressly for this purpose?

16. What varieties of fruits and vegetables are generally grown, specifying which kinds are yielded most abundantly, and are most prized?

17. Which of your indigenous grasses or forage plants are most luxuriant in growth, and which are capable of standing hot, cold, wet, or dry weather, respectively?

18. What area of average pasturage, consisting of any of the grasses or plants you may possess, is required for the keep of a single ox or other animal? and what area is reckoned necessary for fattening either of your domestic animals?

19. Are there in your country any indigenous forage-plants that might be improved by cultivation?

20. Does your country possess any other valuable forms of vegetable life, and which of all the seeds, plants and fruits, belonging to

your country, would you recommend for acclimatisation in other countries of the globe?

You are respectfully informed that a copy of this circular has been sent, so far as that has been possible, to every country throughout the world; and the Royal Society of Victoria trusts, that as the object aimed at is not of a selfish character, but intended to benefit all countries alike, full replies may be given to the subjects embodied in the foregoing questions, whereby a mass of information will be collected for universal diffusion.*

REPORT OF PRIZE ESSAY JUDGES.

DURING last year (1859) the following notification was made public:—

"ROYAL SOCIETY OF VICTORIA.—GOVERNMENT PRIZE ESSAYS, 1860.

"The Council of the Royal Society of Victoria has to announce that the Government has placed at the disposal of the Council the sum of six hundred pounds sterling, voted by the Legislative Assembly as Premiums for Essays. The Council has decided, with the sanction of the Government, that the premium to be awarded for the best essay on each subject shall be one hundred and twenty-five pounds sterling, with a medal. The following subjects have been selected, viz.:—

"1. On the Collection and Storage of Water in Victoria for Gold-Washing, Irrigation, Motive-Power, and General Water Supply; with reference also to the practicability of Artesian Wells in certain localities.

"2. On the Origin and Distribution of Gold in Quartz-Veins, and its Association with other minerals, and on the most approved Methods for Extracting Gold from its matrices.

---

* Since the drawing up of this Report the Acclimatisation Society of Victoria has been formed, and is now carrying out, under the auspices of the Government and the liberality of the Legislature, the objects here contemplated.

"3. On Agriculture in Victoria, with special reference to the Geological and Chemical Character of Soils, to the Rotation of Crops, and to the sources and Application of Manures.

"4. On the Manufactures more immediately required for the Economical Development of the resources of the Colony, with special reference to those manufactures the raw materials of which are the produce of Victoria.

"Competitive essays on the above subjects are required to be written in a legible hand, on foolscap paper, on one side only, and leaving a two-inch margin. The authors will attach mottos only to the essays, and accompany each essay with a sealed envelope, containing inside the name and address of the author, and on the outside the motto affixed to the essay.

"The essays must be in the hands of the Honorary Secretary of the Royal Society on or before the 1st of October, 1860.

"The Council will appoint, subject to the approval of Government, three judges, who may or may not be members of the Society, to decide on the respective value of the competitive essays on each of the four topics named; but the Council reserves the power to withhold the premium in the case of any of the subjects, should the competitive essays on that subject be considered unworthy of such a reward.

"The essays receiving premiums shall be considered the property of the Government.

"Royal Society, Victoria-street, Melbourne, March 28, 1860."

In accordance with this notification, essays to the number of twenty-six were forwarded to the Royal Society, and, after careful examination, the following essays were adjudged to be the successful ones, viz.:—

The subjects treated of in these essays all relate to the further development or more economical use of the principal natural resources of the colony. While some of these have been already so fully developed as to have placed Victoria in a commanding position, it can scarcely be denied that others admit of still further development, and indeed must have the attention they demand, if the progress of the country is to be at all commensurate in the future with that which has marked it for the last few years. Moreover, as the increase of population requires that new sources of industry should be made known, these essays are also designed to indicate the direction in which such sources may be found by those whose unemployed labor or capital seek for a fresh outlet for profitable investment.

The first essay treats of the economical use of the water supply of the country, so as to render it more available for the gold miner, the agriculturist, the manufacturer, and for general, domestic, and sanitary purposes. By collecting and storing the frequently superabundant supply of water, so as to insure a more constant and less costly one, valuable assistance will be given to existing industrial pursuits, many of which are less permanent, at present, than if they could fall back on a reliable water supply, thus adding to the profitable employment of the population and the increase of the available wealth of the country.

The second essay deals with an important branch of gold mining enterprise, and while, to some extent, necessarily taken up with discussing the theories as to the formation of quartz lodes, it yet enters into practical details which cannot fail to be of benefit to those engaged in quartz mining pursuits, enabling them to conduct their operations with more economy, and to utilise what has often been hitherto considered the refuse of the mines, the waste arising from ignorance of its value, or the proper method of treating it to advantage.

The third essay is occupied with the geological and chemical character, &c., of the various soils of the country, a correct knowledge of which alone can enable the agriculturist to carry on his operations with success when the original qualities of the soil have been exhausted, and it becomes necessary to add fertilising elements to make up for those in which it has become poor. To those who are informed on such matters the essay in question may not be entirely profitless; while to those—and they are many—whose farming operations are frequently matters of haphazard, this essay will be read with pleasure, and the principles laid down in it probably followed with advantage.

The questions of water-supply, agriculture, and gold mining having been so far disposed of, the fourth essay is occupied with the consideration of the manufactures which may be necessary to the economical development of such resources as have been as yet but partially recognised in Victoria. A proper degree of attention to the several matters treated of in these essays will, to some extent, enable those, whether in Victoria or at a distance, who possess either less knowledge or more capital than the writers, to judge of the fitness of Victoria as a field for the employment of labor, or the investment of capital.

Whatever else may be the result, it is to be hoped that the perusal of these essays will incite to a more careful study, and a more economical use of the vast resources which require but science and industry to develop them, that Victoria may go on from prosperity to prosperity, celebrated not only for her fertile soil and inexhaustible mineral wealth, but also for her superior manufactures, and the quality of the raw materials she is destined to supply so largely for the industry of other countries.

John Macadam, M.D.,

Honorary Secretary to the Royal Society of Victoria.

REPORT OF THE COMMITTEE ON THE INDIGENOUS FIBROUS PLANTS OF THE COLONY SUITABLE FOR PAPER-MAKING.

Government Offices, Melbourne,
17th October, 1860.

SIR—I am directed by the Governor to forward to the Royal Society of Victoria the enclosed copy of a despatch which His Excellency has received from the Imperial Government, requesting information with regard to any fibrous plants or grasses that may exist in this colony.—I have the honor to be, Sir, your obedient servant,

O. F. TIMINS, Private Secretary.

Dr. John Macadam, M.L.A.,
Secretary Royal Society of Victoria, &c.,

(COPY.)

Downing-street, 3rd August, 1860.

SIR—The extreme want felt by the manufacturing interest of Great Britain of raw material for the production of textile fabrics, has induced an application to the Committee of the General Association for the Australian Colonies for the purpose of discovering the existence (if any) of some fibrous product in the Australian Continent which might tend to remove the difficulty, and at the same time prove a sufficiently valuable article of commerce to ensure its being successfully and profitably cultivated.

2. In compliance with the request of a deputation of the Australian Committee who waited upon the Secretary of State, I have to draw your attention to the great importance of this subject, and to the probability of there being some fibrous grasses of a valuable kind indigenous to the colony under your government.

3. It would be very desirable that these grasses should be collected (if possible) by the Government Botanists, and sent to England—consigned to the colonial agent—for the purpose of having their value tested in such a manner as may best secure the object in view.

4. In the event of its being found practicable to comply with this application, Mr. Bazley, M.P., has offered to place the Committee of the Australian Association in communication with several leading manufacturers, who will gratuitously test the value of the several consignments.—I have, &c.,

(Signed) G. C. LEWIS.

REPORT.

Melbourne Botanic and Zoological Gardens,
October, 1860.

Sir—I have the honor to acknowledge the receipt of your letter, dated 15th October, accompanied by a copy of a despatch from the Under-Secretary of State for the Colonies, desiring information on such plants, yielding textile fibre, as are indigenous to the colony of Victoria, and are likely to supply a want of raw material for British manufactures.

Whilst in compliance with his Excellency the Governor's request, I beg to submit such information as I possess on indigenous vegetable fibres, I regret that I cannot point to any native plant extensively available for the desired purpose, or holding out the prospect of successful introduction into British manufactures.

But it appears to me that the two varieties of New Zealand flax (*Phormium tenax*) are deserving of especial attention, as likely to supply the wanting material to British weavers, the strength of the phormium fibre being almost equal to that of silk, and little doubt being entertained that finally the genius of invention will overcome the hitherto experienced difficulty of separating by an easy method, without sacrifice of the material's strength, the fibre from the leaves.

I beg further to draw attention to the extreme facility with which this plant might be reared on places not available for any other cultivation (such as margins of swamps, periodically inundated banks of lakes, &c.); further, to its great vigor of growth, to the probability of its proving quite hardy in the southern parts of England and Ireland, and to the certainty of its cultivation being attended with full success in South Europe, and therefore in proximity to the British market, and under the advantage of cheap labor.

Specimens for experiment on this promising, and moreover highly ornamental plant will be readily available in Europe, where the plant has been introduced already, in the beginning of the year 1788.

The fibre of the less prolific *Doryanthes excelsa*, or Giant Lily, of New South Wales, greatly resembles that of the phormium.

The fibre of various of our native plants is employed by the aborigines for making their nets and fishing lines, and indiscriminately called by them "Curryong." Still it remains yet a subject of inquiry whether the products of these plants can be brought into qualitative competition with other textile fibres hitherto drawn into universal use, admitted even that the respective plants could be found all in sufficient abundance, or cultivated with a prospect of remunerative yield.

The *Pimelea axiflora* (Ferd. Mueller) was recently observed in great frequency near Twofold Bay, whence it extends to Port Phillip, and I shall have no difficulty, therefore, to obtain of its tough bark, and of that of the allied *Pimelea ligustrina*, *panciflora*, and *microcephala*, samples of bark, all four species being of tall growth, and hence of large yield of fibre.

Sida pulchella (Bonpl.), *Brachychiton populneum* (Rob. Brown), and *Commersonia Fraseri* (Gay), are the other native plants known to be principally employed by the aborigines for obtaining cordage. Considerable quantity of the bark of the former might be gathered in the forests of this colony and of Tasmania ; the two other species have but their scattered outposts on the eastern frontiers of Gipps Land, the main body of plants extending through New South Wales and Queensland.

We possess in Victoria a few species of asclepiadeous plants, which yield a kind of cotton similar to that once by the ancients spun into ropes, as microscopically demonstrated from Pompeiian relics ; but since allied European asclepiadeæ seem no longer employed in the older countries, it is not likely that we will derive advantages of those of these states.

A perennial flax (*Linum marginale*, All. Cunn.) is by no means rare in this colony, but it is not likely to possess any advantages over the common flax, should, indeed, it bear comparison with the European cultivated one.

The Tasmanian stringybark trees, which, as I anticipated, have been, by comparison with original specimens in Sir Joseph Banks' herbarium, identified by Mr. Richard Kippist with the original *Eucalyptus obliqua* of L'Heritier (having been collected during Cook's third voyage at Adventure Bay, by David Nelson), yields, as well as an allied species, which bears amongst the colonists the name of " Mountain Ash," a certainly fibrous, still, not tenacious bark, therefore not available for textile fibre, although, perhaps, for the manufacture of a coarse paper ; otherwise their bark, which moreover is so readily separable, might be obtained in the utmost profusion.—I have the honor to be, Sir, your most obedient servant,

FERD. MUELLER, Government Botanist.

To Capt. Timins,
Private Secretary to His Excellency
Sir Henry Barkly, K.C.B., &c., &c., &c.

POSTSCRIPT.—Attention may also be directed to the fibre of some species of stipa, common in this colony, and more particularly to the fibre yielded by a sedge, *Cypirus vaginatus*, which occurs in the greatest abundance on the River Murray and its tributaries, and in many other parts of Victoria. The aborigines form very durable and tenacious cordage from this sedge, and employ it extensively for fishing nets.

The useful fibrous properties of the *Lepidosperma gladiatum*, and another plant, the *Lavatera plebeja*, were brought into notice by Mr. Alexander Tolmer, of South Australia, who had observed the natives use them for the purpose of making baskets and fishing nets. This circumstance induced him to attempt to turn them to account for the purpose of making paper. Accordingly, to test them, he sent a quantity to England, where it was made into a useful paper.

The *Lepidosperma* is perennial, and has been found in large quantities growing most luxuriantly on the banks of the Murray and several other parts of the Australian continent.

The manufacturer in England who tried its paper-making qualities reported "that there is no doubt whatever of its making good paper; but that the price, exact loss of weight, &c., can only be determined by a continuous working of a large quantity."

To prepare it for the market, it may either be cut down close to the roots, the root being left to spring again. It is then left exposed to the action of the night dews, and the hot sun in the day, and occasionally turned over, until by this exposure the plant becomes partially bleached. It is then cut up into short lengths in any suitable machine, such as a chaff-cutter, and afterwards bleached by chloride of lime or any other of the well-known bleaching processes. It contains a gummy matter, which it is of importance to free it from. The material will then be in a fit state to be manufactured in the same manner as any other fibrous material is converted into paper.

The *Lavatera plebeja* is also an indigenous perennial plant, and grows freely throughout South Australia, Victoria, and New South Wales. It may be obtained in considerable quantities along the banks of the Murray and many of its tributaries, and is also found scattered over various parts of the colony. The fact of its abounding along the banks and in the marshes of a navigable river, such as the Murray is, renders it highly probable that it may be made an article of commerce.

The surveyor of the Victorian Expedition reported that "it clothes the banks of the Moriaminta Creek, and grows to an immense size on nearly all the creeks out here"—that is, beyond the Darling.

The treatment of this plant for the purpose of paper-making corresponds with that applied to the *Lepidosperma gladiata.*

LIST OF INSTITUTIONS, LEARNED SOCIETIES, &c., RECEIVING COPIES OF THE TRANSACTIONS OF THE ROYAL SOCIETY OF VICTORIA, 1860.

VOL. IV.

Royal Asiatic Society, London
Foreign Office Library
Horticultural Society, London
Zoological Society, London
Athenæum, London
British Museum, London
Meteorological Society, London
Statistical Society, London
Geological Society, London
Royal Astronomical Society, London
Museum of Economical Geology
Royal Society, London
Institute of Engineers
Royal Geographical Society
Linnæan Society of London
University Library, Cambridge
Philosophical Society, Cambridge
Philosophical Library, Oxford
Royal Irish Academy
University Library, Edinburgh
Professor Balfour, Edinburgh
Royal Society, Edinburgh
University Library, Glasgow
Royal Botanical Society, Edinburgh
Royal Scottish Society of Arts, Edinburgh

Royal Society of Copenhagen
Royal Academy, Stockholm
Meteorological Society, Utrecht
Royal Botanical Society, Ratisbon
Society of Naturalists, Halle
Imperial Society, Moscow
Archælogical Society of Copenhagen
Petermann's Geographical Journal
Royal Institute, Utrecht
Ernest A. Zueholdt, Leipzig (in reciprocation for his Journal)
Philosophical Society, Sydney
Philosophical Society, Adelaide
Smithsonian Institute, Washington, U.S.
Natural History Society, Boston
Royal Society, Tasmania
American Philosophical Society, Philadelphia
Pharmaceutical Society, Victoria
Augustus Gregory, Esq., Brisbane
His Excellency Sir H. Barkly, K.C.B., for transmission to Her Most Gracious Majesty Queen Victoria, 5 copies
Sir W. Denison
C. Ledger, Esq. (in reciprocation for coca leaves)
Duke of Newcastle
H. R. H. Prince Albert
Professor Asa Gray, Boston, U.S.
Royal Society of Arts
Trinity College, Dublin
Royal Society of Edinburgh
Philosophical Society, Glasgow
Imperial Institute, Vienna
Society of Arts, Mauritius
Institute of France
Imperial Geographical Institute, Vienna
Society of Arts and Sciences, Batavia
Professor Goeppert, Breslau
Professor Grube, Koenigsberg

Museum, Cape of Good Hope
Agricultural and Horticultural Society, Madras
Royal Academy, Berlin
Imperial Academy, St. Petersburg
Society of Culture, Silesia
Royal Academy, Munich
Society of Naturalists, Blankenburg
Royal Society, Goettingen
Physiographic Society, Lund
Society of Northern Antiquaries, Copenhagen
Geographical Society, New York
Professor Haidinger, Vienne Geological Institute
Societé Imperiale d'Acclimatisation, Paris
Horticultural Society of St. Petersburg

MEMBERS

OF

THE ROYAL SOCIETY

OF VICTORIA.

MEMBERS

OF

The Royal Society of Victoria,

31st December, 1860.

(AS FURNISHED BY THE TREASURER.)

[Those whose names have * or † prefixed, are Life or Honorary Members respectively.]

Acheson, Frederick, Esq., C.E., Crown Lands Office
Ackhurst, W., Esq., Brunswick-street, Fitzroy
Adams, Robert, Esq., C.E., Government Railway Department
Agg, Alfred J., Esq., Audit Office, Lonsdale-street
Alpin, Christopher D'Oyley Hay, Esq., Assistant Geological Surveyor, Crown Lands Office
Amsinck, Henry, Lieut. R.N., M.L.A., Melbourne
Archer, W. H., Esq., Registrar-General, Melbourne
Aresti, Joseph, Esq., Lithographer, Smith-street, Fitzroy
Aspinall, B. C., Esq., M.L.A., St. Kilda

Bancroft, W. C., Esq., Lieut., A.D.C., Government House
Ballantyne, Rev. James, Nicholson-street, Fitzroy
Bardin, Rev. C. P. M., Brunswick
Barker, Edward, Esq., M.R.C.S.L., Latrobe-street
†Barkly, Sir Henry, K.C.B., His Excellency the Governor
Barry, Redmond, Sir, Chancellor of the University of Melbourne, Carlton Gardens
Barry, Rev. John, D.D., St. Francis
Baxter, Rev. W., M.A., Church of England Grammar School, South Yarra

Beaney, Dr., Collins-street east
Becker, Ludwig, Esq., Union Hotel, Bourke-street
Bell, Francis, Esq., C.E., Elizabeth-street
Belt, Thomas, Esq, Mount Egerton
Berndt, Adolphus, Esq., M.D., Lonsdale-street
Bibbs, Thomas, Esq., Government Survey Office, Crown Lands
Black, Joseph, Esq., M.R.C.S.L., Bourke-street west
Black, Dr. Thomas, St. Kilda
Blackburn, James, Esq., C.E., Richmond
Blair, David, Esq., Gore-street, Collingwood
Blair, John, Esq., Surgeon, Northcote
Blanch, J. J., Esq., Schoolmaster, Taraville
Bland, R. H., Esq., Melbourne
*Blandowski, William, Esq.
*Bleasdale, Rev. John I., St. Francis, Vice-President
Bosisto, Joseph, Esq., Chemist, Richmond
Bowie, R., Esq. M.R.C.S.L., Surgeon Superintendent, Yarra Bend
Bradshaw, E., Esq., St. Kilda
Brady, Joseph, Esq., C.E.
Braithwaite, C., Esq., C.E., Office of Roads and Bridges
Brodribb, K. E., Esq., Chancery-lane
Bromby, Rev. J. E., D.D., Principal of the Church of England Grammar School, South Yarra
Brooke, J. H., Esq., M.L.A., Khull's Gold Office
Brown, Thomas, Esq., Gardiner's Creek-road
Brownless, Anthony C., Esq., M.D., Vice-Chancellor of the University of Melbourne, Latrobe-street
Bruce, J. V. A., Esq.
Bryson, W. E., Esq., C.E., Government Railway office, Melbourne
Budd, Richard H., Esq., B.A., Denominational School Office
Bull, Captain J. E. N., Gold-Fields Warden, Castlemaine
Burn, Andrew, Esq., Free Church School, Geelong

†Cadell, Francis, Captain
Cairns, John, Esq., Hall of Commerce

Campbell, Thomas, Esq.
Campbell, Colin, Esq., Raglan
Campbell, Robert, Esq., North Melbourne
Campbell, W. H., Esq., Surgeon, Collins-street east
Carr, J. Warburton, Warden, &c., Anderson's Creek
Chalmers, W. L., Esq.
Chambers, Hugh, Esq., Solicitor
Chirnside, Thomas, Esq., Werribee
Chapman, The Hon. H. S., M.L.A., St. Kilda
Christopherson, O. H., Esq., Govt. Railway Office, Melbourne
Christy, F. C., Esq., C.E., Government Railway Office, Geelong
Clark, Robert N., Esq., B.A.
†Clarke, The Hon. A., Captain, R.E.
Clarson, William, Esq., Bourke-street east
*Clow, Rev. James, Queenscliff
Coates, Dr., South Yarra
Corbett, Francis A., Esq., Registrar General's office, Bourke-street west
Crooke, William, Esq., M.R.C.S., Brunswick-street, Fitzroy
Cutts, William H., Esq., M.D., Bourke-street west

Damm, Professor Charles, Principal of German College, Apsley Place
Dauglish, Henry W., Esq., William-street
Davis, J., Esq., North Melbourne
Dell, James, Esq., Assistant Engineer, Sewerage and Water Commission
†Denison, Sir William, K.C.B., F.R.S., Governor General, Lieutenant Colonel R.E., President of the Philosophical Society of New South Wales, &c., &c.,
Dill, George, Esq., *Argus* Office
Divorty, Rev. George, A.M., South Yarra
*Dobree, Arthur, Esq., Flinders-street west
Donaghy, John, Esq., St. Francis' School
Dow, James H., Esq., Foundry, Flinders-street west

Eades, Richard, Esq., M.A., M.B., Collins-street east, Mayor of Melbourne

Eaton, H. F., Esq., Government Stores

Elder, Henry, Esq., Bourke-street east

Ellery, R. L. J., Esq., Director of the Observatory, Williamstown

*Elliott, Sizar, Esq., J.P., Bourke-street east

*Elliott, T., jun., Esq., Bourke-street east

Elsden, William, Esq., C.E., Hobson's Bay Railway

Embling, Thomas, Esq., M.R.C.S., Gore-street, Collingwood

Fairfax, W., Esq., Collins-street east

Farewell, Charles, Esq., M.A., Town Hall

Fawcett, James W., Esq., Melbourne

Feldheim, J. J., Esq., Queen-street

Fenner, Rev. T. P., M.A., South Yarra

Fisher, Alexander, Esq., M.R.C.S.E.

Fitzgibbon, E. G., Esq., Town Hall

Fitzpatrick, Very Rev. J., D.D., St. Francis

Fletcher, Rev. Richard, St. Kilda

Ford, Frederick T. W., Esq., M.R.C.S., Mackenzie-street

†Frederick VII., His Majesty the King of Denmark

Fyfe, Alexander, Esq., Back Creek

†Goeppert, H. R., Knt., M.D., Ph.D., Privy Councillor of State for Medicine, Professor of Medicine and Botany in the University of Breslau

Gardiner, Martin, Esq., C.E., Victoria-street, North Melbourne

Gell, Francis T., Esq., 32 Queen-street

Gemmell, J., Dr., Woodville, East St. Kilda

Gibson, R., Esq., C.E., Tarraville

*Gilfillan, J. A., Esq., Collins-street east

Gillbee, William, Esq., M.R.C.S.E., Collins-street east

Gilmore, Robert G., Esq., Cole's Wharf

Goodhugh, William, Esq., Flinders-lane east

Goold, The Right Rev. J. A., D.D., His Lordship the Catholic Bishop of Melbourne

Greene, William H., Esq., C.E.

†Gregory, A. C., Esq.

Guerard, Eugene Von, Esq., Artist, Collins-street east

Hadden, John, Esq., M.D., Napier-street, Collingwood

†Haidinger, Von, Professor, K.M.T., &c., &c., of Vienna, Director General of the Geological Survey of Austria

Hamilton, John Scott, Esq., 129 Russell-street

Hamilton, W., Esq., John Knox School

Hanify, Michael John Page, Esq., J.P., Lennox-street, Richmond

Hart, H. J., Esq., St. Kilda

Hawkins, Matthew W., Esq., Railway Department

Hayes, Patrick, Esq., Manufacturing Chemist, Saltwater River

Hearn, Professor, M.A., L.L.D., University

Henderson, Rev. William, Ballarat

Hepburn, Thomas, Esq., Smeaton, Creswick

Heron, J. D. S., Esq., Fryers Town

Hetherington, Rev. Irving, Collins-street east

Hickson, J. B., Esq., Homœopathist, Russell-street

Higginson, Rev. Henry, Gipps-street west

Higinbotham, George, Esq., Temple Court

Higinbotham, Thomas, Esq., C.E., Inspector General of Roads and Bridges

Higgins, Patrick, Esq., Flemington

Hill, W., Esq., C.E., Blaydon House, Brunswick

Hodgkinson, Clement, Esq., C.E., Deputy Surveyor-General

Hodgson, The Hon. John, M.L.C., Melbourne Club

Hodgson, C. J., Esq., Metallurgist, Melbourne

Hood, John, Esq., M.L.A., 3 Victoria Parade

*Holmes, George, Esq., box, Post Office

Hopwood, H., Esq., Echuca

Horne, Hon. G. S. W., Esq., M.L.A., 28 Queen-street

Hough, G. S., Esq., *Argus* Office

Houghton, James B., Esq., Melbourne

Howitt, Godfrey, Esq., M.D., Collins-street east

Howitt, William, Esq., M.R.C.S.E., Melbourne Hospital

†Howitt, William, Esq.
Hughes, D. A., Esq., Prahran
Hull, William B., Esq., C.E., Railway Department

I'Erson, Thomas William, Esq., Professor of Music, Geelong
*Iffla, Soloman, Esq., J.P., Surgeon, Collins-st. east, *Vice-President*
Irving, Professor, M.A., University, *Treasurer*

Jamieson, John, Esq., South Yarra
Jarrett, Rev. William, Brunswick
Joachimi, Gustav, Esq., Public Works Department
Jones, Edwin, Esq., 19 Collins-street east
Jones, P. F., Esq., Williamstown
Joseph, Henry, Esq., Bank of Australasia, Sandhurst
Johnson, A. E., Esq., Stephen-street

Kane, Benjamin H., Esq., National School Board
†Kay, Captain J., R.N., Government House
Kemp, Samuel V., Esq., C.E., Government Railway office, Melbourne
Kennedy, Rev. J., Ballarat
Kenworthy, Dr. C. J., President of the Horticultural Society, Ballarat, and Surgeon to the Hospital, Ballarat
Kershaw, William, Esq., 142 Johnston-street, Collingwood
Knaggs, Robert, Esq., M.R.C.S.L., King-street
Knight, J. G., Esq., C.E., Parliament Houses
Kruse, John, Esq., Chemist, Bourke-street east

Lanktree, John, Esq., Government Railway office
Larritt, Richard W., Esq., Sandhurst
Le Gould, Charles, Esq., C.E., Crown Lands office
Lewis, George, Esq., Pharmaceutical Chemist, Collins-street
Ligar, Charles Whybrow, Esq., C.E., Surveyor-General
Lloyd, Frederick, Esq., M.D., 100 Elizabeth-street
Loader, The Hon. Thomas, M.L.A., Elizabeth-street
Lowry, H. A., Esq., Melbourne
Lyall, William, Esq., M.L.A., Library of Parliament

*Macadam, John, Esq., M.D., F.R.S.S.A., M.L.A., Government Analytical Chemist, *Honorary Secretary*
Macarthur, Major-General, C.B.
MacDonald, Rev. Evan, Kyneton
McCoy, Professor, F.G.S., H.M.C.P.S., Government Palæontologist and Director of Museums, University
McCrea, George Gordon, Esq., Chief-Secretary's Office
McMillan, Dr., Kyneton
McCutcheon, John, Esq., Wesleyan School, Richmond
Macdonald, Rev. Donald, A.M., Emerald Hill
McGillivray, P. H., Esq., Williamstown
M'Gowan, S. W., Esq., Superintendent of Electric Telegraphs
Macgregor, Joseph, A. J., Esq., Solicitor, Swanston-street
Macguire, F. J., Esq., Consul, United States of America
Mackay, George, Esq., LL.D., Temple Court
Mackenna, J. William, Esq., Surgeon, Collins-street east
Mackenzie, J. S. Esq., Williamstown
Mackie, Rev. George, Burrembeet
Maclean, David P., Esq., M.R.C.S.L.
McMillan, Angus, Esq., M.L.A., Parliament House
Macrae, James, Dr., Napier-street, Collingwood
Madden, John, Esq., Solicitor, Bourke-street east
Main, W. Findlay, Esq., National Schools, Castlemaine
Manuel, Richard, Esq., C.E., Collingwood
Marsh, S. H., Esq., Professor of Music
Marshall, J., Esq., Solicitor, Little Collins-street
Martley, The Hon. J. F., Esq., M.L.A., Solicitor-General
Mayes, Charles, Esq., C.E., Government Railway Department
Menzies, John, Esq., M.D., Teacher, National Model and Training School
Michie, Archibald, Esq., M.L,A.
Millar, George, Esq., Rokeby Hall, Collingwood
Millar, John, Esq., F.S.A., C.E., Geelong
Miller, Hon. Henry, M.L.C., Bank of Victoria
Miscamble, J., Esq., M.R.C.V.S., 3 Little Bourke-street east
Moors, Henry, Esq., St. Kilda

Morgan, R. Rowland, Esq., Roads and Bridges
Morison, Rev. Alexander, Collins-street east
Morrison, Alexander, Esq., M.A., Scotch College
Morton, William L., Esq., Caroline-street, South Yarra
Motherwell, James B., Esq., M.D., Collins-street east
†Mueller, Ferdinand, Esq., M.D., Ph.D., F.R.G.S., Government Botanist, *President*
Murphy, The Hon. Francis, M.L.A., Speaker, Parliament House
Musson, John, Esq., St. Kilda

Nash, Richard, Esq., Government Storekeeper
Neumayer, George, Professor, Government Meteorologist, and Director of the Magnetic Survey of Victoria
Nicholson, The Hon. William, M.L.A., Chief Secretary
Nish, Rev. J., Sandhurst

O'Connor, Nicholas, Esq., 100 Elizabeth-street
O'Hea, Rev. Charles, St. Patrick's
O'Shanassy, Hon. John, Esq., M.L.A., Hawthorne
Orlebar, A. B., Esq., M.A., National Schools
Osborne, John Walter, Esq., Crown Lands Office
Otway, W. B., Esq., M.D., Steiglitz

Pasley, Hon. C., Captain R.E., Public Works Department
Panton, J. A., Esq., Gold-fields Warden, Sandhurst
Parker, Edward Stone, Esq., Mount Franklin
Pascoe, John Randall, Esq., J.P., Gas office, Collins-street east
Passmore, Richard A., Esq., Melbourne
Perry, The Right Rev. C., D.D., Lord Bishop of Melbourne
Perry, W., Esq., Collins-street west
Pinnock, J. D., Esq., Emigration office, King-street
Pittman, J., Esq., Survey office
Powens, A. S., Esq.
Powlett, F. A., Esq., Melbourne Club
Preshaw, Dr. W. F., J.P., Coroner, Castlemaine

Proeschel, F., Esq., Map Compiler, 81 Carrington-street Collingwood

Pugh, W. R., Esq , M.D., Collins-street

Ralph, Thomas S., Esq., M.R.C.S.L., Caroline-street, South Yarra

Randle, William, Esq.

Rawlings, J. H., Esq., C.E., Epping

Rawlins, Thomas, Esq.

*Rawlinson, Thomas E. Esq., C.E., Highett-street, Richmond

*Reed, Joseph, Esq., Architect, Melbourne

Rentsch, S., Esq., Swiss Consul, Melbourne

Richardson, E., Esq., Post-office, Essendon

Robertson, C. G., Esq., Registrar-General's Office, Grattan-street, Hawthorn

Robertson, James, Esq., M.A., M.D., Swanston-street

Robertson, Captain T., St. Kilda

Robertson, William, Esq., Wooling, near Gisborne

Ross, Alfred, Esq., Market-square

Ross, Captain, R.N., Marine Surveyor

Russell, Alex., Esq., Surgeon, M.L.A., 7 Royal-terrace

Ryder, George H., Esq., Charles-street, Richmond

Sasse, Edmund, Esq , Professor of Music, Geelong

†Scott, R., Esq.

†Scott, Rev. William, M.A., F.C.P.S., Astronomer of New South Wales

Scurry, Alfred, Esq., Melbourne

Selwyn, Alfred R. C., Esq., Government Geologist, Crown Lands office

Shiel, Very Rev. Louis, St. Francis

Skene, Alexander John, Esq., C.E., District Surveyor, Geelong

Skilling, Thomas, Esq., Flemington

Slade, Edgar, Esq.

*Smith, Alexander K., Esq., C.E., F.R.S.S.A.

†Smith, John, Esq., M.D., Professor of Chemistry in the University of Sydney, &c.
Smith, James, Esq., *Punch* Office, Swanston-street
Smith, James, Esq., South Yarra
Smith, L. L., Esq., L.S.A., Bourke-street east
Smith, Peter Henry, Esq., Richmond Barracks
Smyth, Robert Brough, Esq., F.G.S., Crown Lands office
Spowers, Allan, Esq., *Argus* Office
Stanbridge, W. E., Esq., Wombat
Stawell, Sir William Foster, His Honor the Chief Justice, Supreme Court
Stevenson, Henry, Esq., North Melbourne
Strutt, Charles E., Esq., M.R.C.S.L.
Swyer, C. R., Esq., C.E., Temple Court
Symonds, Edward C., Esq., Audit office

Taylor, Matthew W., Esq., Collins-street west
Taylor, H. L., Esq., Victoria Bank
Teale, Goodman, Esq., William-street
Thomas, E. J., Esq., Government Stores
Thompson, Dr. A., Esq., M.L.A., Geelong
Thompson, John, Esq., 39 Collins-street west
Thomson, Ramsay, Esq., C.E., Melbourne
Thomson, William, Esq., C.E., Melbourne
Tierney, Daniel J., Esq., M.D., Registrar-General, Prince's Bridge
†Todd, Charles, Esq.
Tracy, Richard Thomas, Esq., M.D., Brunswick-street
Turnbull, W. M., Esq., M.D., M.R.C.S.E., Spring-street
Turner, Rev. J., Condell-street, Fitzroy
Tyers, C. J., Esq., Crown Lands Office

Ulrich, George, Esq., Assistant Geological Surveyor
Urquhart, William Swan, Esq.

Vaughan, The Hon. Charles, M.L.C., Royal Terrace, Fitzroy
Venables, Henry Pares, Esq., B.A., Inspector, National Schools
Vieusseux, Louis, Esq., Fitzroy-square

Wade, W., Esq., Kew
Walker, John, Esq., Architect, Queen-street
Watson, John, Esq., J.P., Robe-street, St. Kilda
Watson, Robert, Esq., C.E., Geelong Government Railway Office
Watts, Henry, Esq., Warrnambool
Watts, Henry E., Esq., "Argus" Office
Waugh, Rev. James Swanton, Carlton Gardens
Weire, William, Esq., Town Clerk, Geelong
Were, J. B., Esq., Danish Consul, Flinders-lane east
Whyte, Patrick, Esq., National Schools
Wilhelmi, Charles, Esq., Assistant Government Botanist
*Wilkie, The Hon. David E., Esq., M.D., M.L.C., Collins-street east
Wilkie, Joseph, Esq., M.L.A., Collins-street east
Wilkinson, H., Esq., C.E., Prahran
Williams, The Rev. Thomas, late Missionary in Fiji
*Wilson, Professor, M.A., F.C.P.S., University
Wood, The Hon. J. D., M.L.A., Attorney-General
Woods, Rev. Julian Edmund, Penola, South Australia
Woolcott, J. S., Esq., Solicitor, Church-street, Richmond
Woolridge, Henry, Esq., Surgeon, South Yarra
Wright, H. M., Esq., Barrister, 72 Chancery Lane

Zeal, William A., Esq., C.E.

SUSPENSE LIST.

MEMBERS ABSENT FROM THE COLONY.

A'Becket, His Honor Sir William
Bonwick, James, Esq.
Edwards, Henry, Esq.
Dickson, John E. I., Esq.
Griffith, Charles J., Esq.
Goethe, Rev. Dr.
Kentish, N. L., Esq.
Haines, The Hon. W. C.
Ray, Edgar, Esq.
Schultz, William, Esq.
Wilson, Edward, Esq.

APPENDICES.

APPENDIX I.

INSTRUCTIONS TO ROBERT O'HARA BURKE, ESQ., LEADER, VICTORIAN EXPLORING EXPEDITION.

Exploration Committee, Royal Society of Victoria,
Melbourne, August 18th, 1860.

Sir,—I am directed by the Committee to convey to you the instructions and views which have been adopted in connection with the duties which devolve upon you as leader of the party now organised to explore the interior of Australia.

The Committee having decided upon Cooper's Creek, of Sturt's, as the basis of your operations, requests that you will proceed thither, form a depot of provisions and stores, and make arrangements for keeping open a communication in your rear to the Darling—if in your opinion advisable—and thence to Melbourne, so that you may be enabled to keep the Committee informed of your movements, and receive in return the assistance in stores and advice of which you may stand in need. Should you find that a better communication can be made by way of the South Australian Police Station near Mount Serle, you will avail yourself of that means of writing to the Committee.

In your route to Cooper's Creek, you will avail yourself of any opportunity that may present itself for examining and reporting on the character of the country east and west of the Darling.

You will make arrangements for carrying the stores to a point opposite Mount McPherson, which seems to the Committee to be the best point of departure from this river for Cooper's Creek; and while the main body of the party is proceeding to that point, you may have further opportunities of examining the country on either side of your route.

In your further progress from Mount McPherson towards Cooper's

Creek, the Committee also desires that you should make further detours to the right and left with the same object.

The object of the Committee in directing you to Cooper's Creek is, that you should explore the country intervening between it and Leichhardt's track south of the Gulf of Carpentaria, avoiding as far as practicable Sturt's route on the west, and Gregory's down the Victoria on the east.

To this object the Committee wishes you to devote your energies in the first instance, but should you determine the impracticability of this route, you are desired to turn westward into the country recently discovered by Stuart, and connect his furthest point northward with Gregory's furthest southern exploration in 1856 (Mount Wilson).

In proceeding from Cooper's Creek to Stuart's country, you may find the salt marshes an obstacle to the progress of the camels; if so, it is supposed you will be able to avoid these marshes by turning to the northward as far as Eyre's Creek, where there is permanent water, and going then westward to Stuart's furthest. Should you, however, fail in connecting the two points of Stuart's and Gregory's furthest, or should you ascertain that this space has been already traversed, you are requested—if possible—to connect your explorations with those of the younger Gregory in the vicinity of Mount Gould, and thence you might proceed to Shark's Bay, or down the River Murchison to the settlements in Western Australia.

This country would afford the means of recruiting the strength of your party; and you might, after a delay of five or six months, be enabled, with the knowledge of the country you shall have previously acquired, to return by a more direct route through South Australia to Melbourne.

If you should, however, have been successful in connecting Stuart's with Gregory's furthest point in 1856 (Mount Wilson), and your party should be equal to the task, you would probably find it possible from thence to reach the country discovered by the younger Gregory.

The Committee is fully aware of the difficulty of the country you are called on to traverse, and, in giving you these instructions, has placed these routes before you more as an indication of what it has been deemed desirable to have accomplished, than as indicating any exact course for you to pursue.

The Committee considers you will find a better and a safer guide in the natural features of the country through which you will have to pass. For all useful and practical purposes, it will be better for you and the object of future settlement that you should follow the water courses, and the country yielding herbage, than pursue any route which the Committee might be able to sketch out from an imperfect map of Australia.

The Committee entrusts you with the largest discretion as regards the forming of depôts, and your movements generally, but requests that you will mark your routes as permanently as possible, by leaving records, sowing seeds, building cairns, and marking trees, at as many points as possible consistently with your various other duties.

With reference to financial subjects, you will be furnished with a letter of authority to give orders on the Treasurer for the payment of any stores or their transport, cattle, sheep, or horses, you may require, and you will not fail to furnish the Treasurer from time to time with detailed accounts of the articles for which you have given such orders in payment.

Each person of the party will be allowed to give authority for half of his salary being paid into any bank, or to any person he may appoint to receive the same, provided a certificate is forwarded from you to the effect that he has efficiently discharged his duty.

The Committee requests that you will make arrangements for an exact account being taken of the stores, and their expenditure, by the person you place in charge of them.

The Committee also requests that you would address all your communications on subjects connected with the Exploration to the Hon. Secretary; and that all persons acting with you, should forward their communications on the same subject through you.

You will cause full reports to be furnished by your officers on any subject of interest, and forward them to Melbourne as often as may be practicable without retarding the progress of the Expedition.

The Committee has caused the enclosed set of instructions to be drawn up, having relation to each department of science, and you are requested to hand each of the gentlemen a copy of the part more particularly relating to his department.—I have the honor to be, Sir, your most obedient servant,

(Signed) John Macadam, M.D., Hon Sec.,
E.C.R.S.V.

INSTRUCTIONS FURNISHED TO SCIENTIFIC OBSERVERS ATTACHED TO THE VICTORIAN EXPLORING EXPEDITION — SURVEYOR, ASTRONOMER, METEOROLOGIST, GEOLOGIST, MINERALOGIST, ZOOLOGIST, AND BOTANIST.

INSTRUCTIONS FOR THE SURVEYOR, ASTRONOMICAL AND METEOROLOGICAL OBSERVER.

1. Every opportunity should be taken to ascertain the geographical position of the party, referring it to some well marked point, as offered by an easily recognizable mountain, the junction of rivers, creeks, &c., &c.

2. This should be done by astronomical observations, as well as by dead reckoning.

The dead reckoning always to commence with the last good, reliable astronomical observations made.

3. For determining the Latitude, the different methods to be chosen depend entirely upon circumstances, and it is only mentioned here that observations on sun, moon, and stars will have to be used.

4. The determination of the Longitude should be effected by lunar distances; if with stars, eastern and western distances should invariably be taken when possible, and the longitude should be derived from both sets. These observations, as well as those on latitude, should always be reduced immediately after the observations, or at least as soon after as possible. The longitude should further be ascertained whenever an opportunity occurs by occultation of stars, by eclipses of the sun, moon, and Jupiter's satellites. There is no necessity, however, for reducing these observations while on the journey, as it would be impossible to devote that amount of care to this work without interfering with the more essential work, and which would be desirable; and the original observations should, as early as possible, be clearly copied with ink, in a book, with every fact necessary for the subsequent reduction.

5. All astronomical phenomena of particular interest should be observed, if the means at the disposal of the astronomer do admit of such observation, and if these should not interfere with the general progress of the Expedition.

6. The variations of the Compass must be observed as often as circumstances permit.

7. Observations on the Zodiacal Light may be made with great facility and advantage for science. The limits of the phenomenon should be traced upon a good map of stars, and afterwards taken from it and noted in a note-book.

8. A good look out should be kept for Meteors; the declination and right ascension of the beginning and end of their courses, with exact time and accompanying circumstances, should be noted. Particular attention should be paid to meteors near the Zodiac.

9. Wherever a permanent camp is to be erected, a systematic registration on meteorology should at once be carried on. The hours of registration are to be as numerous as possible. The hours 6 a.m., 9 a.m., 3 p.m., and 9 p.m. being obligatory. The registrations should extend over the following elements:—

Pressure of air, observed with the mercurial barometer, and, in case of an accident happening to the instrument, then with the best aneroid in the camp. The aneroids should be compared with the mercurial barometer whenever they are to be taken out for taking measurements of heights, or for conducting meteorological observations in a branch expedition. They ought to be compared again as soon as they are returned to the main camp.

The aneroids to be observed in a horizontal position.

In the case of measurements of heights, Lamont's hypsometrical tables should be used.

Temperature of air and evaporation are to be observed with Munich hygrometer, in the large portable meteorological stand.

Direction and force of wind, by the astronomical meridian, and by Beaufort's notations.

Amount and form of clouds, and direction of the upper current.

Duration and intensity of rain, dew, hail, &c.; solar radiation and terrestrial radiation.

An exact register should be kept on all remarkable phenomena in meteorology, as whirlwinds, storms, thunderstorms, mirage, refraction, twinkling of stars, &c., &c.

10. While travelling, the aneroids and the small hygrometer should be easily accessible, so that without any delay the observations can be made at the hours above mentioned, such observations to be used afterwards for computing the height of the ground passed over.

The temperature of rivers, creeks, lakes, and wells should be observed on the surface, and with the help of the sounding thermometer on the bottom. Should gases arise from the depth, they should be caught in small glasses prepared for the purpose, in order to have them analysed afterwards.

11. Particular attention should be paid to the direction of the flights of birds.

12. Magnetical observations, in addition to the determination of the variation of the compass, should be carried out whenever an

opportunity offers, though without interfering with the main object of the Expedition.

13. The work connected with the topographical survey requires hardly any further remarks, but that everything should be done as minutely and accurately as possible, and that all more strictly called scientific observations should be subordinate to the mapping of the country.

GEOLOGICAL, MINERALOGICAL, AND NATURAL HISTORY OBSERVER.

GEOLOGY.

Diary to be kept regularly, and all observations made during the day to be entered before the next day, and as soon as possible after the camp is pitched for the night, and the necessary duties connected with camping, attention to stock, &c., are completed. This to be, in in all cases, determined by the Leader.

General Heads of Diary—

1. Distance and course travelled.

2. Number, character, distance apart, and general trend or fall of all watercourses or drainage channels crossed.

3. Quality of water, if any, in such courses or channels. To ascertain the nature of the salts in saline or other mineral waters, a certain quantity might be evaporated, and the deposited matter collected for chemical examination.

4. Mode of occurrence of water: springs, lakes, pools, or running streams, with average depth of ditto.

5. Indications relative to probable permanence or otherwise of ditto, also of periodical floods.

6. Geological, physical, and mineral character of the banks and beds of streams, lakes, &c., and also of the intervening and adjacent country. If composed of tertiary deposits of mud, clay, sand, or gravel, note nature of such, whether stratified or irregular accumulations, also mineral character, stating the nature and relative proportions of the materials, whether limestone, sandstone, quartz rock, quartz, or other rock fragments, sedimentary or igneous, or much waterworn. If composed of removed rocks, state probable geological age of such; if stratified and undoubtedly in situ, average direction and angle of dip (noted thus: D. N. 10° E. 15°), also probable thickness and relative geological position of different formations (conformable or otherwise) of igneous rocks, whether intrusive or contemporaneous.

7. Indications or presence of organic remains to be carefully sought for and noted, also of mineral veins, coal seams, lignite beds, &c.; date and locality of such researches, with the time so occupied to be stated.

MINERALOGY AND FOSSILS.

8. Specimens: rock, minerals, and fossils. All specimens to be numbered consecutively, and entered with a corresponding number in a book kept for that purpose, with the locality and date of collection, and a short description of each. The numbers also to be entered in the diary, on the day of collection (thus: June 15, 1860, specimens 1 to 20, stating whether rock, mineral, or fossil).

9. As geological specimens are difficult to transport, owing to their weighty character, it is desirable that only such as are new or doubtful should be collected, and these should be as small as possible for the purpose of examination and recognition; also that whenever an accurate description, or sketch, or both can be made to answer, they should be resorted to in preference to adding unnecessarily to the bulk and weight of the collection.

In all cases the gross weight of the specimens that can be taken, must be subject to the approval and control of the leader.

10. Rock specimens should in all cases be abandoned in favor of either minerals, fossils, or recent natural history specimens.

11. All specimens that it may be found necessary or deemed expedient to abandon, should be marked off in the catalogue, and the date and cause for their being so abandoned stated.

If fossil or recent natural history, sketches of them should, if possible, be retained.

MAPS.

12. A tracing of the route, as laid down by the Surveyor, should be furnished daily, if possible, to the geological and other scientific officers, to enable them to mark the approximate position of their observations. To effect this rapidly, the daily observations in the journal should be numbered, and a corresponding number placed on the map at the point where the observation was made, or to which it refers.

Boundaries of different rocks or geological formations crossed on the line of route, should be marked on the map.

SKETCHES.

13. The observations, whenever practicable, should be copiously illustrated by sketches, with the number of the specimen or observation in the journal to which they refer attached.

A sketch of each camp and its environs should, if possible, be made before quitting it.

Sketches of all remarkable geological sections are desirable, also outline views of mountain ranges, remarkable hills, and other physical features on either side of the line of route; also of all objects of natural history and natives (aborigines).

14. All views should be numbered and dated with the time of day, the position whence they were taken marked on the map, and the compass bearing, and estimated distance given of the extreme points embraced in each.

ZOOLOGY.

The Zoologist, in addition to all general observations which he may be able to make on all classes of animals that may occur to him, illustrated by sketches, is particularly required to ascertain, when possible, the fishes, shells, or articulata occurring in any stagnant or running waters met with, as these are of the highest interest in connection with questions of the geographical distribution of animals.

No duplicate specimens that might encumber the party need be collected. Of fossil animals, if any should be noted, it would be very desirable to secure characteristic specimens. The larger fishes may be skinned, by the removal of one-half of the fish, leaving the fins of the mid-line perfect; if then washed with solution of corrosive sublimate in spirit, the specimen can be packed flat between papers without injury.

The soft Annelida and small Crustacea, as well as the soft parts of Mollusca, should be inclosed in vessels of spirits, the specimens separated by portions of linen cloth to prevent their being injured by shaking. Paper labels, written with black lead pencil, will remain uninjured with specimens so packed. As a general rule, every specimen collected should receive one of a consecutive series of numbers (irrespective of the natural series of the objects), by which it should be indicated in the journal of the day, in which all particulars observed about it or illustrative sketches should appear.

In case a specimen of actually or doubtfully the same species be obtained for the second or third time, at some subsequent dates from its first entry in the journal, there is no objection to its receiving a new number in connection with any additional observations which may be made, in cases where loss of time would result from endeavouring to ascertain the first number applied to the series.

Of Mammalia, the nocturnal ones, as bats, and the small murine forms, are the most interesting, and should receive particular attention.

No opportunity should be lost to obtain through the officer in charge of depôts, or through reconnoitering parties, additional specimens of rocks, fossils, minerals, and natural history.

It will be of vast importance to ascertain, as extensively as possible, what relation the vegetation bears to its geological formation.

BOTANICAL OBSERVER.

For the purpose of elucidating to the fullest extent the phytology of any part of Australia to be explored by the Victorian expedition, it is recommended that the Botanist attached to the caravan should keep a diary, in which the principal botanical features of the country should be noted, and into which any plant, either remarkable or observed for the first time, should be introduced under the same number or designation by which it is distinguished in the herbarium.

To the specimens which will be collected, and which should be pressed into paper always immediately, and dried as speedily as circumstances will permit, a label should be fixed, containing a note of the day of collecting, the habitat of the plant, the soil of the locality, the color and perhaps odour of the flower, the nature of the bark and of the wood of any arboreous species, the size of the plants, and any other characteristics which cannot be derived from the examination of the dried specimens.

These, when dried, it will be desirable should be well secured against pressure and moisture, and the thus formed collections should be forwarded to the Secretary of the Exploration Committee, always at the very earliest opportunity afforded for transmission.

To such selections of botanical specimens might be added any well matured seeds collected on the journey, which should either be numbered corresponding to the specimens of the herbarium, or be accompanied by leaves, flowers, and seed-vessels, for the purpose of recognizing the species.

Samples of gums, resins, barks, and any other vegetable substances, likely to be of technical, or economical, or medicinal use, should be gathered and labelled in such a manner as to facilitate specific determination.

No opportunity should be lost to obtain through the officer in charge of depôts, or through reconnoitering parties, additional specimens of plants and seeds.

Particular attention is directed to the necessity of closely examining the Pandani and Palms which are likely to be met with within the tropics; and since it will be difficult to procure the large fruits of the former, and since the determination of the species greatly depends on the habit of the plants, it would be of great advantage to have, through the artist of the expedition, sketches of the outlines of these rare trees secured, and the flowers and fruits fully delineated.

It will be of vast importance to ascertain, as extensively as possible, what relation the vegetation of the country bears to its geological formation.

Of any plants suspected to have been deleterious to either horses or dromedaries, such a quantity should be dried as will suffice for chemical analysis, and any experiments to be instituted thereafter.

Of plants which may prove of utility for food or otherwise, or which are drawn into use by the natives, more particularly, information is sought.

GENERAL INSTRUCTIONS FOR SCIENTIFIC OBSERVERS.

Scientific observations or work that would cause hindrance, or otherwise interfere with the progress or necessary work of the expedition, never to be undertaken if contrary to the instructions of the Leader.

All specimens, journals, sketches, maps, or other documents, to be exclusively the property of the Royal Society, on behalf of the Government of Victoria; and on no pretence whatever are either specimens or copies of the said documents to be given away, or forwarded privately to any person, or even officially, except through the Leader, although it is intended that each observer should, on publication of the results of the expedition, receive the credit due to him for his observations.

All scientific, or other documents, journals, &c., relating to the expedition, to be at all times accessible to the Leader.

LIST OF ARTICLES AND SERVICES,

With Rate and Amount ordered, supplied, or incurred by the GOVERNMENT STOREKEEPER on account of the VICTORIAN EXPLORATION EXPEDITION, classified under the several headings of—

I.—PROVISIONS.
II.—FORAGE AND FOOD FOR CAMELS AND HORSES.
III.—STORES.
IV.—MEDICINES AND MEDICAL COMFORTS (including Instruments and Veterinary Medicines).
V.—SERVICES.
VI.—HORSES.

I.—PROVISIONS.

Article.		Quantity.	Rate.	Amount.		
Pemican		320 lb	1/3	£20	0	0
Salt Pork, without bone ...		600 ,,	1/3	37	10	0
Bacon		400 ,,	0/9	30	0	0
Meat Biscuit		1000 ,,	1/3	75	0	0
Potted Meats		10 ,,	1/6	0	15	0
Preserved Mutton		60 ,,	1/2	3	10	0
Preserved Vegetables ...		144 ,,	84 @ 1/1½ 60 @ 1/4	8	14	6
Flour		7100 ,,	21/6 ℔ 100 lb	76	6	6
Rice		2500 ,,	0/4	41	13	4
Sugar		3000 ,,	0/4¾	59	7	6
Tea		400 ,,	3/0	60	0	0
Coffee, in tins		50 ,,	1/4	3	6	8
Chocolate		40 ,,	2/0	4	0	0
Salt		200 ,,	0/1½	1	5	0
Soap		200 ,,	0/5	4	3	4
Tobacco		250 ,,	3/8	45	16	8
Ghee, or Clarified Butter ...		993 ,,	3/0	148	19	0
Butter, fresh		10 ,,	2/6	1	5	0
Captains' Biscuits		200 ,,	0/6	5	0	0
Lime Juice		20 gallons	4/0	4	0	0
Vinegar		10 ,,	2/0	1	0	0
Mustard		70 lb	1/0	3	10	0
Pepper		40 ,,	0/9	1	10	0
Ginger (applied for by Mr. Bourke, telegram 28th Aug.)		20 ,,	...	2	0	0
Dried Apples		100 ,,	1/0	5	0	0
Raisins		50 ,,	0/8	1	13	4
Currants		50 ,,	0/9	1	17	6
Dates		189 ,,	1/0	9	9	0
Sperm Candles		150 ,,	1/9	13	2	6
Rations, 6 men, August 2 to 20th, inclusive ...	Royal Park	114 rations	0/8¾	4	3	1
Rations, 4 men, August 7 to 20th, inclusive ...	Royal Park	56 ,,	0/8¾	2	0	10
Tea (for Asiatics)	Royal Park	10 lb	3/0	1	10	0
Total amount for Provisions...		..	...	£677	8	9

II.—FORAGE AND FOOD FOR CAMELS AND HORSES.

Article.	Quantity.	Rate.	Amount.
Oatmeal (camels)... ...	1,112 ℔	0/4	£18 10 8
Potatoes ,, ...	3 cwt.	12/6 ℙ cwt.	1 17 6
Flour ,, ...	600 ℔	21/6 ℙ 100 ℔	6 9 0
Hay, from Govt. stores (camels and horses)	6,160 ,,	various	15 9 5
Oats do. do. ...	1,424 ,,	,,	6 0 9
Bran do. do. ...	1,666 ,,	,,	7 1 10
Straw do. do. ...	2,128 ,,	,,	4 12 7
Hay, from Experimental Farm (camels and horses) ...	12,320 ,,	£5 12/6 ℙ ton	30 18 9
Straw do. do. ...	4,480 ,,	£2 15/ ,,	5 10 0
Mangold do. do. ..	6,720 ,,	£3 10/ ,,	10 10 0
Oats, purchased from C. Steedman, on emergency ...	160 ,,	5/3 ℙ bushel	1 1 0
Total for Forage, &c. ...	...	...	£108 1 6

III.—STORES.

Article.		Quantity.	Rate.	Amount.
Blankets (for Asiatics) ...		16 pairs	16/6	£13 4 0
Pilot Coats, coarse do. ...		8	22/6	9 0 0
Jumpers do. ...		8	6/3	2 10 0
Trowsers do. ...		8 pairs	11/6	4 12 0
Socks do. ...		8 do.	1/2	0 9 4
Boots do. ...		8 do.	4/6	1 16 0
Flannel Shirts do. ...		8	4/3	1 14 0
Half-hose, worsted do. ...		16 pairs	1/2	0 18 8
Stable Forks ...	For use at Royal Park	3	2/6	0 7 6
Barrow (wheel) ...		1	...	2 10 0
Shovels		2	4/3	0 8 6
Brooms and Handles		3	1/9½	0 5 4
Brushes (for camels)		18	7/6	6 15 0
Hobbles do. ...		30 pairs	...	11 5 0
American Tub, large		1	...	0 9 0
Axe (American) and Handle		1	...	0 6 9
Canvas (for repairs of tents, Royal Park) ...		78 yards	1/0	3 18 0
Butchers' Knives, large		3	1/2	0 3 6
Camp Kettles, 8-quart		2	3/0	0 6 0
Pannicans, tin ...		8	0/3	0 2 0
Firewood		6 tons	11/0	3 6 0
Padlocks (for camels' trunks)		4	1/0	0 4 0
Hone, with case (for lancets, &c.)		1	...	0 7 0
Stationery Cabinet... ...		1	...	12 0 0
Stationery, comprising drawing and writing materials, asstd.		...	...	34 16 5

STORES—*continued.*

Article.	Quantity.	Rate.	Amount.
Colt's Revolvers, navy size, with cases and belts, complete	19	Various	£114 0 0
Double-barr'el Guns, with slings	10	,,	62 0 0
Rifles, Carbine	8	£15	120 0 0
Conical Balls, Shot, and Slugs, to match gun	200 lb	...	6 8 4
Percussion Caps, assorted ...	...	...	2 0 6
Gunpowder, coarse grained ...	50 lb	3/6	8 15 0
Cartridges	200	10/ ℔ 100	1 0 0
Wadding, Ely's	5000	5/ ℔ 1000	1 5 0
Powder Flasks	24	4 @ 3/6 20 @ 10/6	11 4 0
Shot Pouches	10	6/6	3 5 0
Nipples, assorted	4 dozen	9/0	1 16 0
Gunsmiths' Tools, complete (selected by Mr. Burke) ...	...	..	35 4 0
Water Bags, large	60	67/6	202 10 0
Do. small	30	25/0	37 10 0
Leather Buckets	5	13/0	3 5 0
Canvas do.	30	8/0	12 0 0
Saddles, complete, bush fitted	15	115/0	86 5 0
Bridles, do.	15	18/0	13 10 0
Pack Saddles (for horses and bullocks)	10	92/6	46 5 0
Pack Saddles (for camels) to pattern...	12	115/0	69 0 0
Riding Saddles do. do....	6	155/0	46 10 0
Pads do. do....	60	30 @ 8/0 30 @ 18/0	39 0 0
Saddle Cloths do. do....	30	32/6	48 15 0
Pack Cloths do. do....	30	...	28 17 6
Head Stalls	20	6/0	6 0 0
Hobbles (horse)	32 pairs	20 @ 3/0 12 @ 3/0	3 0 0 1 16 0
Do. (bullock)	10 do.	5/0	2 10 0
Do. (camels)	20 do.	7/6	7 10 0
Spurs	20 do.	4/6	4 10 0
Stirrup Irons	20 do.	4/6	4 10 0
Stirrup Leathers	20 do.	5/0	5 0 0
Saddle Girths (3 pairs extra each saddle)	45 do.	3/0	6 15 0
Saddle Straps	500	0/6	12 10 0
Halters (for camels) ...	30	9/0	13 10 0
Check String (for camels) ...	30 lb	1/0	1 10 0
Whip Cord, fine	15 ,,	2/6	1 17 6
Camels' Shoes, shod with iron and lined with felt (M'Farland)	80 sets	30/0	120 0 0
Camels' Shoes (Ford Brothers)	15 do.	42/0	31 10 0
Dandriff Brushes	12	2/6	1 10 0
Curry Combs	12	0/11	0 11 0
Water Brushes	12	3/6	2 2 0
Mane Combs	6	0/5	0 2 6

STORES—*continued.*

Article.	Quantity,	Rate.	Amount.
Clipping Scissors	2	3/0	£0 6 0
Clipping Combs	2	0/8	0 1 4
Canvas Packing Bags, Straps, Handles, &c., complete ...	20	21/0	21 0 0
Canvas Water-buckets ...	10	13/0	6 10 0
Leather do. ...	12	15/6	9 6 0
Saddle Cruppers	15	3/0	2 5 0
Leather Straps, strong ...	60	2/0	6 0 0
Waggon Harness, Pole ...	6	180/0	54 0 0
Do. leading ...	8 sets	120/0	48 0 0
Halters' Web	18	1/0	0 18 0
Saddle Cloths, best felt ...	15	12/6	9 7 6
Breastplates, with martingales	15	21/0	15 15 0
Saddle Serge	20 yards	3/6	3 10 0
Collar Cloth	20 do.	2/0	2 0 0
Curled Horse Hair... ...	60 ℔	1/4	4 0 0
Waggon Hames (extra) ...	3 pairs	15/0	2 5 0
Snaffle Bits do. ...	6	3/0	0 18 0
Soft Soap (for harness, &c.) ...	6 ℔	1/6	0 9 0
Tether Rope	180 yards	0/3	2 5 0
Spur Rowels	48 pairs	0/3	0 12 0
Waggon Driving Crops, with kangaroo thongs... ...	6	24/0	7 4 0
Kangaroo Thongs (extra) ...	6	9/0	2 14 0
Saddle Cloths, kersey ...	5	7/6	1 17 6
Carbine Buckets and Straps	15	6/6	4 17 6
Cushions (for waggons) ...	3	25/0	3 15 0
Pole Straps	6	7/0	2 2 0
Hame Straps	24	1/0	1 4 0
Horse Rugs, with breast straps	6	20/0	6 0 0
Surcingles	6	5/0	1 10 0
Neck Straps	24	5/6	6 12 0
Despatch Bags	8	{3 @ 20/0} {5 @ 15/0}	8 15 0
Saving Collars	14	7/6	5 5 0
Straps (for camels)... ...	12	3/0	1 16 0
Saddle Cloth, felt	1	12/6	0 12 6
Bridles, Harness	2	25/0	2 10 0
Tarpaulins (for camels), made to order, with buckles, &c.—well oiled	26	28/0	36 8 0
Fryingpans	6	2/0	0 12 0
Gridirons...	3	2/4	0 7 0
Camp Ovens	3, 77 ℔	18/0 ℔ cwt.	0 12 4
Corkscrews	2	1/0	0 2 0
Tin Dishes, Pannicans, and Camp Kettles	2 sets	Various	6 6 6
Knives, Forks, and Spoons ...	50 of each	,,	10 18 3
Iron Dippers, large ...	12	1/0	0 12 0
Turkey Stone	3 ℔	1/8	0 5 0
Branding Iron, V.E. over B. (for marking trees) ...	1	...	1 15 0
Fish Hooks, assorted ...	200	Various	0 15 0

STORES—*continued.*

Article.	Quantity.	Rate.	Amount.
Fishing Lines	4 dozen	6/0	£1 4 0
Farriers' Tools, complete ...	2 sets	95/6	9 11 0
Carpenters' Tools	1 set	...	2 8 0
Shovels, steel	6	4 @ 4/3 2 @ 5/0	1 7 0
Axes (Pick), double-headed, and Handles	6	4/6	1 7 0
Axes and Handles, American	12	6/9	4 1 0
Axe Handles (extra) ...	12	1/6	0 18 0
Saws, hand	5	5/0	1 5 0
Do. cross-cut	1	...	0 8 3
Tomahawks	6	4/6	1 7 0
Spring-balance Scale, with chain, 40 lb	1	...	0 10 6
Bells and Straps (for horses)	3 dozen	34/0 ℔ doz.	5 2 0
Do. do. (bullocks) ...	½ ,,	156/0 ℔ doz.	3 18 0
Nails and Spikes, assorted ...	30 lb	...	0 7 5
Grindstone, small, with frame	1	...	3 10 0
Horse-shoe Nails, pointed, 6 lb ℔ 1000	56 lb	0/10	2 6 8
Matches, vesta	40 boxes	1/10	3 13 4
Do. lucifer	3 gross	6/0	0 18 0
Fuses	1 ,,	...	0 15 0
Tinder Boxes, with flint and steel	28	1/0	1 8 0
Tailors' Scissors	6 pairs	2/0	0 12 0
Geologists' Steel Hammers, ½ lb and 3 lb	2	1/6	0 3 0
Knives, sporting	6	2 @ 14/0 4 @ 8/6	3 2 0
Do. pocket, three blades	6	5/0 each	1 10 0
Do. butchers'	9	1/2	0 10 6
Flesh Hooks	2	1/0	0 2 0
Billhooks, Switzberg ...	6	6/6	1 19 0
Reaping Hooks	6	0/6	0 3 0
Beads (for natives)	2 lb	1/0	0 2 0
Looking-glasses (for natives)	4 dozen	3/0 ℔ dozen	0 12 0
Do. plate, with slide	6	6/0	1 16 0
Boatswain's Whistles ...	5	3/0	0 15 0
Canvas Bags, numbered with paint	30 pairs	25/0 ℔ pair	37 10 0
Canvas, &c. (for repairs of bags, &c.	1 bolt No. 1 1 ,, No. 4	...	5 7 10
Calico (for ditto)	50 yards	1/0	2 10 0
Rope and Twine, assorted ...	290 lb	Various	7 18 5
Light Tents, to pattern ...	10	6 @ 88/6 4 @ 132/6	53 1 0
Store Tents, 10 × 12 ...	2	£10	20 0 0
Camp Cots, to pattern ...	20	£3	60 0 0
Litters do. ...	4	£5	20 0 0
Tent Pegs, large	12 dozen	5/6 ℔ dozen	3 6 0
Musket-holders	20	2/ each	2 0 0
Canvas Bag	1	2/0	0 2 0

STORES—*continued.*

Article.	Quantity.	Rate.	Amount.
Trowsers, serge	40 pairs	12/6	£25 0 0
Do. canvas	80 do.	5/9	23 0 0
Do. moleskin, lined ...	40 do.	13/6	27 0 0
Shirts, flannel	80	12/6	50 0 0
Do. serge, blue	40	12/6	25 0 0
Boots	80 pairs	25/0	100 0 0
Cabbage-tree Hats, to order...	30	20/0	30 0 0
Blankets	40 pairs	16/6	33 0 0
Towels	40	1/2	2 6 8
Diaper (for spare towelling, &c.)	100 yards	2/0	10 0 0
Flannel (for repairs) ...	100 do.	2/0	10 0 0
Blue Serge do. ...	100 do.	1/6	7 10 0
Moleskin do. ...	50 do.	1/9	4 7 6
Thread do. ...	6 ℔	3/4	1 0 0
Metal Buttons do. ...	12 dozen	0/2	0 2 0
Rugs, heavy fawn (for ponchos)	20	20/0	20 0 0
and making same ...	...	10/0 each	10 0 0
Air Bed (to hold water) ...	1	...	3 0 0
Air Pillows	6	12/6	3 15 0
Cork Mattress	1	...	1 10 0
Waterproof Cloth	180 yards	4/6	40 10 0
Green Gossamer (for veils) ...	45 do.	1/0	2 5 0
Goggles, with cases ...	2 dozen	24/ ℔ dozen	2 8 0
Canvas Flour Bags... ...	50	4/0	10 0 0
Oak Camp Stools	2	12/6	1 5 0
Oak Camp Tables, cedar top	1	...	1 7 6
Field Glasses	2	1 @ 70/0 1 @ 65/0	6 15 0
Rockets	50	6/0 each	15 0 0
Blue Lights	3 dozen	25/0 ℔ dozen	3 15 0
Chinese Gong	1	...	4 10 0
Blocks—1 double, 2 single ...	3	...	2 7 0
Files, hand saw	1 dozen	...	0 3 10
Do. cross-cut saw ...	½ do.	6/0	0 3 0
American Waggons ...	3	2 @ £45 1 @ £55	145 0 0
Tools and Materials for repairs (for blacksmith), as selected	...	...	21 8 10
Soldering Irons	2	3/6	0 7 0
Solder	8 ℔	1/3	0 10 0
Tin, 1 xx, 14 × 10 ...	12 sheets	0/3½	0 3 6
Resin	4 ℔	14/0 ℔ cwt.	0 0 6
Borax	2 ,,	1/6	0 3 0
Palms	6	3/6	1 1 0
Needles, sewing & roping (For mending tents)	12 dozen	10½ doz. @ 1/6 1½ ,, @ 3/0	1 0 3
Twine do. (For mending tents)	48 ℔	1/3	3 0 0
Sail Hooks ... (For mending tents)	6	0/4	0 2 0
Fid, small ... (For mending tents)	1	...	0 3 0
Stabber ... ... (For mending tents)	1	...	0 2 0
Saddlers' Tools, &c. (for repairs)	As selected	...	4 18 8
Anti-friction Grease ...	100 ℔	...	2 2 6
Harness Oil	2 gallons	...	1 0 0

STORES—*continued.*

Article.	Quantity.	Rate,	Amount.
Silver Watches, strong, with extra glasses, keys, &c., &c.	2	£7 16/0 each	£15 12 0
Water Bottles (procured in Sydney)	12	6/6 each	3 18 0
Leather (for hobbles, &c.) ...	8 hides	45/0	18 0 0
Total amount for Stores ...	...	...	£2608 8 5

IV.—MEDICINES AND MEDICAL COMFORTS.

(Including Instruments and Veterinary Medicines.)

Article.	Quantity.	Rate.	Amount.
Drugs, miscellaneous, selected by Dr. Beckler at Messrs. E. and M. Keogh's, Latrobe-street west	...	...	£49 17 11
Medical Comforts—Arrowroot	6 lb	1/0	0 6 0
Do. Brandy ...	4 gallons	25/6 ℔ gallon	5 2 0
INSTRUMENTS *Selected by Dr. Beckler.*			
Surgeon's Field Case ...	1	...	12 12 0
Cupping Apparatus, complete	1	...	6 15 0
Syringes, metal	6	1/0	0 6 0
Syringe, enema	1	...	0 13 0
Leg Splints	2 sets	6/0	0 12 0
Arm do.	2 do.	6/0	0 12 0
Dressing Forceps	1	...	0 7 6
Surgical Needles	24	0/6	0 12 0
Silver Probe, grooved ...	1	...	0 3 6
Caustic-holder	1	...	0 5 0
Blunt Hooks	2	7/6	0 15 0
Spatula (Bolus Knife) ...	1	...	0 1 6
Scales and Weights ...	1 set	...	0 5 0
Veterinary Instruments and Medicines (for camels), as selected by Mr. Landells ...	...	...	52 1 11
Rum (for camels)	60 gallons	..	48 0 0
Veterinary Instruments and Medicines (for horses) ...	...	...	69 8 10
Pepper (for camels—applied for by Mr. Burke, by telegram from Swan Hill ...	20 lb	...	0 15 0
Total for Medicines, &c. ...	...	...	£249 11 2

V.—SERVICES.

Name.	Particulars of Service.	Amount.
Alfred Ford	220 nights' Livery—Horses at Artillery Hotel stables—6d. per night	£5 10 0
M'Gregor and M'Naughton	Lengthening and altering Waggons, and supplying spare Axle Boxes, Bars, Poles, &c., &c.	81 1 6
W. and E. Grave ...	Extra labour in covering and banding 12 Tents... ...	25 7 6
R. Taylor	Storage of Gram, &c., &c., in private rooms at the Parliament Stables—July 7th, August 25—7 weeks, at £1 per week	7 0 0
John Miscamble ...	Examination of Horses as to soundness, Shoeing, and supplying 4 spare sets of Shoes	2 15 0
W. Powell and Co. ...	Fitting and supplying 45 sets Shoes to Horses, 5s. ℔ set...	11 5 0
	Lampering 2 Horses ...	0 5 0
Penal Department ...	Fitting and supplying 60 sets Horse Shoes	15 0 0
	Repairing Waggons... ...	10 0 0
	Total for Services	£158 4 0

VI.—HORSES.

From whom Purchased.	Brand and Description.	Amount.
Robert M'Farland ...	Bay Horse, branded on near shoulder RJC over AA; on neck S 51	£40 0 0
John Orr	Roan Horse, aged; brands not stated	50 0 0
James M'Conaghy ...	1 Bay Horse, branded D on near shoulder; white star on forehead	35 0 0
James Henderson and Co.	Bay Horse; W near neck; TW near shoulder; near hind foot little white Grey Horse; LM off shoulder Bay Horse; IH do. Bay Horse; P near shoulder; stripe; off hind foot white...	110 0 0

HORSES—*continued.*

From whom Purchased.	Brand and Description.	Amount.
W. W. Treacy	Chesnut Mare; JH near shoulder Iron-grey Horse; HH conjoined near shoulder White Horse; H near shoulder	£60 0 0
Robert S. Sturrach ...	Brown Horse; no brand ...	34 10 0
William Dickenson ...	Brown Horse; JK near shoulder; three white legs; star on forehead	20 0 0
Charles Cock	Bay Horse, draught; no brands	50 0 0
John Wilson	Bay Horse; A over M near shoulder; black points ...	20 0 0
William Manley ..	Grey Horse; D near saddle ...	28 0 0
A. L. Blake	Bay Horse; ? near shoulder; white hind feet; 6 years old	50 0 0
Joseph Nihill	Chestnut Horse; BI off neck; blaze on face—(less £1, fee to Veterinary Surgeon) ...	31 0 0
B. Hutchinson	Grey Horse; M on near shoulder; snip off near ear; 6 years old—(less £1 1s., fee to Veterinary Surgeon) ...	48 19 0
W. W. Treacy	Brown Horse; SS over M, ST under, near shoulder; two hind feet white Brown Mare; N in circle near shoulder	50 0 0
Richard Edwards ...	Brown Horse; ISB off shoulder; star on forehead; two hind feet white	26 0 0
W. W. Treacy	Brown Horse; B in circle near neck and near shoulder ...	30 0 0
	Bay Horse; OP near shoulder...	25 0 0
	Total for Horses	£708 9 0

VII.—In addition to the above, the Exploration Committee expended the following on account of Exploring Expedition, viz.:—

	£	s.	d.
Six Camels, @ £50	£300	0	0
Books	0	19	6
Astronomical Instruments	132	19	6
Chronometer Watch	42	0	0
	£475	19	0

SUMMARY.

		£	s.	d.
1	Provisions	£677	8	9
2	Forage and Food for Camels and Horses ...	108	1	6
3	Stores	2608	8	5
4	Medicines and Medicinal Comforts (including Instruments and Veterinary Medicines) ...	249	11	2
5	Services	158	4	0
6	Horses	708	9	0
7	Sundries, supplied by Exploration Committee ...	475	19	0
	Total	£4986	1	10

CONTENTS

OF FORMER AND PRESENT VOLUMES

OF THE

TRANSACTIONS OF THE VICTORIAN INSTITUTE;

OF THE

PHILOSOPHICAL SOCIETY OF VICTORIA;

OF THE

PHILOSOPHICAL INSTITUTE OF VICTORIA;

AND ULTIMATELY OF THE

ROYAL SOCIETY OF VICTORIA.

APPENDIX II.

TABLE OF CONTENTS OF TRANSACTIONS AND PROCEEDINGS OF THE VICTORIAN INSTITUTE—1854 AND 1855.

		PAGE
ART. I.	Inaugural Address on the Objects of the Institute, by MR. JUSTICE BARRY	1
II.	Observations on the Country near Lake Torrens, by FREDERICK SINNETT, ESQ.	15
III.	On Statistical Sanitary Processes, by W. ARCHER, ESQ.	20
IV.	Description of Fifty New Victorian Plants, by Dr. FERDINAND MUELLER	28
V.	On the Deterioration of Grain and Flour, by Dr. MAUND	48
VI.	On Water Supply to the City of Melbourne, by M. B. JACKSON, ESQ., C.E.	54
VII.	Loan for Public Works in Victoria, by E. G. MAYNE, ESQ.	61
VIII.	On the Gunyang, a new Indigenous Fruit, by Dr. F. MUELLER	67
IX.	On the Mineral Waters of Victoria, by Dr. MAUND	70
X.	Gas and Gasworks, by A. K. SMITH, ESQ., C.E., F.R.S.S.A.	74
XI.	On Phonetics, by W. CLARSON, ESQ.	92
XII.	On the Timber of Victoria, by GEORGE HOLMES, ESQ...	100
XIII.	On Microscopic Investigation and Manipulation, by W. S. GIBBONS, ESQ.	104
XIV.	Description of Fifty New Australian Plants, by Dr. FERD. MUELLER	114
XV.	On the Water of the Plenty River, by Dr. MAUND ...	136
XVI.	On Gas and Gasworks, considered in relation to the requirements and conditions of the Colony, by A. K. SMITH, ESQ., C.E., &c.	143
XVII.	On the Trussed Bridge at Keilor, by E. RICHARDSON, ESQ.	149
XVIII.	On Iron Lattice Bridges, by F. BELL, ESQ., C.E. ...	154

		PAGE
ART. XIX.	On Translation of Languages, by W. SYDNEY GIBBONS, Esq.	157
XX.	On the Manufacture of Stearine, by A. K. SMITH, Esq., C.E.	162

PROCEEDINGS.

Preliminary Meeting, 15th June, 1854	iii.
Foundation of the Institute	iii.
General Meeting, 31st July, 1854	vii.
Conversazione, 22nd September, 1854	ix.
Ordinary Meeting, 26th September ,, ...	x.
,, ,, 23rd October ,, ...	xii.
,, ,, 28th November ,, ...	xiii.
,, ,, 23rd December ,, ...	xiii.
General Meeting and Report of Half-year, 8th March, 1855	xiv.
Ordinary Meeting, 5th April, 1855...	xvii.
Ordinary Meeting and Report of Amalgamation Conference, 3rd May, 1855	xvii.
Ordinary Meeting, 7th June, 1855	xix.

TABLE OF CONTENTS OF TRANSACTIONS OF THE PHILOSOPHICAL SOCIETY OF VICTORIA, 1855.

		PAGE
ART. I.	Inaugural Address of the President, CAPTAIN CLARKE, R.E., Surveyor-General, &c., &c.	1
II.	Definitions of rare, or hitherto undescribed, Australian Plants, collected within the boundaries of the Colony and examined by Dr. FERDINAND MUELLER	5
III.	On the comparative Value and Durability of the Building Materials in use in Melbourne, by ROBERT BROUGH SMYTH, ESQ.	24
IV.	Definitions of rare, or hitherto undescribed, Australian Plants, collected within the boundaries of the Colony of Victoria, and examined by Dr. FERDINAND MUELLER (continued)	34
V.	Personal observations made in an excursion towards the central parts of Victoria, including Mount Macedon, McIvor, and the Black Ranges, by WM. BLANDOWSKI, ESQ.	50
VI.	Original Rules and Tables, adapted to cases of sidelong Ground in the Setting-out and Computation of Railway Earthworks, by CLEMENT HODGKINSON, ESQ., C.E., Survey Department	74
VII.	On the Construction of an Instrument for Ascertaining the mean Temperature of any place, by Dr. DARCY...	85
VIII.	Meteorological Observations at Bendigo, by LUDWIG BECKER, ESQ., with a plate	87
IX.	On the Influence of Gravity on the Physical condition of the Moon's surface, by BALFOUR STEWART, ESQ., with a plate	92
X.	On the Adaption of the Eye to the nature of the Rays which emanate from Bodies, by BALFOUR STEWART, ESQ.	95
XI.	Descriptive Characters of new Alpine Plants, from Continental Australia, by Dr. FERDINAND MUELLER ...	96
XII.	On the Failure of the Yan Yean Reservoir, embracing an examination of the Report of the Committee on the Yan Yean Scheme, by DAVID E. WILKIE, ESQ., M. D.	111
XIII.	The Meteorology of Melbourne, by Dr. E. DARCY ...	164

		PAGE
Art. XIV.	On the probable Influence of Evaporation on the Quantity of Water to be Supplied by the Reservoir at Yan Yean, by Clement Hodgkinson, Esq., C.E., Survey Department, with a plate	175
XV.	Report of the Commissioners appointed by the Philosophical Society to investigate the alleged insufficiency of Supply for the Yan Yean Water Works, by Dr. Wilkie, and Messrs. F. Acheson and F. C. Christy	187
XVI.	On the Influence of the Physical Character of a Country on the Climate, by R. Brough Smyth, Esq., Mining Engineer, with four plates	203
XVII.	A description of Fossil Animalculæ in Primitive Rocks from the Upper Yarra district, by William Blandowski, Esq., with a plate	222
XVIII.	Practical Remarks on Hydrometry, by Clement Hodgkinson, Esq., C.E.	223
XIX.	On the Primary Upheaval of the Land round Melbourne, and the recent Origin of the Gypsum or Sulphate of Lime on the Great Swamp between Batman's and Emerald Hills, Flemington, Williamstown, and Melbourne, illustrated by a large number of specimens from the locality, by William Blandowski, Esq., with two plates	229
XX.	On what Data does the City of Melbourne depend for an adequate Supply of Water from the Yan Yean Reservoir? by David E. Wilkie, Esq.	234
XXI.	Remarks on the favorable Geological and Chemical nature of the Principal Rocks and Soils of Victoria, in reference to the production of Ordinary Serials and Wine, by Clement Hodgkinson, Esq., C.E., Survey Department	260
XXII.	Proceedings	
XXIII.	The Philosophical Society...	

TABLE OF CONTENTS OF THE TRANSACTIONS OF THE PHILOSOPHICAL INSTITUTE OF VICTORIA, 1856.

Vol. I.

		PAGES
	Anniversary Address of the President, the Hon. ANDREW CLARKE, R.E., Surveyor-General of Victoria, &c. ...	1—10
ART. I.	On a Viviparous Fish, from Hobson's Bay, by LUDWIG BECKER, Esq., with a plate	11—13
II.	On a Sygnathus, from Hobson's Bay, by LUDWIG BECKER, Esq., with a plate	14
III.	On the Age of the Animal and Vegetable Kingdoms of Australia relatively to that of the rest of the world; and some remarks on the changes of this Land by Upheavals, by LUDWIG BECKER, Esq., with a plate...	15—18
IV.	On a proposed Railway Pier, by FREDERICK ACHESON, Esq., C.E., with a plate	18—24
V.	Report II., of WILLIAM BLANDOWSKI, Esq., to the Hon. the Surveyor-General, on an Excursion to Frankston, Balcomb's Creek, Mount Martha, Port Phillip Heads, and Cape Shank	24—37
VI.	Observations on the Geology and Soil of the Country adjacent to the Upper Murray, and also on the Productive Capabilities of that portion of the territory of Victoria, by CLEMENT HODGKINSON, Esq., C.E., &c...	37—50
VII.	Report III. of WILLIAM BLANDOWSKI, Esq., to the Hon. the Surveyor-General, on an Excursion from King's Station to Bass' River, Phillip and French Islands ...	50—67
VIII.	On Irrigation, by F. C. CHRISTY, Esq.	67—70
IX.	Some Observations on Primary Schools, by WILLIAM E. HEARN, Esq., L.L.D., M.A., Professor of History and Political Economy in the University of Melbourne ...	70—80
X.	On the Importance of Sanitary Works for Towns, having especial reference to Collingwood, with suggested remedial Works for that district, by THOMAS E. RAWLINSON, Esq., C.E	81—108
XI.	On Motive Power in Victoria, economically considered, by FREDERICK ACHESON, Esq., C.E.	108—127
XII.	On Museums in Victoria, by FREDERICK M'COY, Esq., F.G.S., Professor of Natural Science in the University of Melbourne, &c.	127—134

		PAGES
ART. XIII.	On the Phenomena of Hailstorms in Victoria, by R. BROUGH SMYTH, ESQ., C.E., F.G.S., &c.	135—138
XIV.	Report on the Steps taken in England to provide a Telescope for observing the *Nebulæ* of the Southern Hemisphere, by Professor WILSON, M.A., Professor of Mathematics in the University of Melbourne, &c. ...	138—152
XV.	On the Nest, Egg, and Young of the Lyre Bird (*Menura superba*), by LUDWIG BECKER, ESQ.	153—154
XVI.	On the Tenacity of Life in the Platypus (*Ornithorhyncus paradoxus*), by LUDWIG BECKER, ESQ.	155—156
XVII.	On Native Zinc, imbedded in Basalt, by LUDWIG BECKER, ESQ.	156—158
	Proceedings, &c.	i—xxxvi.
	Report of the Council for the year 1856 ...	xxxvi.*—xxxviii*
	Balance Sheet to the end of 1856	...
	Appendix	xxxvii.—xxxix.

TABLE OF CONTENTS OF THE TRANSACTIONS OF THE PHILOSOPHICAL INSTITUTE OF VICTORIA, 1857.

Vol. II.

		Pages
Art. I.	On a new form of Propeller for Steam Ships, by David E. Wilkie, M.D., with three plates	1—12
II.	On the "Lyre Bird" (*Menura superba*), by J. Wood Beilby, Esq., Gipps Land	12—14
III.	On the Phenomena attending an Interesting Case of Mirage, by Professor Wilson, M.A., Melbourne University	14—15
IV.	On the *Cestracion Phillippi* (Port Jackson Shark), *Trigonia* and *Terebratula*, of the Australian Seas, by Sizar Elliott, Esq.	15—17
V.	On a new Mineral, from McIvor, by R. Brough Smyth, Esq., C.E., F.G.S.	17—19
VI.	On the *Octoclinis Macleayana*, a new Australian Pine, described by Ferdinand Mueller, M.D., Ph. D., F.R.G.S., Colonial Botanist of Victoria, with a plate...	20—22
VII.	On the Murray River Cod, with particulars of experiments instituted for introducing this Fish into the Yarra Yarra, by Edward Wilson, Esq.	23—34
VIII.	On the Supply of Water to the Town of Geelong, by John Millar, Esq., C.E., F.S.A., &c., Engineer-in-Chief to the Geelong Water Commission	34—61
IX.	On the Construction of an Instrument for ascertaining the Dew Point, by R. Brough Smyth, Esq., C.E., F.G.S., with a plate	61—12
X.	Account of some new Australian Plants, by Ferdinand Mueller, M.D., Ph. D., F.R.G.S., &c., with two plates	62—77
XI.	On the Introduction of the British Song Bird, by Edward Wilson, Esq.	77—88
XII.	On a Suggestion for a new Mode of Life Insurance, by Professor Wilson, M.A., Melbourne University ...	88—92
XIII.	On a General Introduction of Useful Plants into Victoria, by Ferdinand Mueller, M.D., Ph.D., F.R.G.S., &c.	93—109
XIV.	On Railway Gradients, by William Austin Zeal, Esq.	109—124
XV.	Recent Discoveries in Natural History on the Lower Murray, by William Blandowski, Esq.	124—137

		PAGES
Art. XVI.	On the Astronomy and Mythology of the Aborigines of Victoria, by William Edward Stanbridge, Esq.	137—140
XVII.	On Extensive Infusoria Deposits in the Mallée Scrub, near Swan Hill, on the Lower Murray River, in Victoria; and on the presence of Fucoidæ in Silurian Rocks, near Melbourne, by William Blandowski, Esq., with two plates	141—146
XVIII.	Observations on the Saw Fish, by Thomas E. Rawlinson, Esq., C.E.	146—148
XIX.	An Historical Review of the Explorations of Australia, by Ferdinand Mueller, M.D., Ph.D., F.R.G.S., &c., with two plates	148—168
XX.	Observations on some Metamorphic Rocks, in South Australia, by the Rev. Julian Edmund Woods ...	168—176
Proceedings—Reports of Committees		i.—xxiii.
,, Minutes of the Meetings of the Institute... ...		xxx.—l.
Report of the Council for the year 1857		li.—liii.
Balance Sheet to the end of 1857		liv.—lv.
Appendix		lvii.—lxii.
List of Members as at 31st December, 1857		...
Laws of the Institute, adopted 25th September, 1857		...
List of the Officers of the Institute for 1857		...

TABLE OF CONTENTS OF THE TRANSACTIONS OF THE PHILOSOPHICAL INSTITUTE OF VICTORIA, 1858.

Vol. III.

		PAGES
	Anniversary Address of the President, His Honour Sir William Foster Stawell, Knt., Chief Justice of Victoria, &c., &c.	1—6
Art. I.	Some Facts determining the Rate of the Upheaval of the South Coast of the Australian Continent, by Ludwig Becker, Esq.	7—9
II.	On the Reclamation and Cultivation of Batman's Swamp, by Alexander Kennedy Smith, Esq., C.E., F.R.S.S.A., with a plate	9—18
III.	On the Hirudo Australis, by Joseph Bosisto, Esq., President of the Pharmaceutical Society, Melbourne ...	18—22
IV.	Diagnostic Notes on New or Imperfectly-known Australian Plants, by Dr. Ferdinand Mueller	22—31
V.	On the Weir Mallée (a Water-yielding Tree), the Bulrush and Porcupine Grass of Australia, by John Cairns, Esq.	32—35
VI.	A few Notes on Two Kinds of Australian Leeches, by Ludwig Becker, Esq., with a plate	36—38
VII.	On an Australian Bat, No. I., by Ludwig Becker, Esq., with a plate	38—40
VIII.	Some hitherto Unknown Australian Plants, described by Dr. Ferdinand Mueller	40—63
IX.	Mr. J. T. Gellibrand's Memoranda of a Trip to Port Phillip in 1836, addressed to His Excellency the Lieutenant-Governor, from a MS. Copy presented to the Philosophical Institute of Victoria, by the Hon. Captain Clarke, R.E.	63—85
X.	Remarks on a Tertiary Deposit in South Australia, by the Rev. Julian Edmund Woods, Penola, South Australia	85—94
XI.	Description and System of Working of the Flagstaff Observatory, Melbourne, by Professor George Neumayer, with three plates	94—103
XII.	Some Facts Illustrative of the Meteorology of August, 1858, in the Southern Hemisphere, by Professor George Neumayer, with four plates	104—114

PAGES

ART. XIII. Index of the Plants described in the Transactions of the Victorian Institute, of the Philosophical Society, and of the Philosophical Institute of Victoria, by Dr. FERDINAND MUELLER ... ... 115—120

Proceedings—Minutes of the Meetings of the Institute ... i.—xxix.

Annual Report for 1858 ... ... xxxi.

Balance Sheet for 1858 ... ... xxxiv.

Reports of Committees ... ... xxxv.

List of Institutions, Learned Societies, &c., receiving copies of the Transactions of the Institute in 1858 ... ... xliii.

List of Members as at 31st December, 1858 ... ... xlv.

Laws of the Institute ... ... end of volume.

TABLE OF CONTENTS OF THE TRANSACTIONS OF THE PHILOSOPHICAL INSTITUTE OF VICTORIA, 1859.

VOL. IV.

		PAGES
	Address of the President, FERDINAND MUELLER, ESQ., Ph. D., M.D., F.R.G. and L.S., &c., &c., at the Anniversary Meeting	1—8
ART. I.	Observations on Donati's Comet, made between Oct. 12th and Nov. 12th, 1858, by LUDWIG BECKER, ESQ., with five plates	9—13
II.	Some interesting facts founded on Barometrical Observations, by A. C. GREGORY, ESQ., F.R.G.S., &c., with plate	14
III.	On the Geological distribution of Gold, with special reference to some Auriferous Rocks in South America, by P. NISSER, ESQ.	15—40
IV.	Notes on an Australian Bat, No. II., by LUDWIG BECKER, ESQ., with a plate	41—43
V.	Suggestions for a System of Drainage for Melbourne, by the Hon. JOHN HOOD, M.L.C.	43—60
VI.	A description of the Silver Mines of the Cerro de Pasco, and the Journey to them across the Andes, by JOHN CAIRNS, ESQ.	61—65
VII.	On some Domesticated Animals of South America which would be useful in Victoria, by P. NISSER, ESQ. ..	65—69
VIII.	On the First Technical Use of Gold by the Aborigines of South America, with a description of the Indian Tombs, by P. NISSER, ESQ., with a plate	69—75
IX.	Improvements in Fundamental Ideas and Elementary Theorems of Geometry, by MARTIN GARDINER, ESQ., C.E.	76—96
X.	On some new Australian Polyzoa, by P. H. MACGILLIVRAY, ESQ., A.M., M.R.C.S., with a plate	97—98
XI.	On Lightning Conductors generally, with special reference to the Conductor attached to the tower and spire of the Wesley Church, Melbourne, by SIZAR ELLIOTT, ESQ.	99—102
XII.	On Dove's Law of the Turning of the Wind, as illustrated and supported by Observations made at the Flagstaff Meteorological and Magnetic Observatory, Melbourne, by Professor GEORGE NEUMAYER, Government Meteorologist and Director of the Magnetic Survey of Victoria ; with four plates	102—122

PAGES

ART. XIII. An Attempt to Simplify and Generalise the Theory and Practice of Railway Curves, by WILLIAM HILL, ESQ., C.E., with a plate ... ... 123—141

XIV. On the Resources of Victoria and their Development, by WILLIAM E. BRYSON, ESQ., C.E. ... ... 141—159

XV. Notes on the Cheilostomatous Polyzoa of Victoria and other parts of Australia, by P. H. MACGILLIVRAY, A.M., M.R.C.S., with two plates ... ... 159—168

XVI. On Some Tertiary Rocks at Portland Bay, by Rev. JULIAN EDMUND WOODS, Penola, South Australia ... 169—172

XVII. On a new Photo-Lithographic Process, by JOHN WALTER OSBORNE, ESQ., with an illustrative map ... 172—183

XVIII. Notes on the Plants collected during Mr. John Macdouall Stuart's recent Expedition into the North-West interior of South Australia, by Dr. FERDINAND MUELLER ... 183—188

XIX. Notes of a recent personal visit to the unoccupied Northern District of Queensland, by WILLIAM LOCKHART MORTON, ESQ., with a Map of the District ... 188—199

XX. On a new application of Lever Power in the Extraction of Teeth, by the Hon. DAVID E. WILKIE, M.D., M.L.C., with a plate ... ... 200—204

XXI. Address of the President, FERDINAND MUELLER, M.D., Ph. D., F.R.G. and L.S., &c., &c., on the occasion of Opening of the Hall of the Society ... ... 204—210

PROCEEDINGS.

Minutes of the Meetings of the Institute ... ... i.—lvii.

Annual Report for 1859 ... ... lix.—lxi.

Balance Sheet for 1859 ... ... lxii.

Reports of Committees ... ... lxiii.—lxx.

List of Institutions, Learned Societies, &c., receiving copies of the Transactions of the Philosophical Institute of Victoria for 1859 ... ... lxxi.—lxxiii.

List of the Members of the Institute, as at 31st December, 1859 ... ... lxxvii.—lxxxvi.

Appendices, containing: 1. Report of a Committee of the Institute on the "RESOURCES OF THE COLONY OF VICTORIA." 2. Report of a Public Meeting held in Melbourne on the 23rd January, 1860, on the subject of "AUSTRALIAN EXPLORATION." 3. REPRINT OF THE CONTENTS OF FORMER VOLUMES OF THE "TRANSACTIONS OF THE INSTITUTE" ... ... end of volume

Laws of the Institute ... ... ditto

TABLE OF CONTENTS OF THE TRANSACTIONS OF THE ROYAL SOCIETY OF VICTORIA, 1860.

Vol. V.

		PAGES
	Inaugural Address of the President, His Excellency Sir HENRY BARKLY, K.C.B., &c., &c.	1—18
ART. I.	The "Three Sections," the "Tangencies," and a "Loci Problem" of Apollonius, and Porismatic Developments, by MARTIN GARDINER, C.E. (formerly Science Scholar, Queen's College, Galway)	19—89
II.	A Communication from the Rev. W. B. CLARKE, of Sydney, to His Excellency Sir HENRY BARKLY, K.C.B., &c., &c., President of the Royal Society of Victoria, on Professor M'COY'S "New Tæniopteris" from the Coal-bearing Rocks of the Cape Patterson District in particular, and on the Evidence bearing on the Question of the Age of Australian Coal Beds in general.—Communicated to the Society by His Excellency THE PRESIDENT	89—95
III.	A Commentary on "A Communication made by the Rev. W. B. CLARKE to His Excellency Sir HENRY BARKLY, K.C.B., &c., &c., President of the Royal Society of Victoria, on Professor M'COY'S 'New Tæniopteris,' &c., &c.," by FREDERICK M'COY, ESQ., F.G.S., Honorary Fellow of the Cambridge Philosophical Society, Professor of the Natural Sciences in the University of Melbourne, Government Palæontologist, and Director of the National Museum	96—107
IV.	The Conjugal Condition of the People of Victoria, considered in relation to Laws of Divorce, by FRANCIS A. CORBETT, ESQ.	108—127
V.	Remarks on the Physical Geography, Climate, &c., of the Regions lying between the Rivers Lachlan and Darling, by W. LOCKHART MORTON, ESQ.	128—140
VI.	On the Nest and Eggs of the Coach-whip Bird (*Psophodes Crepitans*, Gould), and of the White-fronted Epthianura (*Epthianura Albifrons*, Gould), with some general remarks on the Nidification of Australian Birds, by A. DOBREE, ESQ.	141—144
VII.	On the Application of Galvanic Electricity to Practical Astronomy, by R. J. L. ELLERY, ESQ., Government Astronomer	142—155

PAGES

Art. VIII. Suggestions for the Introduction of Animals and Agricultural Seeds into Victoria, by W. Lockhart Morton, Esq. ... ... 153—157

IX. On a Deposit of Diatomaceæ at South Yarra, by John Coates, Esq., M.R.C.S.L., South Yarra ... 158—164

X. Manners and Customs of the Australian Natives, in particular of the Port Lincoln District, by Charles Wilhelmi, Esq. ... ... 164—203

XI. Description of a New Species of Plumatella, by P. H. MacGillivray, Esq., A.M., M.R.C.S. ... ... 203—204

XII. Indigenous Fibrous Plants, by F. A. Corbett, Esq. ... 205—208

XIII. Remarks on Professor M'Coy's Commentary, by Rev. W. B. Clarke, M.A., F.G.S., &c. ... ... 209—214

XIV. Note on Rev. Mr. Clarke's "Remarks," &c., by Professor M'Coy ... ... 215—217

XV. On the Multisection of an Angle by means of the Cycloid, by the Hon. D. E. Wilkie, M.D., M.L.C., with a plate ... ... 217—220

PROCEEDINGS.

Minutes of the Meetings of the Society ... ... i.—xxv.

Annual Report for 1860 ... ... xxvii.—xxx.

Balance Sheet for 1860 ... ... xxxi.—xxxii.

Reports of Committees .. .. xxxiii.—xliv.

List of Institutions, Learned Societies, &c., receiving copies of the Transactions of the Royal Society of Victoria for 1860 xlv.—xlvii.

List of Members ... ... li.—lxii.

Appendices, containing—

1. Instructions to Members of Exploring Expedition, List of Stores, &c. ... ... lxv.—lxxxiv.
2. Reprints of the Contents of former Volumes of the "Transactions," &c. ... ... lxxxvii.—c.

Laws of the Institute ... ... end of volume

MINUTES, &c.,

OF

COMMITTEE ON PRIZE ESSAYS.

MINUTES, &c.,

OF

COMMITTEE ON PRIZE ESSAYS.

First Meeting of Judges appointed to Report on the Prize Essays for 1861.

November 7th, 1860.

Present—Dr. Mueller (in the chair), Dr. Macadam, A. R. C. Selwyn, Esq., C. J. Hodgson, Esq., J. W. Osborne, Esq.

For No. 1 (six essays)—Mr. Humffray (as chairman), Dr. Wilkie, and Clement Hodgkinson, Esq.

For No. 2 (seven essays)—Mr. Hodgson (as chairman), Professor McCoy, and R. H. Bland, Esq.

For No. 3 (five essays)—Mr. Selwyn (as chairman), W. Wade, Esq., and Dr. Macadam.

For No. 4 (six essays)—Dr. Mueller (as chairman), J. W. Osborne, Esq., and Dr. Davy.

Second Meeting of Judges of Prize Essays.

December 15th, 1860.

Present—Hon. J. B. Humffray, M.L.A. (in the chair), W. Wade, Esq., Hon. Dr. Wilkie, M.L.C., Professor McCoy, J. H. Bland, Esq., J. W. Osborne, Esq., and Clement Hodgkinson, Esq.

Professor McCoy sent in report of No. 2.

Dr. Mueller sent in report of No. 4.

The reports of Nos. 1 and 4 to be given in on Monday, before the meeting of Council.

Meeting of Judges adjourned to Monday at 6·30, to receive reports of sections 1 and 3.

Third Meeting of Prize Essay Judges.

December 19th, 1860.

Present—C. J. Hodgson, Esq. (in the chair), J. W. Osborne, Esq., W. Wade, Esq., Dr. Macadam, Hon. J. B. Humffray, Professor McCoy, H. J. Bland, Esq.

A short discussion ensued prior to the adjudication of the prizes, after which the following resolution was adopted:—

"That the names accompanying the mottos of the essays selected as the best, be forwarded to the Government as the names of the gentlemen entitled to the premiums and medals for the Prize Essays of 1860; and that the Government be recommended to print the Prize Essays for immediate distribution, at a price merely sufficient to cover the necessary expense. Further—that the judges desire to call the attention of the Government to the fact that the prize competitors have not in all cases fully satisfied the expectations entertained as to excellence, but that the judges have been induced to exhibit, on this, the first occasion of awarding such prizes, a disposition to encourage the efforts of those (twenty-five in number) who have devoted so much time and labor in responding to the invitation of the Government.

Chas. J. Hodgson, Chairman.

No. 1 P.E.

Royal Society of Victoria,

January 3rd, 1861.

Sir,

I am instructed by the Council of the Royal Society to inform you that the Report of the Judges on the Government Competitive Essays for 1860 has been received.

The premium has been awarded in the case of each of the four subjects previously submitted to and approved of by the Government.

The premium in each case is as originally arranged, £125 (say one hundred and twenty-five pounds), with a medal.

The successful competitors are:—

1st. On the Collection and Storage of Water—Frederick Acheson, Esq., C.E., Crown Lands Department.

2nd. The Origin and Distribution of Quartz Veins, &c.—Henri Rosalis, Esq., Ballarat.

3rd. Agriculture, &c.—W. Storey, Esq., Lygon-street, North Melbourne.

4th. Manufactures in Victoria, &c.—Charles Mayes, Esq., C.E., Railway Department.

The medals to be awarded to these gentlemen are to be of silver; and the Council, in accordance with the views of the Judges, has decided that a silver medal should also be awarded to each of the four second-class competitors.

The following is the Report of the Judges as set forth in the resolution arrived at by them, and approved of by the Council, and now forwarded to the Government for confirmation as already set forth:—

"I am specially instructed to solicit the immediate attention of the Government to the recommendation for the immediate publication of the Prize Essays, and to state that the Council will be happy to superintend the printing and production of the same.

"As to the mode of the distribution of the Prize Essays, the Council would suggest that the money premiums should be publicly bestowed, in the usual form of claims on the Treasury, on as early a day as possible.

"In conclusion, and in reference to financial matters, I enclose the accounts for the advertisements in newspapers, amounting in the aggregate to £50 17s. 2d., and the requests that these claims may be immediately liquidated.

"When this sum is added to the £500, viz., the four premiums of £125 each, of the £600 voted for the Prize Essays of 1860, there remains a balance of £49 2s. 10d. This balance would require to be set aside at the Treasury to meet the cost of the eight medals, and any other necessary expenses.

"Requesting an early reply, as the Council is anxious that the distribution of the rewards should take place without any unnecessary delay,

"I have the honor to be, Sir,

"Your obedient servant,

(Signed) JOHN MACADAM, M.D., Hon. Secretary.

"To the Hon. the Chief Secretary."

No. 2 P.E.

Royal Society of Victoria,

Victoria Street, Melbourne, February 2, 1860.

SIR,

I am instructed by the Council of the Royal Society to request your attention to my communication of the 3rd ultimo, and to report to you the further additional expenditure, for which the vouchers are enclosed:—

To advertising in *Argus*	£1	15	0
Do. *Herald*	1	16	0
Do. *Age*	1	4	0
	£4	19	0
To eight Prize Medals, at 60s.	24	0	0
	£28	19	0
Postages, &c.	1	3	10
	£30	2	10
To amount reported January 3rd	50	17	2
	£81	0	0
Balance from Prizes retained for necessary expenses	100	0	0
To expenses as above	81	0	0
Balance remaining, ...	£19	0	0

I am further instructed to request your immediate attention to the recommendation of the Council as to the printing of the Essays, and the offer of the Council to superintend the preparation and production of the same.

There are two of the Essays that were written by foreigners, which will require very careful revision, and one on the subject of agriculture, which contains much valuable information, but, as it was written by a self-taught man, will require to be re-written before it can be sent to the printer; besides which, all of them will require careful superintendence to insure their appearance as creditable literary compositions. It is, therefore, recommended that the services of a person accustomed to correcting scientific authors' manuscripts should be obtained, and that the balance of £19 should be appropriated to that purpose.

I have the honour to be, Sir,
Your obedient Servant,
(Signed) John Macadam, M.D., Hon. Secretary.

(Copy.)

Royal Society of Victoria,
Victoria-street, Melbourne, May 1st, 1861.

Sir,

I am instructed by the Council of the Royal Society to request you to name the day and hour it will be most convenient to you to receive a deputation from the Council on the subject of printing the Prize Essays.

I have the honor to be, Sir,
Your obedient servant,
(Signed) John Macadam, M.D., Hon. Secretary.

Hon. Richard Heales, M.L.A., Chief Secretary.

G.B. 843. Chief Secretary's Office,
Melbourne, 3rd May, 1861.

Sir,

In reply to your letter of the 1st instant, I have the honour to inform you that the Chief Secretary will receive the deputation from the Council on Monday next, at eleven o'clock.

I have the honour to be, Sir,
Your most obedient servant,
J. Moore.

The Honorary Secretary,
Royal Society of Victoria.

LAWS.

LAWS

OF THE

ROYAL SOCIETY

OF

VICTORIA.

Melbourne:

PRINTED BY MASON & FIRTH, 51 & 53 FLINDERS LANE WEST.

[illegible]

[illegible]

[illegible]

[illegible]

LAWS.

I. The Society shall be called "The Royal Society of Victoria." Name.

II. The Royal Society of Victoria is founded for the advancement of science, literature, and art, with especial reference to the development of the resources of the country. Objects.

III. The Royal Society of Victoria shall consist of Members and Honorary Members, all of whom shall be elected by ballot. Members and Honorary Members.

IV. His Excellency the Governor of Victoria, for the time being, shall be requested to be the Patron of the Society. Patron.

V. There shall be a President, two Vice-Presidents, a Treasurer, and a Secretary of the Society, who, with twelve other members, shall constitute the Council. Officers.

VI. The Council shall have the management of the affairs of the Society. Management.

VII. The ordinary meetings of the Society shall be held every third week during the months from March to November, inclusive. Ordinary Meetings.

VIII. In the first week in December there shall be a General Meeting to receive the report of the Council, and in the first week in March there shall be the Anniversary Meeting to elect the Officers of the Society for the ensuing year. General and Anniversary Meetings.

Annual Conversazione.

IX. During the month of March there shall be an Annual Conversazione of the Members of the Society, after which the newly-elected President shall read an address.

Retirement of Officers.

X. The President, the Vice-Presidents, the Treasurer, the Secretary, and six senior ordinary Members of Council shall retire from office annually at the Anniversary Meeting. The officers, so retiring, shall be eligible for the same or any other offices then vacant.

Election of Officers.

XI. The President, the Vice-Presidents, the Treasurer, and the Secretary shall be separately elected by ballot, in the above-named order, at the Anniversary Meeting, and the six vacancies in the Council shall be then filled up together by ballot. Those Members only shall be eligible for any office, whose names, together with those of their proposers and seconders, shall have been posted in the Hall of the Society one clear week before the Anniversary Meeting. The posting of a name for any office shall he held a nomination for any office, the election to which is to be subsequently held.

Members in arrear.

XII. No Member whose subscription is in arrear shall take part in the election of Officers or other business of the Meeting.

Vacancies.

XIII. If any vacancy occur among the Officers, notice thereof shall be inserted in the summons for the next Meeting of the Society, and the vacancy shall be then filled up by ballot.

Duties of President.

XIV. The President shall take the Chair at Meetings of the Society and of the Council, regulate and keep order in all their proceedings, state questions and propositions to the Meeting, report the result of ballots, introduce newly-elected Members, and carry into effect the regulations of the Society. He shall deliver an address at the Annual Conversazione of the Society.

In the absence of the President, the Chair shall be taken by one of the Vice-Presidents, the Treasurer, or an ordinary Member of Council.

Duties of Treasurer.

XV. The Treasurer shall receive all money paid to the Society, and shall deposit the same in the

Colonial Bank of Australasia, to the credit of an account opened in the name of the Royal Society of Victoria, all cheques against which shall be signed by himself and countersigned by the Secretary. He shall make all payments ordered by the Council, on receiving a written authority from the Chairman of the Meeting, keep a detailed account of all receipts and expenditure, prepare a balance sheet to be laid before the Council and included in their Annual Report, and produce his books if called on by the Council.

The Treasurer shall issue the notices required by Rules XXV. and XXVI.

XVI. The Secretary shall conduct the correspondence of the Society and of the Council, attend all Meetings of the Society and of the Council, take minutes of their proceedings, and enter them in the proper books; he shall inscribe the names and addresses of all Members in a book to be kept for that purpose, from which no name shall be erased except by order of the Council; he shall issue notices of all Meetings of the Society and of the Council, shall have the custody of all papers of the Society, and, under the direction of the Council, superintend the printing of the Transactions of the Society, and the correction of the Press. Duties of Secretary.

He shall make all preparations for the Meetings of the Society.

XVII. The Council shall meet one week before every ordinary Meeting of the Society. Notices of such meetings shall be sent to every Member at least two days previously. No business shall be transacted at any Meeting of the Council unless five members be present. That any Member of Council (the President excepted) absenting himself from three (3) consecutive Ordinary Meetings of Council, without having obtained leave of absence from the Council, shall be considered to have vacated his office, and the election of an officer to fill his place shall be proceeded with at the next Ordinary Meeting of Members, in accordance with Law XIII. Meetings of Council.

XVIII. The Secretary shall call a Special Meeting Special Meetings of Council.

of Council on the authority of the President or of three Members of Council. The notice of such meeting shall specify the object for which it is called, and no other business shall be entertained.

Annual Report.

XIX. The Council shall annually prepare a report of the proceedings of the Society during the past year, embodying the balance sheet, duly audited, and a statement of the present position of the Society. This report shall be laid before the Society at the General Meeting in December. No paper shall be read at this meeting.

Expulsion of Members.

XX. If it shall come to the knowledge of the Council that the conduct of a Member is injurious to the character of the Society, and if two-thirds of the whole Council shall be satisfied, after an opportunity of defence has been afforded to the Member, that such is the case, they shall request him to resign, and in case of his not doing so, may expel him from the Society.

In every case all proceedings shall be entered upon the minutes.

Special General Meetings.

XXI. The Council shall call a Special General Meeting of the Society on receiving a requisition in writing signed by twenty-four Members of the Society, specifying the purpose for which the meeting is required; no other business shall be entertained at such meeting. Notice of such meeting, and the purpose for which it is summoned, shall be sent to every Member at least ten days before the meeting.

Election of Members.

XXII. Every candidate for membership shall be proposed and seconded by Members of the Society. The name, the address, and the occupation of every candidate, with the names of his proposer and of his seconder, shall be communicated in writing to the Secretary, and shall be read at a Meeting of Council, and also at the following Meeting of the Society, and the ballot shall take place at the next following ordinary meeting of the Society. When the number of voters in favour of any candidate shall be five times the number of those against him, he shall be declared duly elected, and not otherwise.

XXIII. Every newly-elected member shall, at the first meeting of the Society at which he may be present, sign a declaration, in a book provided for that purpose, that he will observe the laws of the Society. Members shall sign laws.

XXIV. Gentlemen not resident in Victoria, who are distinguished for their attainments in science, literature, or art, may be proposed for election as Honorary Members, on the recommendation of an absolute majority of the Council. The election shall be conducted in the same manner as that of ordinary Members, but nine-tenths of the votes must be in favor of the candidate. Honorary Members.

XXV. Members of the Society, resident in Melbourne or within fifty miles thereof, shall pay two guineas annually, and members residing beyond that distance shall pay one guinea annually. The subscriptions shall be due on the 1st of January in every year, and notice thereof shall be sent to every member during the preceding December. Subscription.

If the subscription of any member be not paid before the 1st of March, his name shall be posted at the next ordinary meeting of the Society, and at the two following ones, should his subscription remain so long unpaid; and a second notice shall be sent, informing him that this will be done.

After the third meeting, notice shall be sent to him that he has ceased to be a Member of the Society, but that he may be restored on furnishing in writing to the Council a satisfactory reason for his delay, and paying arrears within one month.

XXVI. Newly-elected members shall pay an entrance fee of two guineas, in addition to the subscription for the current year. Those elected after the 1st of July shall pay only half of the subscription for the current year. If the entrance fee and subscription be not paid within one month of the notification of election, a second notice shall be sent, and, if payment be not made within one month from the second notice, the election shall be void. Entrance Fee, &c.

XXVII. Members may compound for all annual Life Members.

subscriptions of the current and future years by paying twenty guineas.

Duration of Meetings.

XXVIII. At the ordinary meetings of the Society the chair shall be taken punctually at half-past seven o'clock, and shall be vacated not later than half-past ten o'clock.

Order of Business.

XXIX. At the ordinary meetings business shall be transacted in the following order:—

Minutes of the preceding meeting to be read, amended if incorrect, and confirmed.

New Members to enrol their names, and be introduced.

Ballot for the election of new Members.

Vacancies among Officers, if any, to be filled up.

Business arising out of the minutes.

Communications from the Council.

Presents to be laid on the table, and acknowledged.

Motions, of which notice has been given, to be considered.

Notices of motion for the next meeting to be given in, and read by the Secretary.

Papers to be read.

No vote of thanks to any Member for his paper shall be proposed.

Immediately after each paper, the Chairman shall call on the Members for any remarks they may wish to make, or questions they may wish to ask.

No Member shall speak more than once on any paper, or for a longer period than five minutes, unless called on by the Chairman, who, however, shall not allow him to exceed ten minutes on the whole.

When no Member has any further questions to ask or remarks to offer, the Chairman shall call on the author for his reply to such questions and remarks, which shall terminate the discussion.

Strangers.

XXX. No stranger shall speak at a meeting of the Society, unless specially invited to do so by the Chairman.

Business to be notified.

XXXI. No business shall be entertained at any meeting which has not been inserted in the summons for that meeting.

XXXII. The Council may call additional meetings whenever it may be deemed necessary. Additional Meetings.

XXXIII. Every Member may introduce two visitors to the meetings of the Society by orders signed by himself. Visitors.

XXXIV. Members shall have the privilege of reading before the Society papers containing accounts of experiments, observations, and researches conducted by themselves, on subjects within the scope of the Society. Members may read papers.

XXXV. If a member be unable to attend for the purpose of reading his paper, he may delegate to any Member of the Society the reading thereof and his right of reply. Or depute other Members.

XXXVI. Any Member desirous of reading a paper shall give in writing to the Secretary, ten days before the Meeting at which he desires it to be read, its title and the time its reading will occupy. Members must give notice of their papers.

The Secretary shall lay this communication before the Council at its next meeting. Papers shall be read in the order in which such notices are received by the Secretary.

XXXVII. The Council may permit a paper of a nature similar to the above, not written by a Member of the Society, to be read, if for any special reason it shall be deemed desirable. Papers by strangers.

XXXVIII. Every paper read before the Society shall be the property thereof, and immediately after it has been read shall be delivered to the Secretary, and shall remain in his custody. Papers shall be the property of the Institute.

XXXIX. At the Meeting of the Council next following the reading of a paper, the Council shall decide whether it shall appear in the Transactions of the Society. Council shall decide as to publication.

XL. No paper shall be published in the Transactions, which in the opinion of the Council, does not Papers must be original.

consist mainly of original matter as regards the facts or the theories enunciated.

This rule shall not, however, be taken to exclude the reading of papers at the Ordinary Meetings of the Society, descriptive of recent discoveries or inventions, or upon subjects of general scientific interest.

Council may refer papers to Members.

XLI. Should the Council feel a difficulty in deciding on the publication of a paper, the Council may refer it to any member or members of the Society, who shall report on the same.

Rejected papers to be returned.

XLII. Should the Council decide not to publish any paper, it shall be at once returned to the author.

Transactions to be published half-yearly.

XLIII. The Transactions of the Society shall be published in parts at intervals not exceeding six months.

Institute to have priority of publication.

XLIV. No member shall publish or consent to the publication of any paper read before the Society until it shall have been published in the Transactions, or returned to him by the Council.

Members may have 50 copies of their papers.

XLV. The author of any paper which the Council has decided to publish in the Transactions may have any number of copies of his paper, not exceeding fifty, on giving notice of his wish in writing to the Secretary, with his paper, and on paying the extra cost of such copies.

Members to have copies of Transactions.

XLVI. Every member whose subscription is not in arrear, and every honorary member, is entitled to receive one copy of the Transactions of the Society as published. Newly-elected members shall, on payment of their entrance-fee and subscription, receive a copy of the volume of the transactions last published.

Property.

XLVII. Every book, pamphlet, model, plan, drawing, specimen, preparation, or collection presented to or purchased by the Society, shall be placed in the museum of the Society.

Museum.

XLVIII. The museum shall be open to members of the Society and the public at such times and under such regulations as the Council may deem fit.

XLIX. The legal ownership of the property of the Society is vested in the President, the Vice-Presidents, and the Treasurer for the time being, in trust for the use of the Society; but the Council shall have full control over the expenditure of the funds and management of the property of the Society. Legal ownership of property.

L. Every Committee appointed by the Society shall at its first Meeting elect a Chairman, who shall convene the Committee and bring up its report. Committees elect chairman.

LI. All Committees and individuals to whom any work has been assigned by the Society shall present to the Council, not later than the 1st of November in each year, a report of the progress which has been made; and, in cases where grants of money for scientific purposes have been entrusted to them, a statement of the sums which have been expended and of the balance of each grant which remains unexpended. Report before November 1st.

LII. Grants of pecuniary aid for scientific purposes from the funds of the Society shall expire on the 1st of November next following, unless it shall appear by a report that the recommendations on which they were granted have been acted on, or a continuation of them be ordered by the Council. Grants expire.

LIII. In all cases where additional grants of money are made for the continuation of researches at the cost of the Society, the sum named shall be deemed to include as a part of the amount the specified balance which may remain unpaid on the former grant for the same object. Additional Grants.

LIV. In grants of money to committees and individuals, the Society does not contemplate the payment of any personal expenses which may be incurred by the members. Personal expenses not to be paid.

LV. The Chairman of each Committee shall be the person entitled to call on the Treasurer for such portion of the sum granted as may from time to time be required. Chairman to draw grants.

Termination of Committees.

LVI. Every Committee shall cease to exist on the day of meeting next following the 1st of November, unless then re-appointed.

Alteration of law.

LVII. No new law or alteration or repeal of an existing law shall be made, except at the General Meeting in December, or at a special General Meeting summoned for the purpose, as provided in Law XXI., and in pursuance of notice given at the preceding ordinary meeting of the Society.

Cases not provided for.

LVIII. Should any circumstance arise not provided for in these laws, the Council is empowered to act as may seem to be best for the interests of the Society.

Sections.

LIX. In order that the Members of the Society prosecuting particular departments of science may have opportunities of meeting and working together with fewer formal restraints than are necessary at the ordinary meetings of the Society, Sections shall be established.

Names and number of sections.

LX. Sections shall be established for the following departments, viz.:—

Section A. Physical, Astronomical and Mechanical Science, including Engineering.

Section B. Chemistry, Mineralogy, and Metallurgy.

Section C. Natural History and Geology.

Section D. The Microscope and its applications.

Section E. Geography and Ethnology.

Section F. Social Science and Statistics.

Section G. Literature and the Fine Arts, including Architecture.

Section H. Medical Science, including Physiology and Pathology.

Meetings of sections.

LXI. The meetings of the Sections shall be for scientific objects only.

Members of sections.

LXII. There shall be no membership of the Sections as distinguished from the membership of the Society.

LXIII. There shall be for each Section a Chairman to preside at the meetings and Secretary to keep minutes of the proceedings, who shall jointly prepare and forward to the Secretary of the Society, prior to the 1st of November in each year, a Report of the Proceedings of the Section during that year, and such report shall be submitted to the Council. Officers of sections.

LXIV. The Chairman and the Secretary of each Section shall be appointed at the first meeting of the Council after its election in March, in the first instance from Members of the Society who shall have signified to the Secretary their willingness to undertake these offices, and subsequently from such as are recommended by the section as fit and willing. Mode of appointment of officers of section.

LXV. The first meeting of each Section in the year shall be fixed by the Council, subsequently the Section shall arrange its own days and hours of meeting, provided these be at fixed intervals. Times of meetings of sections.

MASON AND FIRTH, PRINTERS, FLINDERS LANE WEST, MELBOURNE.