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MDCCCXCIV.

PREFATORY NOTE.

Owing to the want of funds the Society has been unable to publish any of the papers read since the beginning of 1892, with the exception of the Presidential Address, by Mr. John Shirley, B.Sc., and Proceedings, issued in 1893, Volume IX. The difficulties alluded to having at length been overcome, through the exercise of economy and retrenchment, it is hoped that the Transactions and Proceedings will be published regularly in future. The Council take the present opportunity of thanking those members and others who have contributed papers in spite of the discouraging knowledge that their publication would be long delayed; and also the Institutions which have continued to send their publications as donations to the library, even when this Society had nothing to offer in exchange.

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PAPERS AND EXHIBITS.

No.	Title.	Author.	Date.
1	On the Prevention of Infectious Diseases	Eugen Hirschfeld, M.D.	13 Aug. 1892
2	On the Occurrence of a Green Mineral in the Schists of Adelaide Street, Brisbane	H. G. Stokes, F.G.S. ..	13 Aug. 1892
3	On the Drought-resisting Properties of the Eucalypti	J. Lauterer, M.D. ..	10 Sep. 1892
4	On Leprosy in the North of Europe, and its Contagious Character	J. Lauterer, M.D. ..	8 Oct. 1892
5	On the Flora of Moreton Island	John Shirley, B.Sc. ..	10 Dec. 1892
6	Description of a new Eucalypt	F. M. Bailey, F.L.S. ..	10 Mar. 1893
7	On Queensland Scorpions ..	J. Lauterer, M.D. ..	8 Apl. 1893
8	On the Disposal of Sewage ..	Hon. W. F. Taylor, M.D.	17 June 1893
9	Account of a Botanical Excursion to Burleigh Heads and the Macpherson Range	John Shirley, B.Sc. ..	17 June 1893
10	Notes on Floods in the Brisbane River	Mrs. Charles Coxen, M.R.Met.Soc.	12 Aug. 1893
11	Bacteria: their Life History and Effects	John Shirley, B.Sc. ..	12 Aug. 1893
12	On the Effect of Advanced Bacteriogical Knowledge as applied to the Human Race	F. A. Blackman	12 Aug. 1893
13	On Some New Species of Queensland Spiders	J. Lauterer, M.D. ..	9 Sep. 1893
14	Notes on the Cypræa	Mrs. Charles Coxen, M.R.Met.Soc.	14 Oct. 1893
15	Exhibition of Plants possessing or credited with Medicinal Properties; with Explanatory Remarks	J. Lauterer, M.D. ..	14 Oct. 1893
16	Exhibit of New and Interesting Plants; with Explanatory Remarks	F. M. Bailey, F.L.S. ..	14 Oct. 1893
17	Obituary Notice of Dr. George Bennett, F.C.S., F.Z.S., &c.	Mrs. Charles Coxen, M.R.Met.Soc.	17 Nov. 1893
18	Notes on Poisonous Cones ..	Ditto ditto	17 Nov. 1893
19	Report of Delegates, Adelaide Meeting of the Australasian Association for the Advancement of Science	John Shirley, B.Sc. ..	15 Dec. 1893
20	On Ceratodus Fosteri	Thomas Illidge	15 Dec. 1893
21	On Queensland Wines	J. Lauterer, M.D. ..	5 Feb. 1894
22	On the Discovery of Two Crater Lakes and other Evidences of Volcanic Activity in the Neighbourhood of Ban Ban, near Gayndah	Nugent Wade Broun ..	16 Mar. 1894

No.	Title.	Author.	Date.
23	An Unpublished Lecture by Dr. Ludwig Leichhardt; communicated by	Archibald Meston ..	16 Mar. 1894
24	Observations on Extinct Volcanoes	Samuel MacGregor ..	21 Apl. 1894
25	Obituary Notice of Dr. Chas. Prentice	F. M. Bailey, F.L.S. ..	21 Apl. 1894
26	Account of Excursion of Field Naturalists' Section to Eumundi	Ditto ditto	21 Apl. 1894
27	Exhibit of a Bunya Nodule; with Explanatory Remarks	Ditto ditto	21 Apl. 1894
28	On Some Victorian Lichens ..	John Shirley, B.Sc. ..	21 Apl. 1894
29	On the Australian Cassowary	Archibald Meston ..	19 May 1894
30	On the Prevalence of Cancer in Australasia. (First and Second Papers)	Eugen Hirschfeld, M.D.	12 Aug } 17 Nov } 1893
31	Ditto (Third Paper)	Ditto ditto	19 May 1894

Mrs. Coxen has forwarded Monthly Reports of Meteorological Observations taken at Omega Cottage, Bulimba.

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ADDITIONAL PAPERS AND EXHIBITS.

No.	Title.	Author.	Date.
			1894
32	Native Medicinal Plants of Queensland	J. Lauterer, M.D. ..	15 June
33	A Trip to the Darling River in 1859, 1st Part	Hon. A. Norton, ..	,,
34	A Trip to the Darling River in 1859, 2nd Part	Hon. A. Norton, ..	14 July
35	Obituary Notice of Dr. Joseph Bancroft	E. Hirschfeld, M.D. ..	,,
36	Notes on Fresh Queensland Plants	F. M. Bailey, F.L.S. ..	,,
37	Exhibit of Mylitta australis, with Notes	F. M. Bailey, F.L.S. ..	18 Aug.
38	Tuberculosis	Hon. A. Norton, ..	,,
39	On a new Queensland Locality for Zygomaturus	R. L. Jack, F.G.S.	22 Sept.
40	The Lesser Chelonians of the Nototherian Drifts	C. W. DeVis, M.A.	,,
41	The Prevalence of Hydatids in Australia	Hon. A. Norton, M.L.C.	,,

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No.	Title.	Author.	Date.
23	An Unpublished Lecture by Dr. Ludwig Leichhardt; communicated by	Archibald Meston ..	16 Mar. 1894
24	Observations on Extinct Volcanoes	Samuel MacGregor ..	21 Apl. 1894
25	Obituary Notice of Dr. Chas.	F. M. Bailey, F.L.S.	21 Apl. 1894

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ON THE PREVENTION OF INFECTIOUS DISEASES.

By EUGEN HIRSCHFELD, M.D.

[*Read before the Royal Society of Queensland*, 13*th August*, 1892.]

In this Paper, written on the occasion of the Small-pox "scare" of 1892, the Author argued against the efficacy of the means of disinfection commonly employed by Boards of Health in Australia, and suggested the use of steam.

NOTES ON THE OCCURRENCE OF A GREEN MINERAL IN THE SCHISTS OF ADELAIDE ST., BRISBANE, QUEENSLAND.

By HENRY G. STOKES, F.G.S.

[*Read before the Royal Society of Queensland*, 13*th August*, 1892.]

The mineral which forms the subject of these notes and specimens of which are submitted for examination, was first observed by me some three years ago as occurring in the altered sedimentary rocks exposed in the road-cutting in Adelaide street, close to Petrie's Bight, which have been evidently subjected to considerable local disturbance. The only other place in the neighbourhood where it is said to occur is in the end of the railway tunnel close to Creek street, but I have received no evidence of the accuracy of this statement.

In conclusion, I may mention that several very fine specimens of a somewhat similar description of mineral were recently received at the Queensland Museum from Mr. Aird, of Sea Hill, who obtained them from the Keppel Rocks at my request.

As far as I am aware no description of it has been hitherto published in Australia, but that it has attracted attention may be concluded from the fact that for some time past specimens have been received by me for determination from the workmen engaged in the excavation, and from foot passengers passing the spot; their curiosity in each case had, doubtless, been attracted by the beautiful colour which the substance exhibits.

The following is a description of its different physical and chemical properties, &c. :—

The mineral generally occurs filling and lining the joints and small cavities in the enclosing rock; in several instances it occurs in isolated patches in these joints, the intervening space being occupied by an earthy ferruginous substance, and, except in the latter case, it adheres firmly to the matrix. It is met with in an amorphous compact form without any trace of cleavage: also less frequently as mammilated, botryoidal, stalactitic, and incrusting masses. It is brittle and has a smooth, sub-conchoidal fracture with a tendency to break into thin flakes (one isolated specimen possessed a somewhat granular fracture when broken); lustre dull, but sometimes waxy on the surface of the incrusting mass: it varies in colour from apple-green to dark sea-green, and several of the specimens obtained were spotted and streaked with white; subtranslucent on thin edges; the hardness varies from 4 to 5; the specific gravity is 2·6. It appears to bleach on exposure and decomposes, forming a white pulverous substance.

Small fragments heated in the closed tube yield water and assume a pale lavender colour; it is slightly attacked by acids; it gives no colouration to the flame when moistened with sulphuric acid: when heated on charcoal it decrepitates; it is infusible, and with micrososmic salt it gives a faint reaction for iron only.

The powdered mineral on charcoal when moistened with cobalt solution gives the usual reaction for alumina. From repeated tests the colour of the mineral appears to be due to the presence of vanadium.

A quantitive analysis by Mr. Edgar Hall, F.C.S., Albert Street, gives the following result:—

	Per cent.
Phosphoric Acid	48·25
Alumina	29·07
Vanadium	trace
Loss on ignition (OH_2) ...	23·61
	100·93

From the above analysis it appears that this mineral is a Hydrous Phosphate of Alumina with a formula approximating to $4\ Al_2O_3 . 5\ P_2O_5 + 18\ H_2O$. It is distinguished by several characters from the Aluminium Phosphates described by "Dana," but somewhat resembles turquoise. The specimens received from the Keppel Rocks possessed a hardness of 5 to 5·5, and were susceptible of a high polish.

ON THE DROUGHT-RESISTING PROPERTIES OF THE EUCALYPTI.

By JOSEPH LAUTERER, M.D.

[Read before the Royal Society of Queensland, 10th Sept., 1892.]

ON LEPROSY IN THE NORTH OF EUROPE AND ITS CONTAGIOUS CHARACTER.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, 8th October*, 1892.]

Before I left my old home for Australia I made an extensive European tour, partly for the furtherance of my studies and partly for amusement. In Norway I fixed my attention especially on *Leprosy*, which is by no means of rare occurrence in the north-west of the Scandinavian peninsula.

Although the disease is genuine leprosy—the bacillus of leprosy itself having been discovered in Scandinavia by Dr. Hansen soon after I had left the place—it is always called by the name of "Spetalska" or "Speœalskhet" all over Norway, Sweden, and Finland.

In my time, now some years ago, this disease was not considered to be at all contagious, and patients suffering from it were treated in the same room with skin disease and of syphilitic complaints of every description. There were about twenty sufferers in the Christiania University Hospital, and I met with about ten more in a private hospital in Drammen—a town some miles further to the north. Scarcely any of them were lying in bed; on the contrary they were moving about freely over the whole hospital among the other patients, and the nurses and doctòrs handled them without fear. Dr. Sörensen, who acted as my usher and teacher, had all the patients undressed in the course of some days, always passing his hand all over the diseased skin (and I followed his example) for the purpose of noting the roughness of the scaly surface and the small nodules under it, arranged like beads on a string, following the threads of the lymphatic vessels. Dr. Sörensen assured me that the bedclothes and linen of the lepers were washed in the same steam-kettle where the other hospital linen had to be cleansed.

As I am not speaking here from a medical point of view, I shall describe the disease just as it presented itself to me at the first glance, comparing it with the notes given by Moses in thirteenth chapter of Leviticus. The most striking appearance is offered to the eye by those northern leprosy patients, where the disease has spread over a large area of the skin, and where this latter is covered by glossy-white scales on an elevated base with a deep central depression. Well-defined patches of scales and white or hoary hairs form the starting-points of this leprous skin disease, which soon runs all over the body. Moses mentions this form of leprosy under the name of *Berat lelena*, or White Leprosy : "And the priest shall look on the plague in the skin of the flesh : and when the hair in the plague is turned white, and the plague in sight be deeper than the skin of his flesh, it is a plague of leprosy : and the priest shall look on him, and pronounce him unclean." [Verse 3.]

Not so easily recognised and not so well pronounced is that form of northern leprosy where the scales are of a dusky or livid hue, without a central depression, and where they are confined to scattered or confluent patches, increasing and spreading over the body. The Hebrews named this kind of leprosy "berat kecha" (black spot) and made the diagnosis by the quickness of spreading : "And if the priest see that, behold, the scab spreadeth in the skin, then the priest shall pronounce him unclean : it is a leprosy." [Verse 8.]

A third form of leprosy often seen in Norway is characterised by dull-white scales surrounded by a dry-red border. This seems to be the Bohek of Moses, although he did not consider it a contagious disease. The small tubercles under the surface of the skin have in my time been the means of establishing a diagnosis. Some cases of leprosy where anæsthesia had set in and the sense of feeling was lost, complete the series of cases seen by me in Norway. The poorer people suffering from the disease used to doctor themselves. They made infusions of *Ledum palustre*, a plant growing in marshes and swamps all over Northern Europe, or they used the bark of the Elm Tree

(*Ulmus campestris*) or the twigs of a nightshade (*Solanum Dulcamara*) in the same way, and drank these decoctions in great quantities and, as they said, with some effect.

Since the discovery of a leprosy bacillus by Hansen, a bacillus smaller than that of tuberculosis and pointed on both ends and living in enormous numbers in the nodules of the skin and in the mucous membrane of the mouth and larynx, and in the lymph in general, there cannot be any doubt of the contagious character of the disease.

All the time when I was in Christiania the medical men there would have laughed if anybody had spoken of getting leprosy from a leper. Still, remembering the strict measures taken by Moses and in the Middle Ages all over Europe to prevent the spread of leprosy, I was quite determined not to leave Christiania without satisfying myself whether the disease was contagious or not. I, therefore, aided by Dr. Sörensen, instituted some experiments on rabbits, injecting with a Pravatz Syringe lymph mixed with blood from the three different varieties of Scandinavian leprosy above referred to. In the same manner injections were made of a lymph prepared by macerating the scales of diseased skin in a mixture of water and glycerine. The rabbits were watched carefully during the three following weeks, but no eruption on the skin ensued, though some of the rabbits sickened and, as Dr. Sörensen wrote to me afterwards, died of what he called consumption.

When I left Christiania I took about an ounce of the scaly powder with me which I had scraped from the worst leprosy patient and I carried it with me over Finland and Prussia in the travelling-box where I had my shirts, till the box and its contents were stolen by a Polish Jew near Warsaw. I do not think much now of my experiments made at that time, extended as they were only over three weeks. Dr. Damsch soon afterwards is said to have succeeded in transferring leprosy to rabbits. The following conclusions, however, may be deduced from my experience:—(1) Leprosy, as long as it is confined to the skin, is contagious only in a slight degree, to about the same extent as Actinomycosis and much less than Tuberculosis. (2) The contagious principle is not fixed to the scaly detritus of the skin, and therefore no infection takes place by touching a leper or being near him.

ON THE FLORA OF MORETON ISLAND.

By JOHN SHIRLEY, B.Sc.

[*Read before the Royal Society of Queensland*, 10*th Dec.*, 1892.]

DESCRIPTION OF A NEW EUCALYPT.

By F. M. BAILEY, F.L.S.

[*Read before the Royal Society of Queensland*, 10*th March*, 1893.]

While on a visit to Melbourne in January, 1892, I was delighted with a magnificent display of bloom on a young tree amongst a plantation of species of the above genus in the Botanic Gardens. The able and energetic curator, Mr. Guilfoyle, informed me that it came up from a packet of seed which he had received from Western Australia as *E. ficifolia*. Other plants raised from the same packet had proved true and were flowering in close proximity. The distinction, however, between these and the new form was most marked. Since then the tree has borne fruit and again flowered, and Mr. Guilfoyle, with his usual generosity, has kindly forwarded me herbarium specimens. From a careful examination of these it proved to be only a form of *E. ficifolia*, differing from the normal plant in its smaller foliage, more compact inflorescence, different colour of flowers, with prominent umbo to the operculum and slight difference of seed-wing.

The following may be given as a short description of the plant which is probably only an accidental sport. It will be interesting to know whether the form can be propagated from the seed. I have called it *Eucalyptus ficifolia*, var. *Guilfoylei*. Plant, 12 to 15ft. high; branchlets sharply angular from the prominent decurrent lines from base of petioles; leaves on the flowering branchlets lanceolate, tapering to rather acuminated points, cuneate and unequal-sided at the base, $2\frac{1}{2}$in. to $3\frac{1}{2}$in. long; petioles about $\frac{3}{4}$in. long, more or less flattened; blade coriaceous in texture; veins very obscure, from the thick substance of the leaf, but under a lens found to be close, parallel, and joining the intramarginal one close to the edge; the oil-dots not easily seen without the aid of a lens, and then found to be abundant; flowers of a deep rose, in terminal corymbose panicles, the shoot bearing the inflorescence elongated in the form of a common peduncle and bearing small bract-like leaves; umbels bearing from one to three flowers each; both the peduncles and pedicels flattened; calyx goblet-shaped, no angles, 4 or 5 lines long; operculum hemispherical, very prominently umbonate; stamens about six lines long; anthers oblong; stigma not dilated. Fruit ovate-urceolate, nearly $1\frac{1}{2}$in. long, three-celled; seeds glossy-brown, winged on one side, round the base, but more elongated at the upper end, the shape somewhat lunate.

ON QUEENSLAND SCORPIONS.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, 8th April*, 1893.]

THE natural family of Scorpions is of a very old standing, as they are found in strata as old as the Carboniferous rocks of Bohemia. The genus to which I wish specially to draw attention is called *Cyclophthalmus*, and is characterised by having twelve eyes like the recent African genus Androctonus.

In Queensland we find many scorpions, and in Koch and Keyserling's great work on the Spiders of Australasia there are thirteen species described. It is lucky for us that none of these is as big or as poisonous as the African or Indian scorpions are. The scorpions belong to the best known Arachnodæ, and are distinguished by the long dostonally segmented abdomen, terminating in a hooked claw, which is perforated at its point by the duct of a poisonous gland situated at its base. The maxillary palpi are greatly developed, and constitute strong nipping-claws—the outer half of which is moveable—in opposition to those of the Crab, where the inner half changes its position. The *scorpions* of our country live under stones and in crevices, but mostly under the deciduous barks of Eucalypts, such as *Eucalyptus tereticornis*, *E. maculata*, and of *Angophora lanceolata*. They run swiftly, carrying the tail curved over the back. They feed on insects which they hold in the nipping-claws and sting to death. Like the larger number of Australian animals the scorpions are of nocturnal habits and lie quietly asleep under the bark during the day.

A near relation to the Scorpions is the genus *Charon*, though destitute of a sting. It was established by Karse in 1879 from a fragmentary specimen, and was founded principally on the formation of the maxillary palpi, resembling those of the Scorpionidæ but ending in moveable claws instead of chelæ. L. Koch, the editor of the Spider-Fauna of Australia, received a fragmentary specimen of a Charon from Upolu which he described as *Charon australianus*, mentioning that the first pair of ambulatory feet had been broken off. I had the good fortune to obtain a specimen of a hitherto unknown species of Charon, in which specimen the left foreleg was preserved, but broke off when I tried to measure it. As it can be seen in the specimen the first pair of legs does not possess anything of the character of an ambulatory leg. The chief segments of the leg are still to be seen, but its terminal phalanx consists of minute segmentary rings corresponding as closely as possible to the antennæ of an insect or a crustaceous animal, ending in a decided point, and presenting every appearance of a sensorial organ of feeling and evidently doing the same service as the antennæ do to the insects and the palpi to the other Arachnidæ.

What might be the cause of this singular metamorphosis? The answer to this question seems easy when you look at the singular formation of the maxillary palpi, no more used for feeling, and as little for grasping; used only as an offensive, aggressive weapon, intended to make a deep wound, into which afterwards a poisonous secretion is infused from the mouth. The palpi having been metamorphosed in the manner described, the animals of the genus Chevora, waking mostly in the dark, have to employ the first pair of legs in the capacity of feeling organs. The individuals able to carry the forelegs in the manner suited best for that purpose survived in the lapse of millenniums and the first pair of legs were transformed as it is now into a pair of feelers, of course not from a morphological point of view but only physiologically corresponding to the feelers of insects.

ON THE DISPOSAL OF SEWAGE.

By

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[*Read before the Royal Society of Queensland, 17th June, 1893.*]

Wherever people are collected together in communities, the necessity for dealing with refuse matters inseparable from such, becomes a question on the proper solution of which depends the health and consequent well-being of each individual. The liquid refuse is usually conveyed away by means of drains and sewers—the more solid matters being removed either by water carriage or by some other means. The removal by water carriage may be effected by either a combined or separate system of sewage—the former making provision for the disposal of the rain water as well as the refuse; the latter dealing with the refuse only—most, if not all, of the rain water being excluded from the sewers and drains.

The Separate System deals with the water supply to the inhabitants, which is contaminated by domestic use and trade products, and the amount of water used for flushing the drains and sewers. As the quantity of liquid to be dealt with does not vary to any great extent, from time to time, provision can be made for its disposal at the outfall with a tolerable degree of accuracy. This is a matter of very great importance in every instance; more especially in cases when it is necessary to purify the sewage by any of the well-known means at present in use.

In the Combined System, where the rain water is mixed with the sewage, the quantity of liquid flowing in the conduits is subject to great variations, so that storm overflows are necessary to prevent flooding of the sewers and drains in times of heavy and sudden rainfall. The disposal of the sewage and rain water at the outfall is a matter of very much greater difficulty than is the case of the Separate System, on account of the variable nature of the rainfall. Where the sewage flows directly into the sea, or into a tidal non-potable river, this difficulty does not present itself; but even in these cases a serious objection against the Combined System lies in the comparatively larger conduits which are required. These, in times of dry weather, have only a small stream of sewage flowing down them, and their size precluding adequate flushing, sewer gas is generated, which, filling the sewers, may find its way to the surface by means of imperfectly trapped sinks, gullies, or manholes, and cause a serious danger to the public health. But in the case of inland towns and others, where discharge direct into the sea cannot be practised, the treatment and disposal of the sewage at the outfall is much facilitated, when the quantity of liquid to be treated is somewhat uniform. This is the case, whether the sewage is treated chemically, by downward intermittent filtration, broad irrigation, or by any two or all of these methods combined—the more uniform the daily flow, the more easily and effectively it can be purified.

Purification of the sewage is the object aimed at, and this should be attained economically, efficiently, and without causing any nuisance. The Separate System, by insuring a degree of uniformity in the flow and quantity of the sewage, affords facilities for its treatment which cannot be aimed at by any combined system. The relative cost of the two is in favour of the Separate System in most cases, for the drains and sewers required are much smaller, and are laid at a much less depth, and when the sewage has to be raised from a lower to a higher level the smaller quantity of liquid reduces very much the cost of pumping. Wherever, practicable, therefore, it is advisable to deal with the sewage separately from the rainfall—the latter being carried off by surface grades as far as possible. The system of sewerage introduced by Colonel Waring, of Newport, R.I., is probably the best illustration of the Separate System that we have. It was first tried at Memphis on the Mississippi, and was found to be so efficient and economical that it has since been adopted in many other places in the United States and elsewhere. This system differs from every other in the following particulars :—(1) The storm or surface waters rigorously excluded from the sewers ; (2) The pipes carrying the sewage must be of small size, so that they shall never be less than half full, and that a constant and rapid flow may exist in them, thereby preventing accumulation of solid matters and the generation of gases ; (3) Automatic flushing tanks capable of discharging from 120 to 150 gallons at a time, are placed at the end of each line of pipe ; (4) Perfectly free access of air to the sewers is provided, not only in order to ventilate them, but to prevent the traps in the houses being unsyphoned by the sudden rush of water from the flushing tanks.

Four-inch salt-glazed vitrified earthenware pipes are used for the house drains and six-inch pipes for the lateral sewers. The main sewer consists of pipes varying in diameter from nine inches upwards, according to the quantity of sewage they will be required to carry. In America these pipes are laid at a depth of six feet so as to be beyond the influence of the frost ; in warmer countries a much less depth, two or three feet, sufficient to protect them from breakage by the street traffic. Great care is exercised to have the joints close-fitting and watertight, and the pipes laid on a firm bed so as to avoid breakage, and especial care is taken to lay the pipes to the exact grade and line. The average grade of the six-inch pipes is three, six, or nine inches to the hundred feet. There should be lamp-holes every three hundred feet along the sewers, through which to observe their action and to facilitate the cleaning out of any obstruction. The lamp-holes are made by bringing a six-inch pipe from the sewer up to within two feet of the surface of the ground : a lid is then placed on the pipe and it is covered with earth. Manholes are provided at certain points—the sewers running through the bottom—and are covered with close-fitting iron covers. In some cases, however, the covers are perforated so as to act as ventilators—a dustpan being placed under them. The house connections are recommended to be made without any trap or obstruction to the flow of air through the whole course of the drain or soil pipe.

The automatic flushing-tanks are a noticeable feature in the system. Placed at the head of each lateral sewer they can be discharged as often as may be deemed advisable to keep the line of pipes free from gas or any obstruction—the frequency of their discharge being regulated by the quantity of water flowing into them in a given time. The effect of each discharge would be the sudden entrance into, and passage along the sewer of 120 or 150 gallons of water, according to the size of the tank, which would force the air contained in the sewer out through the house connections, and forming a vacuum as it proceeded, fresh air would readily enter from the house drains. The house connections are continued above the roofs of the houses; no nuisance, therefore, would be caused by the escape of the air forced through them from the sewers at each discharge of the flushing-tank. The cost of the system in America is about one dollar per foot. At Keene 61,232 feet of sewers cost $76,688·85, including construction, superintendence, land damage, fees, &c.

The disadvantages of a separate system are, that separate channels and pipes have to be provided for the rain; that the rain from all larger cities carries from roofs and street much organic débris, which pollutes the river or watercourse into which it may be discharged. But with the combined or single system the drains require to be much larger, and storm overflows must be provided, sufficient to carry off the storm water when the drains get filled, and with this storm water the whole contents of the sewers are discharged, so the stream would run greater risk of being polluted in this way than if the surface water only were allowed to flow into it. However, the second objection to the Separate System has been done away with by an ingenious contrivance of Mr. Horace Andrews, by means of which the first portions of rain water, containing the foulest parts of the street washings, etc., may be intercepted, and be thus prevented from polluting any watercourse into which they would otherwise run. It consists in placing an intercepting drain at a lower level than the conduits for rain water, and so arranged that the contents of the conduits will flow into it until they increase in volume and rapidity sufficiently to shoot over the drain, by which time they are comparatively pure.

The cost of the 40 miles of Memphis sewerage was under £60,000, or less than one dollar and a-half per foot. The various schemes for draining Memphis on the Combined System were estimated to cost between £300,000 and £400,000. In 1889 I received a letter from Colonel Waring stating that the System had been much improved, and was being applied to many different places in America. In localities where the sewage has to be raised from a lower to a higher level, Mr. Isaac Shone's pneumatic ejectors would in most cases answer much better, and be a great deal cheaper than pumping. Mr. Shone's system consists in forcing the sewage by means of compressed air, from iron tanks, termed ejectors. The height to which sewage or water can be lifted by this system is practically unlimited. The town can be completely sewered on this principle, ejectors being placed at certain cross streets to receive the sewage from a number of houses, the sewage being forced into and along air-tight mains to the outfall. I had an opportunity of inspecting this System in full work at Eastbourne in 1885, and was much pleased with what I saw. In that town there were seven pneumatic ejectors, which were supplied with compressed air from one station, one ejector being about two miles from the station. The cost of working the system at Eastbourne—the sewage of which was entirely, and the rainfall to a large extent, managed by it, was £600 per annum; the total cost of land, plant, houses, etc., being £8,500. From all that I have been able to learn, the system has worked satisfactorily up to the present time. The application of Shone's pneumatic ejectors to the small pipe system of Colonel Waring, would, I am of opinion, form the most perfect system of sewerage as well as the most economical, not only in the first outlay but also in maintenance, that we have any knowledge of at present. Where the sewage could be dealt with by gravitation, the Separate System of Colonel Waring would answer all requirements, and would, I believe, be much cheaper, and possibly more reliable, than Shone's system; but when it is necessary to raise the sewage from a lower to a higher level, I am convinced that Shone's pneumatic ejectors are superior to, and much cheaper than, pumping. Furthermore, the number of ejectors that can be operated on from a central station is practically unlimited. For a place such as Brisbane, therefore, Waring's and Shone's systems combined would admirably answer all requirements, for where gravitation alone would suffice to carry the sewage to the main, Waring's small pipe and automatic flushing tanks would answer, and where gravitation would be no longer practicable Shone's pneumatic ejectors would prove their utility. Attention is being directed to a complete system of water carriage for all excumnentitous matter, and now is certainly the time, when an efficient water supply exists, owing to the Brisbane River scheme in use, to take the matter practically in hand. Hitherto the objection to entertaining the subject practically has always been laid on the deficient water supply. That objection never had a tangible form; the increased consumption of water consequent on a thoroughly water-closeted and efficiently sewered condition of the city would be a mere bagatelle. However, that objection has had the effect up to the present of staying any steps to rid us of the very unsatisfactory method we have been condemned to all these years. That objection no longer holds, and I trust that no further delay will be caused in bringing about a cheaper, cleaner, healthier, and less offensive method than the present. This city is spending annually about £20,000 for the removal of refuse, but only a very small part of the refuse is dealt with at this cost, as all the contaminated water supply finds its way to the river by means of the watertables and underground drains. The flowing of this sewage, mildly termed slop-water by some, along the watertables is both offensive and injurious to health, and even if the present plan of interception is continued, or some other adopted, this so-called slop-water should be conducted away from our dwellings by some less objectionable method than the present one. But, according to the systems which I have mentioned, the city and suburbs could be efficiently and cheaply sewered in such a manner as to provide for the removal of all the refuse matter, which is at present intercepted at such enormous cost, as well as the contaminated water supply. Sir Joseph Bazalgette, late engineer to the Metropolitan Board of Works, London, said, years ago:—"There are few who will not now recognise that the removal of the refuse of large towns by water is so vastly superior to any other known method, as to have caused it to be an essential in these days of civilization and refinement."

With regard to our immediate surroundings, the Brisbane River, below Ipswich, is a non-potable stream—the water not being used for any domestic purpose beyond watering the streets and for swimming baths ; and up to the present time all the contaminated water of the city and towns on its banks has been allowed to flow into it. What has been the effect of this on the health of the people residing on or near the river banks ? This is a matter that should be very carefully and seriously considered, for if no evil effects have followed so far, it is clear that the river is sufficient in size to purify by oxidation the sewage which has been admitted into it ; and if that is the case the question arises, "Is it not capable of dealing also with the material at present intercepted ?" The consideration of this matter should be divested of all sentiment, and the question approached in a practical manner, for if all the refuse can be safely admitted into the river without any preliminary treatment, then the difficulty of dealing with the subject of sewage disposal is very much simplified. But if it is found unsafe to health, or likely to cause a nuisance, to admit the whole of the refuse matter into the river, the sewage could undergo such preliminary treatment as would render the effluent practically harmless. A modified chemical treatment would no doubt answer probably better than filtration or irrigation, as the area of ground required at the outfall would be so small as to render it possible to treat the sewage at a number of different points, to which it could flow by gravitation, thus avoiding the expense of raising it by pumping or pneumatic ejectors, in order to collect it at one point. Chiswick offers an example of the chemical treatment of sewage, the effluent being rendered sufficiently pure to permit of its discharge direct from the settling-tanks into the River Thames above London. Lime and Spence's alumino-ferric are the chemicals used, in the proportion of seven grains of the former to five grains of the latter to the gallon. The lime is first mixed with the sewage, which then has a run of 300 feet before being mixed with the alum. It then flows into tanks and is allowed to precipitate for three hours, when the effluent is run off into the river. The sludge is turned into a small tank at the rear of the sludge-press shed, and is then passed through a Johnson's pneumatic sludge-press, which turns out twenty-four cakes of

54 lbs. each at a time, a bag of slaked lime being added to each lot. The sludge-cakes are sold as a manure at 1s. 6d. per ton. In 1885, when I visited Chiswick, the population was 20,000, and it cost £1,200 a-year to treat the sewage, so as to secure a good effluent. The cost of pressing the sludge was £380 additional. The press treated from forty-five to fifty tons of wet sludge per day. The engine and presses cost £900. A Latham's extractor was used to remove the larger suspended matters, the cost of which, with engine complete, being £400. The sewers were flushed with automatic flushing tanks at a cost of £350 a-year—Field's, Adams's, or Doulton's being used. The effluent must be of a tolerable standard of purity, as a number of water companies have their intake from the Thames some miles above Chiswick, viz., at Hampton, Ditton, Kew, and Sunbury, and one company—the West Middlesex—has a pumping station at Hammersmith, which is about two miles lower down the river from Chiswick.

A process of somewhat recent origin termed the Ferozone and Polarite Process, is said to yield very satisfactory results. In this the introduction of the precipitating material termed "ferozone" is followed by the filtration of the effluent through a filter containing polarite. Professor Roscoe gives the follow- analysis of ferozone :—

Ferrous sulphate	26.64
Aluminium sulphate	2.19
Calcium sulphate	3.30
Magnesium sulphate	5.17
Combined water	8.20
Moisture	24.14
Silica	11.35
Magnetic oxide of iron	19.01
	100.00

Professor Roscoe gives the analysis of polarite as—

Magnetic oxide of iron	53.85
Alumina	5.68
Magnesia	7.55
Water, with a trace of carbon	5.41
Silica	25.50
Lime	2.01
	100.00

The process has been in operation at Acton for the last three or four years, and appears to be a very simple one, and requiring only a small area of land. Three tanks are used, the ferozone being mixed with the sewage before the latter is admitted into them; and after precipitation of the suspended matters, the effluent is made to pass through the small filters composed of polarite and sand. The filter has four inches of coarse gravel at the bottom through which run 4-inch pipes. Upon this pea gravel is laid to the depth of four inches, then six inches of sand, five inches of polarite mixed with five inches of sand, and, finally, nine inches of sand. The effluent passes downwards on the intermittent principle. Dr. Arthur Angell, Ph.D., F.I.C., says, respecting it:—"The ferruginous effluent from the tanks is poured through a filter composed of polarite mixed with sand, which will filter sewage effluents at the rate of 1000 gallons per square yard per twenty-four hours with better results than can be obtained by land, which filters about 1½ gallons per square yard per twenty-four hours; or, in other words, one acre of filtering area containing a layer of polarites will do more efficient work than 666 acres of land." The value of this discovery can scarcely be overestimated, as by the use of these small but powerfully-active filter-beds it is entirely unnecessary to acquire large areas of land for sewage farms; the polarite in these beds never requires to be changed, or to be removed—a slight rest of a few hours occasionally being all that is needed to effect revivification, and to admit of the top of the filter being cleansed.

"The action of the polarite is entirely independent of any property inherent to the polarite itself, which remains the same in weight and bulk after an indefinite amount of oxidising work has been done. Polarite is simply a carrier of oxygen and a means of bringing about a contact between that element and the foul matter in the filtering bed. It derives its oxygen from the air and also from the tank fluid, and as these sources are inexhaustible, so also is the life and power of the filter-bed."

Sir H. Roscoe says:—"As the sewage at Acton is received in the fresh state, the liquid has not yet lost its dissolved oxygen, nor has the greater part of the organic matter been broken up into soluble and therefore non-hurtful products. The larger portion of this organic matter is removed therefrom partly by natural subsidence and partly by the precipitates formed by the ferrous sulphate. The filtration removes all the suspended matter, and a further precipitation is effected by the porous magnetic oxide, which, on absorption of organic matter in its pores, oxidises it by help of the dissolved oxygen existing in the liquid."

This method has also been lately adopted at Hendon, and then the sludge, air-dried, is said to be very valuable as a manure—Dr. Angell estimating the value of the sludge from one million of gallons of sewage to be worth £27. At this rate a ton of sewage would be worth 1½d. But Dr. Angell estimates the quantity of sludge, air-dried to 12½ per cent. of moisture, in one million gallons to be sixteen tons, so that each ton of sludge would be worth about 34s. and the cost of production 3s. 9d. If this is so, it is by far the most valuable product which has yet been obtained, and treatment of sewage by this process would be made decidedly payable.

The treatment of sewage by electrolysis, termed the Webster Process, has from all accounts been very encouraging. Sir H. Roscoe says, respecting the sewage operated :—"The reduction of organic matter in solution is the crucial test of the value of a precipitating agent, for unless the organic matter is reduced the effluent will putrefy and rapidly become offensive. I have not observed in any of the unfiltered effluents from this process, which I have examined, any signs of putrefaction, but, on the contrary, a tendency to oxidise. The absence of sulphuretted hydrogen in samples of unfiltered effluents, which have been kept in stoppered bottles for three weeks, is also a fact of importance. By this process the soluble organic matter is reduced to a condition favourable to the further precipitation of natural agencies."

In the matter of cost this system is said to compare favourably with all others.

In dealing with the subject of sewage disposal the idea of its manurial value should not be allowed to influence one to any great degree. The difficulty has always been elsewhere, and I presume it will be the same here, when the subject comes to be practically considered in all its details, to get rid of the nuisance (for nuisance it undoubtedly is) at as cheap a rate as possible. No known process of converting it into manure, if we may except the Ferozone one, pays the expense of doing so, although it may diminish the cost of disposal to a greater or less degree, according to the circumstances of the case. I know that there is a rooted conviction in the minds of many that sewage farms can be made to yield very profitable results, and that it is a sinful waste of good manure to use the sewage in any other way. Sewage farms, with very few exceptions, do not pay a profit on the money invested, either in Europe or America, but probably they might do so in some dry parts of Australia, where land is cheap and farming products scarce—the irrigation alone would, independently of any manurial ingredients in the liquid, be a profitable undertaking. But it is only as a means of *irrigating* that the question should be looked at, even in this country.

Dr. C. Meymott Tidy says :—" You will never make sewage pay: I am convinced of that. The idea of making sewage pay is a pure myth. Any profit that can be got out of a farm by reason of the sewage is less than the expense of applying the sewage to the farm, instead of letting it run away to waste."

In conclusion, I cannot do better than quote the opinion of the Royal Commission on Metropolitan Sewage Discharge given in their report of 1884 :—

" (1) That the most likely mode to obtain a profit from the utilisation of sewage is by irrigation, but that in the present state of our knowledge of the subject there is no hope of any town doing so consistently with the due attainment of the more important object, the purification of the sewage. In some very favourable cases (as in Edinburgh) a profit may be made without purification, and very frequently the purification may be effected without profit, but the two cannot apparently be combined."

"(2) There is still less hope of profit by attempting to extract manure from the sewage by depositing or precipitating processes—the available manurial value of the sewage is at present too small to admit of obtaining from it any product which can be sold at anything like the cost of its production.

Considering the small value of the sewage, 2d. per ton at the most, and seeing, moreover, that its chief manurial value lies in its soluble constituents, it is not probable that any mode of abstracting from it a marketable manure can be devised. The only possibility is that the precipitated matters might be made to yield some little return in diminution of the cost, and even this appears at present uncertain."

ACCOUNT OF A BOTANICAL EXCURSION TO BURLEIGH HEADS AND THE MACPHERSON RANGE.

By J. SHIRLEY, B.Sc.

[*Read before the Royal Society of Queensland*, 17*th June*, 1893.]

NOTES ON FLOODS IN THE BRISBANE RIVER.

By Mrs. C. COXEN, M.R.M.S.

[*Read before the Royal Society of Queensland*, 12*th August*, 1893.]

Mr. McConnel, of Cressbrook, writes me that the flood of 1840 was the highest known to the blacks living in the district at that time. The *débris* left by that flood was shown to Mr. McConnel's father when he took up the station in 1842. The flood of 1864 was the highest known until that of 1890, which was higher by a foot. The flood of 1893 was four feet higher than that of 1864, or five feet higher than that of 1840. Mr. McConnel adds that there is no doubt that the flood of 1893 was by far the highest Brisbane has seen since 1839. If there have been higher floods, it must have been before the advent of the white man.

The first flood of which I have any recollection was in March, 1847. The water was right across Stanley street, but not, I believe, above a foot or so deep. It overflowed the bank of the river at Kangaroo Point where I then lived. I am able to fix the date owing to the circumstance that Mr. Coxen was travelling to Brisbane at the time with cattle, which he left in charge of his blackboy and pushed on to the Settlement, reaching Brisbane just in time to catch the ill-fated steamer *Sovereign*, then starting on what proved to be her last voyage.

On May 4th or 5th, 1857, there was another flood, after a rainy season which had lasted from the previous October, with only intervals of a few days consecutively. The fresh in the river was so strong that our cutter was in sight from the Terraces for two days, no boat being able to stem the strong tide.

I recollect the flood of 1864 to which Mr. McConnel refers, but have no notes on it.

On August 30th, 1879, there was another heavy flood. In January, 1887, there was a very high flood. The punt at Bulimba Ferry was unable to ply for ten days. The water was up to the floor of the ferry cottage, five feet above the wharf at the Apollo Works.

In March, 1890, there was another flood, and no punt service at Bulimba for six days. Boats followed the low lands and landed passengers in Ann street. At the Port Office the water was 5 feet 2 inches above the 1887 flood; at the ferry cottage, 3 feet 3 inches; and the Apollo Works, 3 feet 10 inches. On the 29th and 30th March there was another slight rise in the river.

Of the disastrous floods of February, 1893, I need not say much, as they are still fresh in the memory of everybody, and their extent and effects are sure to be more carefully recorded than those of the floods which took place in the infancy of the Colony. For the sake of comparison, however, I may add a few notes.

On February 5th the water at the Port Office was 10 feet above the flood-mark of 1890; and at Bulimba Ferry about 11 feet 6 inches. At the Apollo Works the water rose 7 feet 10 inches over the wharf, and Victoria and Indooroopilly bridges were swept away. On February 19th the water was still higher down the river—being about 12 feet at Bulimba and 8 feet 2½ inches at the Apollo Works above ordinary high tides.

BACTERIA, THEIR LIFE HISTORY AND EFFECTS.

By JOHN SHIRLEY, B.Sc.

[*Read before the Royal Society of Queensland*, 12*th August*, 1893.]

The Lecturer described the structure, reproduction, and diffusion of the Bacteria, the methods employed for their cultivation and study, and their function in diseases.

ON THE EFFECT OF ADVANCED BACTERIOLOGICAL KNOWLEDGE AS APPLIED TO THE HUMAN RACE.

By F. A. BLACKMAN.

[*Read before the Royal Society of Queensland*, 12*th August*, 1893.]

This Paper dealt chiefly with speculations on the possibility of curing or preventing diseases by means of injections of infusions containing germs.

ON SOME NEW SPECIES OF QUEENSLAND SPIDERS.

By J. LAUTERER, M.D.

[*Read before the Royal Society of Queensland*, 9*th September*, 1893.]

The Author reviewed the various Australian families of Spiders, and exhibited a number from his private collection, including several which are still undescribed.

NOTES ON THE CYPRÆÆ.

By Mrs. C. COXEN, M.R.M.S.

[*Read before the Royal Society of Queensland*, 14*th October*, 1893.]

Few people are aware how curious and indeed how beautiful is the animal which inhabits the cowrie shell. In years gone by, when on our boating trips, I have had the living cowries in a vessel of water in the boat, and have, therefore, had opportunities of watching them and of observing their colour and form. I have myself picked up from ten to twelve different species alive from under the corals, stones, and seaweeds in small shallow pools of water.

It was my late husband's intention to get the animal modelled in wax and coloured, and then to place the models of the different species in their proper shells. For this purpose he had the animals alive in the boat, but illness prevented him carrying out his wishes. I have, however, Mr. Coxen's descriptions of three cowries, which may be regarded as supplementing those of Linnæus, who described only the shells.

Cypræa errones, Linn.

Foot yellowish cream colour, the upper part finely mottled all over with black markings ; small lobe under the respiratory canal marked with fine dark lines ; tentacles blackish-brown ; around the trunk a light-brown fringe.

Cypræa vitellus, Linn.

Mantle creamy white, largely mottled with black, full of minute white dots, also with many spicules $\frac{1}{8}$ of an inch high, terminating in two or three points ; respiratory canal creamy white, with fine yellow fringe at the edge ; tentacles black. The little spicules on the mantle are only perceptible when the animal is in the water.

Cypræa erosa, Linn.

Foot creamy white, mottled with brownish markings; mantle dark brown, covered with long moss-like filaments about $\frac{1}{8}$ of an inch in length, some light brown, others of a bluish tint; respiratory canal dark brown with a fringe at the edge; tentacles blackish-brown; around the trunk a light brown fringe.

I have in my collection 27 species of Cypræe which I know are found in Moreton Bay, 24 from other parts of Australia, and 21 foreign—making a total of 72. There are several in the Queensland Museum which I do not possess. Amongst these are the beautiful *C. Scottii* from Port Lincoln and the aurora or orange cowrie from the South Seas.

EXHIBITS OF PLANTS POSSESSING OR CREDITED WITH MEDICINAL PROPERTIES:

WITH EXPLANATORY REMARKS.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland*, 14*th October*, 1893.]

EXHIBIT OF NEW AND INTERESTING PLANTS; WITH EXPLANATORY REMARKS.

By F. M. BAILEY, F.L.S.

[*Read before the Royal Society of Queensland, 14th October*, 1893.]

The Author exhibited and described a number of Plants of the Orders *Malvaceæ, Rutaceæ, Olacineæ, Rhamneæ, Sapindaceæ. Leguminosæ, Rosaceæ, Saxifrageæ, Myrtaceæ, Compositæ, Goodenovieæ, Epacrideæ, Asclepideæ, Convolvulaceæ, Solanaceæ, Verbenaceæ, Chenopodiaceæ, Laurineæ, Proteaceæ, Santalaceæ, Cupuliferæ, Aristolochiaceæ, Commelynaceæ, Centrolepideæ, Cyperaceæ, Gramineæ, Filices, Musci, Hepaticæ, Lichenes*, and *Fungi*. The Descriptions have since been officially published in "Botany Bulletin," No. VIII of the Department of Agriculture (Brisbane: By Authority: 1893).

OBITUARY NOTICE OF DR. GEORGE BENNETT, F.L.S., F.Z.S., &c.

By Mrs. C. COXEN, M.R.M.S.

[*Read before the Royal Society of Queensland*, 17*th November*, 1893.]

I think some notice ought to be taken by this Society of the loss sustained by the colonies and by Science through the death of the veteran naturalist, Dr. George Bennett, of Woolloomooloo, who died on the 29th September, 1893, in his 90th year. Dr. Bennett was a contemporary of John Gould and

Richard Owen, all three being born in the same year. That he was a naturalist of the first order is proved by his classical works, "Wanderings in New South Wales, Singapore, and China" and "Gatherings of a Naturalist in Australia." It may be mentioned that he was the first to capture the living Nautilus (in 1829), and was an ardent student of the extinct marsupial and avian fauna of the Darling Downs. He visited the Darling Downs in 1871, and spent some time in collecting fossil bones.

NOTES ON POISONOUS CONES.

By Mrs. C. COXEN, M.R.M.S.

[*Read before the Royal Society of Queensland*, 17*th November*, 1893.]

In "Gatherings of a Naturalist," page 382, Dr. Bennett makes the first reference with which I have met to the poisonous properties of some species of the genus *Conus*. He says:—"The common *Conus textilis* of Linnæus is found at Aneiteum and other islands of the New Hebrides group; the animal is poisonous. On biting its captor, it injects a poisonous and acrid fluid into the wound, occasioning the part to swell, and often endangering the life of the injured person."

This account is borne out by a specimen received from Tanna. My late husband sent £2 to a missionary at Tanna for shells. In one of those (a *Conus*) which he received from the missionary is a memorandum—written, I suppose, by the sender—stating that the animal sometimes bites its captor, and injects a fluid poison into the wound which causes death in a few hours through contraction of the throat. The shell and memorandum are on the table. Again, in an article by Messrs. H. Cross and E. Narie‡ three species are mentioned, viz., *C. tulipa*, Linn.,

‡ Catalogue des Cones de la Nouvelle-Calédonie et des Iles qui en dépendent: *Journal de Conchyliologie*, Paris, October, 1874.

C. textilis, Linn., and *C. aulicus*, Linn., as being poisonous. Speaking of *C. textilis*, the author observes that " the fact already mentioned by several English naturalists of the venomous properties of the sting of the textile cone has been confirmed in New Caledonia. According to an eye-witness, a native of Pouébo, having been stung in the hand experienced in this hand and in the corresponding arm a considerable swelling, accompanied by very severe pain ; this swelling continued for some time. But in this country the mistake is made of attributing to the operculum of the Conus what is really due to its lingual teeth." Referring to *C. tulipa*, the authors further say :— " According to Dr. Marie, the animal of *C. tulipa* is as venomous as that of *C. textilis*. However, it is a mistake to attribute to the operculum what is due to the lingual armature."

I have with me a specimen of *Strombus luhuanus*, Linn., with the horny foot. Not having one belonging to a *Conus* I thought this would serve to show what is meant. I was once stung or bitten by a Strombus which I had alive in my hand, but no ill results followed. Although I have with impunity picked up live cones I would not now do so. When I had charge of the shells in the Queensland Museum I placed an extract from Dr. Bennett's work in the tray of *Conus textilis*, thinking it might draw people's attention to the danger of picking the animal up alive.

I have brought a few cones for exhibition : *Conus textilis*, from Tanna ; *Conus Coxeni*, Brazier, found on the bank between Stradbroke and Moreton islands ; *C. mineatus* and *C. hebræus*, Linn., from Caloundra ; a fine *Conus* from Lady Elliott's Island (*C. marmoreus*, Gm.), and one from Townsville.

REPORT OF DELEGATES TO ADELAIDE MEETING OF THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

By JOHN SHIRLEY, B.Sc.

[*Read before the Royal Society of Queensland, 15th December*, 1893.]

Mr. C. W. De Vis, M.A., and the Author of this Report attended the meeting as Delegates from the Royal Society of Queensland. The Report was received with approbation, and the thanks of the Society were recorded. In view of the approaching publication of the volume of the Proceedings of the Association at the Adelaide Meeting, the publication of the Report of the Delegates has become unnecessary.

ON CERATODUS FOSTERI.

By THOMAS ILLIDGE.

[*Read before the Royal Society of Queensland, 15th December*, 1893.]

Ceratodus Fosteri.

The Burnett Salmon, so called, is an inhabitant of the Burnett and Mary rivers in Queensland, and is confined to those rivers so far as is known. It is well known to biologists as one of the connecting links between the fishes and the amphibia.

Wonderful stories, mostly fables, are related of Ceratodus. One of these fables is that the fish can travel on land, and any one who has caught it can testify to its inability to do so. I was once told, with every appearance of sincerity, by a gentleman who lives on the Burnett, that he had seen a "salmon" over twenty feet from the water, where it must have gone of its own free will, and that the fish made its way back to the river. This is quite contrary to my experience, which I may say should be considered fairly extensive—extending, as it does, over a six years' residence on the Burnett, during which I have secured numbers of fish for scientific purposes. The Ceratodus has no power in its flappers or tail sufficient to move its weighty body. After capture it is really the quietest fish I have ever seen. It makes but a very feeble attempt to escape, and after a few struggles lies quite helpless. In a cool damp place it will live for several hours out of the water, but if left exposed to the sun it dies very quickly and its large scales speedily become sunburnt and assume a reddish-brown colour.

When caught the Ceratodus is of a greenish-brown appearance on the back and a slatey color on the belly, but shortly after capture a great change is noticed and the fish becomes very prettily colored with red, pink and violet hues on the abdominal parts. All these pretty hues disappear after death. The scales are covered with a fine oily substance which makes it very difficult to hold the fish in one's hands; it is not a dirty slime like that of an eel, but more like the finest filtered oil which does not adhere to the hands. This oil, I fancy, is exuded from the head or from glands under the scales through perforations.

The fish is reported to attain a larger size, but so far as my experience shows, the largest I have captured, or seen, weighed twenty-seven pounds and the smallest four pounds. One which I did not capture (as it broke my line) appeared to me to be of extra size, but most anglers fancy they lose their finest fish when it escapes.

The best bait for Ceratodus is the Shrimp, which is plentiful in the Burnett; but it will also take snails, worms and moss. The Ceratodus is, for the most part, a vegetarian and eats moss, grass which has fallen into the water, and the seed-pods of the Eucalyptus. It will even gnaw the bark from the trees growing in the water, for it has strong teeth—two incisors on the upper jaw and strong molars on both upper and lower. These molars are not loose but form part of the jaw-bones.

A peculiar noise is made by the Ceratodus, somewhat resembling the grunt of a pig. The noise is sometimes made when the fish rises to the surface of the water to inhale more air but not always, as I have frequently seen it rise without noticing any sound. The noise can be made after the fish has been brought on land, and appears to be caused by a rush of air through the throat and gills. I have frequently watched the fish when making the noise and seen the fluttering of the gills at the same time. I have passed my hand with a slight pressure on the lower part of the throat and heard the noise plainly there. This noise is also produced by the fish when under the water, as on several occasions when I have been out with the blacks I have dived for the purpose of hearing it.

The fish though edible, is not, as a rule, much relished. There is a dry insipid taste with it when freshly caught and cooked; but by those who do eat the fish it is generally salted for a day or two, then washed, stuffed *à la* sucker and baked. In colour the flesh resembles that of the English salmon, from which circumstance it probably derives its popular name; it is a deep pink colour and makes a pretty dish.

The Ceratodus, like other fish, lays eggs. The season commences about the beginning of November and terminates about the middle of December. The eggs are generally deposited amongst the growing weeds, but are occasionally found adhering to the side or bottom of logs lying in the water. When first ejected, the whole ovum is spherical and about one-tenth of an inch in diameter; its colour is brown. A filmy whitish cloud accompanies the ova on their ejection, and it is at this time that the male fish is supposed to accompany his mate, swimming alongside or over this cloud and depositing the sperm which germinates or fertilizes the eggs. There is a gelutinous covering to the eggs which quickly swells on contact with the water and assumes a blubbery appearance, but is still clearly transparent—the centre germ being distinctly visible. After a few hours a greenish colour forms around the edge of the germ. In twenty-four hours the egg is very nearly spherical and has increased in size to $\frac{5}{16}$ of an inch, the germ showing an increase to $\frac{2}{16}$ of an inch, and the whole blub now becoming slightly clouded. As day succeeds day, the only perceptible change is that the egg has become more clouded and coarser in appearance and has not the same beautiful transparence as at first—the germ being of a greener tint and now resembling a small green pea. About the fourth day the ovum is more egg-shaped and the inside germ is also lengthened out a little bit. About the seventh day a dark curved line is visible from nearly the centre of the germ to the outer edge, and the germ has become more oval and has increased in length to $\frac{3}{16}$ of an inch. From about the ninth day, when the embryo shows the first symptoms of life, a further six days elapse before it is ready to emerge—each motion of the embryo increasing the centre space. During this time the embryo has grown to nearly the length of the egg. After the embryo protrudes its head through the outer covering of the egg, a further period of three or four days elapses before its final release. After its release, the creature is not, to the naked eye, very much like a fish but resembles a small green grub without head or legs and is somewhat oval in shape. It is, at this stage, of a green colour and $\frac{6}{16}$ of an inch long. It does not, even now, exhibit many symptoms of life, but occasionally will give a jerk which sends it upwards into the water, wriggling about for two or three seconds, and then falling to the bottom apparently dead. Here it lies, hour after hour, without any visible motion or sign of life. By the fourth day the creature is half-an-inch long and still very inactive, continuing to lie at the bottom on its side. It does not feed up to this stage, but exists on the nutriment contained in an external envelope supplied by Nature for that purpose.

The eggs of the Ceratodus have many enemies, amongst which may be placed the shrimp which pulls the egg to pieces and devours the germ; and in places where the larva of the mosquito exist the egg is speedily destroyed. The young fish, on the first and for several days after emerging from the egg, are so entirely helpless that they must be consumed in great numbers by other small fish and by shrimps; consequently, a very small proportion attain maturity.

A remarkable fact in connection with Ceratodus is that the smaller sizes, say under three or four pounds in weight, are very rare, and even with a fine net cannot be obtained. I have been on the Burnett, as I previously stated, for six years and have never seen one or heard of one having been caught smaller than four pounds. On questioning others, who from long residence here should know something about these fish, they say they have never seen the smaller-sized fish. It is not that the egg has lost fertility, as I have hatched them in glass jars after being procured from the river weeds; but it is peculiar that the small ones are never procured, and the thought arises, Do they now attain maturity, or have they enemies which destroy them as they grow? If so, the extinction of the species is in the near future.

[A skull of Ceratodus was exhibited in illustration of the Paper.]

ON QUEENSLAND WINES.

By J. LAUTERER, M.D.

[*Read before the Royal Society of Queensland, 5th February*, 1894.]

ON THE DISCOVERY OF TWO CRATER LAKES AND OTHER EVIDENCES OF VOLCANIC ACTIVITY IN THE NEIGHBOURHOOD OF BAN BAN, NEAR GAYNDAH.

By NUGENT WADE BROUN.

[COMMUNICATED BY ROBERT L. JACK, F.G.S.]

[*Read before the Royal Society of Queensland, 16th March*, 1894.]

"I have the honour to announce the discovery of a large extinct volcano, having apparently two craters distant from each other about half a mile, each crater containing a large quantity of water in the form of a circular lake of unknown depth. The distance from Ban Ban station is about twelve miles in a north-easterly direction, and in a line with Degilbo station. From a distant view there would appear to be only one mountain, but on looking down from the summit there is evidence of there having been at one time two distinct volcanoes. The mountain is not any higher than others in the locality, and, like all the others surrounding it, is covered with a dense scrub, with almost impenetrable underwood and loose basalt. For many years past the blacks talked of the existence of a lake among these mountains. They referred to it with the deference due to an old and respected legend; but none of them had seen it. On several occasions I sent blacks out to search for it, but without success. A very old blackfellow lately came to Ban Ban, and was questioned on the subject. He remembered having seen it when a lad, and described the locality sufficiently to enable us to discover it, but with great difficulty. We had to ascend more than one mountain before we hit upon the right one. After struggling up the steep incline, forcing our way through the dense undergrowth, we reached the summit, and then found we were standing upon the rugged lips of an extinct volcano. The scene from here was weird and impressive. Opposite was distinctly seen the outline of the lip of the crater, distant about a mile across, and below us about 200 yards, with the dark clouds overhead reflected in it, was a wide and apparently very deep sheet of water—I should say fully 300 yards wide. The crater is circular and most distinctly marked. We descended to the water, but with considerable difficulty. It is perfectly fresh and good, and deepens quickly from nothing to about 14 feet twenty yards from the edge. The young trees, for about fifteen to twenty yards from the edge, are dead, proving that the water is higher now than in former years. There is, however, no natural watercourse. Possibly the water may go into it from below. The lips of the crater consist of large masses of black lava, much honeycombed and very light. [A sample of the larva was exhibited.] The two lakes are distant about half a mile from each other, the division forming a portion of the lips of both craters. The one lake has the same appearance as the other, circular in form and equal in size. I had not the time to descend to the second.

The mountain must formerly have been many thousands of feet high. It was from here, I believe, that about 200 square miles of Ban Ban and Degilbo runs were covered many feet deep with lava, and in various places deposits of volcanic ash many feet deep and miles distant from the source of the eruption. I purpose later on, and in the cooler weather, exploring the locality more thoroughly, and will attempt to ascertain the depths of the lakes in their centres. I have asked and obtained the permission of the Hon. A. H. Barlow, Secretary for Public Lands, to name the lakes the Coalstoun Lakes and this mountain Le Brun, and these names will be recorded on official maps. Another item of interest on Ban Ban run may be mentioned, namely, an artesian spring which forces its water in considerable quantity (probably two or three million gallons daily) above its surroundings, and with it a quantity of white gravel and sand. This spring is not connected with the mountain lakes, as it flows from a different direction, but is, I believe, from an ancient bed of a stream—probably Baramba Creek—which has been covered over with lava, because the present Baramba Creek has the appearance of having been pushed out, and its present course follows in most cases the edge of the lava."

AN UNPUBLISHED LECTURE BY DR. LUDWIG LEICHHARDT.

[COMMUNICATED BY A. MESTON.]

[*Read before the Royal Society of Queensland, 16th March,* 1894.]

This Lecture, descriptive of the fauna and flora observed on the journey to Port Essington, was delivered by the lost explorer in Sydney in 1845. Mr. Meston found the MS. in the possession of Mr. Robert Lynd.

OBSERVATIONS ON EXTINCT VOLCANOES IN VICTORIA.

By SAMUEL MACGREGOR.

[COMMUNICATED BY THE HON. A. NORTON.]

[*Read before the Royal Society of Queensland*, 21*st April*, 1894.]

MOUNT Eccles, which I first saw in January, 1841, is about nineteen miles inland from the seashore, east of Portland Bay; its base is about 100 feet above sea level; the mouth of the crater at the west end may be another fifty feet. Following this easterly to the end of the crater you reach the mount, which forms a perfect cone, rising about 300 feet, thickly clothed with grass and various plants, and studded to the apex with lightwood and sheoak trees of beautiful forms. From the top of the hill on a clear day the view all round is most enchanting. Immediately beneath the observer is the crater in which is the lovely lake, with its perpendicular rocky wall on the south; the east, south, and west are less abrupt, and one can approach the lake if careful. Trees grow all round the sides. The lake is about half-a-mile in circumference, and must be of immense depth, judging from the great quantity of lava which has been thrown out of it, covering the surface on the north half-a-mile, east seven miles, west six miles, south six miles; from thence a stream fully a mile in width, to near the seashore. I never had an opportunity of ascertaining the depth of this large bed of rocks, though in some places I have seen cavities over twenty feet deep, and still rocks.

On one occasion I, with a number of friends, wished to be on the top of the hill at daybreak. We camped under an overhanging rock on the eastern end of the lake, at least 100 feet above the water. Our fire did not burn freely, but not thinking of any danger we lay down to sleep. In the course of an hour or two we were all aroused by a fidgetty feeling as if the place was alive with vermin. The fire had gone quite out. On holding lit matches near the fissures in the rock they went out instantly. We removed a little distance away and slept soundly. Does this indicate another outburst, if these escape-valves, from "which a current of odourless air flows," were by any means to get shut up?

The lava, now consolidated into rock, is in many places so smooth that one can walk or even ride a shod horse with comparative ease; while in other parts the rocks form very rough barriers. Wherever the lava has become decomposed sufficiently to form even a thin layer of earth, grasses grow most luxuriantly; on these stock fatten very quickly. The rocky country, even in the roughest parts, is generally studded with gum and lightwood trees.

Mount Napier, another volcanic hill, twelve miles north of Mount Eccles, and of larger size, is round and hollow as a basin. The walls rise very abruptly to about 500 feet above the surrounding country. They are thin on the top and level all round. There is a crater in the middle of the hill some 300 feet deep, but no water; large trees in the bottom and all round the sides. The rocks extend fully three miles all round the hill, and from the south side several streams have flowed south towards the sea and disappear about seven miles distant in the Lake Condah Swamp. There are two very fine streams of water which, when I knew them first, ran on the surface for about two miles, and were then lost. They continue on the surface now over four miles, in the middle of the valleys through which the lava formerly flowed. On the east of the mount and rocks there is a large swamp known as Buckley's Swamp, the outlet running N.W. towards Hamilton.

Mount Rouse, about thirteen miles east of Mount Napier, is much larger and of greater altitude than either of the former. Judging by the depth of soil, "decomposed lava," and freeness from rocks, all over the hill, I fancy the eruptions here must have ceased long prior to those at Mounts Napier and Eccles. The crater, which has been of great size, is very much filled up—doubtless by the corresponding reduction in the height of the hill; the quantity of lava which has been ejected from this mount is enormous. It covers an area of over a mile to the north, three miles east, five miles west, and in irregular widths to the sea coast at Port Fairy, forty miles distant. On the north-west of the mount there is a strong-running spring of water and on the south-east another equally strong. Some thirty years ago the owner of the property (Mr. Twomeny) desired to have water in another place suitable to the requirements of his cattle, and determined upon sinking a well. After going through scoria, about sixteen feet, a layer of grass and plants, with pieces of wood and other materials, similar to those seen on the surface, were gone through; the sinking was continued, and at the depth of another forty feet, or about fifty-six feet from the surface, another layer of vegetation, similar to the one described above, was found, but no indications of water. The sinking was then abandoned. These facts lead me to think that there must have been a great lapse of time between the eruptions.

Meningorott, or McArthur's Hill, situated about seven miles north-west of Camperdown, is about 300 feet above the level of the extensive plains by which it is surrounded. The crater which is of considerable size, has evidently been filled up greatly by the mouldering down of the walls. The present bottom is very little, if any, below the level of the country around it, and is entirely covered with vegetation, trees, &c. There is no water in the crater, and on the country immediately round the hills there are very few rocky parts—the lava seeming to be almost entirely decomposed, leaving a great depth of fruitful soil. On the top of the very highest part of the hill there are the remains of a perfect tree, in a state of petrifaction; roots, trunk and branches still connected, though now very much broken, as if by falling when it was in a perfect state.

In addition to the hills named there are Mount Shadwell, Flat-topped Hill, The Elephant, Ware's Hill, Pon Pon, Purrumbete, Leura, Basin, Banks, Noorat, The Sisters, Garvoc, Koroit, Mount Taurus, and many others, varying in size, character, and appearance, though apparently distinct from each other. They may have been outbursts from the same immense body of molten matter far below the surface of the earth.

OBITUARY NOTICE OF DR. CHAS. PRENTICE.

By F. M. BAILEY, F.L.S.

[*Read before the Royal Society of Queensland, 21st April,* 1894.]

By the death of Dr. Chas. Prentice, which occurred at his residence, Woolloongabba, on 20th April, the scientific workers of Queensland have suffered a very great loss, and therefore, although he was not a member of this Society, a notice of the sad event should be recorded in our Proceedings. The learned Doctor was a resident amongst us for over thirty years, and during the whole of that time was always a ready helper of those working at the branches of scientific research of which he was a master. The natural history subjects in which he took special interest were the Ferns, Grasses, and Beetles; but his knowledge was by no means confined to these. The Doctor has not been an extensive public writer in Queensland, but he has been appointed upon several Boards and Royal Commissions of importance. His loss will be felt by the many, but by none more than by him who pens these few lines.

AN ACCOUNT OF THE EASTER EXCURSION OF MEMBERS OF THE FIELD NATURALISTS' SECTION TO EUMUNDI.

By F. M. BAILEY, F.L.S.

[*Read before the Royal Society of Queensland*, 21*st April*, 1894.]

It will be in the recollection of many of the members of this Society, that in former years when the outings of the Field Naturalists' Section were more frequent than they have been of late, it was the custom to read a short account of each excursion at the following monthly meeting. This was especially the case when objects of more than ordinary interest had been observed or new species discovered. It was a good rule, for it gave members who could not accompany the excursion party an opportunity of hearing and seeing some little of what had been accomplished. Thus it has been considered that a few words about the most interesting of the plants met with by the party who took advantage of the Easter holidays this year for a few days' collecting at Eumundi, might be read at this evening's meeting.

Two new trees were met with; the first a new Quandong, *Elæocarpus Eumundi*—so named because, as far as at present known, it would seem confined to that district. It forms a rather handsome tree of medium size. The leaves seem more coriaceous than other Australian species of the genus. In form they are lanceolate or oblong-lanceolate, and from 3 to 5 inches long, and 1 to 1½ inch broad in the middle; the stalks (petioles), 1½ to 2 inches. The margins are entire, or with a few distant, more or less prominent blunt teeth in the upper half of the leaf; the apex often elongated but obtuse. The young growth, petioles and midrib, more or less clothed with appressed short grey hairs; these sometimes also being found sparsely scattered over the underside of the leaf. Inflorescence lateral, on the two years' old wood. Racemes seldom exceeding in length 2 inches, the pedicels about ½ inch; drupe blue, oval, ¾ inch long, the pericarp juicy, sharply acid; stone deeply pitted, containing 1 or 2 seeds.

The second was a species of *Sideroxylon*, which, having been met with upon Mount Eerwah, has been named *S. Eerwah*. The tree is one of medium size, but only loose leaves and very early and fully matured fruit were obtained. From such meagre material it might be considered unsafe to found a species. They, however, differ considerably from all the other Australian species of the genus, so may well bear a distinctive name. The leaves closely approach those of *S. obovata*, being obovate or broadly elliptical, obtuse, decurrent upon the petiole, and, including the latter, measure about 5 inches in length, with a breadth of about 2½ inches at the broadest part. The pedicels are glabrous, and from 3 to 4 lines long; calyx-segments obtuse, nearly orbicular, glabrous, except for the ragged membranous margins being ciliated, about 1 line in diameter. Ovary with a dense ring of glossy-brown hairs at its base, the rest part glabrous. Ripe fruit of a reddish-purple colour, oval, but often tapering much towards the base, and thus becoming pear-shaped, 2 to 2½ inches long, containing 1 or 2 seeds; the 2-seeded fruits much compressed. Seeds, when there are two in a fruit, shaped like a cowrie-shell, from ¾ to 1¼ inch long; hilum broad, the length of the seed. What is wanting in the above description can be added when material is at hand to furnish it.

During this excursion the Australian *Bursera* was frequently met with in full fruit; the tree was found to be by no means rare in the locality, but no local name seems to have been given it. This species was first discovered by two of our members while botanising in the district in 1892, but their specimens were obtained from a bough which had been blown down by the wind. From the better specimens now obtained, the description given in Botany Bulletin V. 8, may be extended and revised in the following particulars:—Tree comparatively large, shedding its bark in hard, thick, woody scales somewhat similar to the Red Cedar and some Yellow-woods. Leaflets often 7; the larger ones attaining the length of 4 inches, on petiolules of 9 lines, the common petiole often 2 inches long. Drupe with, when fully ripe, a very juicy epicarp.

Good fruit-bearing specimens were also obtained of *Sideroxylon myrsinoides*, *Macadamia Youngiana*, *Polyosma Cunninghamii*, and *Schizomeria ovata*. The last is well worthy of the settler's attention as a preserving fruit. It is about the size of a large cherry, the stone small and the flesh having a sharp acid flavour. I will not take up time to speak of the many other plants observed.

Hoping that this short notice will show that the Field Naturalists' section of your Society are fully alive to the importance of working up the natural history of the colony and whenever holidays occur and the weather is suitable, are found ready for a day or so in the bush.

EXHIBIT OF A BUNYA NODULE: WITH EXPLANATORY REMARKS.

By F. M. BAILEY, F.L.S.

[*Read before the Royal Society of Queensland*, 21*st April*, 1894.]

The curious specimen of wood exhibited this evening is one of those eccentric growths found in the bark of trees, and known botanically as "nodules." The present one was taken from the bark of a Bunya tree. I have not observed them in any other of our native trees, but the Hon. A. C. Gregory tells me that in Western Australia they are found in the bark of a Eucalypt. In other parts of the world they are found in the bark of the Beech, Cedar and Olive. My object in bringing the present exhibit under your notice this evening is the belief that these wood formations have a value, and would if better known find a ready market in Europe for cutting into veneers. It could not be recommended that these magnificent trees should be cut down for the sake of the nodules, but when these woody formations are contained in the bark of fallen trees, they might be collected for the purpose above stated.

ON SOME VICTORIAN LICHENS.

By JOHN SHIRLEY, B.Sc.

[*Read before the Royal Society of Queensland, 21st April*, 1894.]

In my study of the Queensland Lichens it has been found necessary from time to time to refer to papers on American plants of the same order for original descriptions; and it has gradually been forced upon me that the relationship between American and Australian lichens is far closer than that between European and Australian lichens, and even more close than are the similarities and resemblances shown by Asiatic and Australian plants of this family. During my visit to Tasmania in 1892, to attend the meeting of the Australasian Association, I made a small collection of Tasmanian lichens—an account of which, unfortunately bristling with printer's errors, appears in the Transactions of the Royal Society of Tasmania for 1892. In working out these lichens the wonderful relationship to the plants published in American lists was again shown, and led me to review the subject as a whole; and this review was embodied in a paper read before the members of the Australasian Association at Adelaide, in September last. Having in my possession a small collection of Victorian lichens, obtained in exchange from the Rev. F. R. M. Wilson, of Kew, V., I determined to make a special examination of them with a view to show whether the same relationship to American forms would again be exhibited. Most of the Victorian lichens had been named by my correspondent, but on reference to the latest American works on lichenology, my labels had to be changed, as the greater number bore synonyms of plants whose names had been given long before by other workers. In the list attached corrections have been made, and the bibliography supplied.

It may perhaps be doubted by some of my hearers whether these lowly plants deserve so exhaustive a study; and it will perhaps not be out of place to give some reasons for the interest I take in them.

It is known that the flora of a country changes radically in the course of geologic ages; for instance, in the Miocene age, parts of Switzerland possessed a flora resembling that of Australia, the Molasse beds containing fossil remains of Banksias, Hakeas, Sparganiums, Cinnamomums, Grevilleas, Persoonias, and species of Smilax, etc., etc. Lowly plants like the lichens may outlive their loftier and nobler flowering allies. It is at least possible, so slow is the growth of many lichens and so unchangeable their character, that a lichen flora may outlive many changes in phanerogamic plants. The character of a lichen flora may therefore give a better clue to the source from whence an oceanic island or island continent was peopled with its floral wealth, than the forest trees of the island or region under consideration. Much interest has lately been evinced, and much speculation indulged in, concerning a former Antarctic continent. Wallace in his "Island Life," Hutton in his papers on "The Origin of the Fauna and Flora of New Zealand," Forbes in his writings on "Antarctica," and lately our old colleague, Mr. C. Hedley, in his pamphlet, "The Relation of the Fauna and Flora of Australia to that of New Zealand," have dealt most cleverly and exhaustively with various phases of the subject. So far as the lichens of Australia can give their testimony they offer a greater proof of an old time and intimate connection with America than with the nearer and more island-joined continent of Asia; and, though these are mere fractured links in what may yet be a complete chain of evidence, the discovery of the fossil bones of a peccary in Queensland by Mr. C. W. De Vis, and the finding of fossil marsupial remains in Patagonia of an Australian type, are also worth their place in a discussion on the subject.

More than three-fourths of the lichens in the list appended are found also in America, and two others belong to the genus Acolium, a family of tropical American habitat. A species of this family was first found in Queensland among some lichens gathered by the late C. H. Hartmann, kindly presented to me by Mr. Henry Tryon.

Order I.—Collemaceæ, Mull. Arg., Lich. Genève, p. 80.

Tribe I.—Lichineæ (*Lichinei*, Nyl. Syn. p. 88, pro p.)

1. Ephebe pubescens, *Fr.* s. *Stigonema ephebioides*, Wilson, Trans. Linn. Soc. 1890. On rock, summit of Mount Macedon, 3-4,000 feet above sea level.

Tribe II.—Collemeæ, *Körb.* Parerg. p. 408.

2. Leptogium tremelloides, *Fr.* v. marginellum, *Nyl.* s. *L. philorheuma*, Wils., *L. sinuatum*, Wils. Vic. Nat. Vol. IV. No. 6, p. 86; Roy. Soc. Vic., Nov. 10th, 1892. On mossy rocks by streams near Melbourne.

3. Leptogium tremelloides v. isidiosa, *Mull. Arg.* s. *L. limbatum*, Wils. Vic. Nat. Vol. VI. No. 4, p. 63. On Prostanthera, Mount Macedon.

4. Synechoblastus laevis, *Mull. Arg.* s. *Collema senecionis*, Wils. Vic. Nat. Vol. VI. No. 4, p. 62. On Senecio Bedfordii, near Melbourne.

5. Synechoblastus texanus, *Mull. Arg.* s. *Collema atrum*, Wils. Vic. Nat. Vol. VI. No. 4, p. 62. On calcareous earth and rocks by the seaside, Victoria.

6. Synechoblastus Robillardi, *Mull. Arg.* s. *Collema quadrilocularis*, Wils. Vic. Nat. Vol. VI. No. 4, p. 61. On rocks, Mount Macedon.

7. Lempholemma myriococcum, *Th. Fr.* s. *Synalissa cancellata*, Wils. Proc. Roy. Soc. Vic., Nov. 10th, 1892. On mossy rock, Mount Macedon, at 3-4,000 feet.

Order II.—Epiconiaceæ, Mull. Arg. Lich. Genève, p. 18.

Tribe III.—Caliciеæ, Fries. Lich. Europ. p. 6

8. Calcium pachypus, *Mull. Arg.* s. *C. flavidum*, Wils. Vic. Nat. Vol. VI. No. 4, p. 64. Gippsland.

9. Acolium parasema, *Mull. Arg.* s. *Trachylia viridilocularis*, Wils. Vic. Nat. Vol. VI. p. 66. Kew.

10. Acolium subocellatum, *Mull. Arg.* s. *Trachylia lecanorina*, Wils. Vic. Nat. Vol. VI, No. 4, p. 66. On old rails, Ararat.

Order III.—Discocarpeæ, Mull. Arg. Lich. Genève, p. 18.

Tribe IV.—Ramalineæ, Mull. Arg. Lich. Genève, p. 26.

11. Ramalina fraxinea v. platyna, *Nyl.* s. *R. brevis*, Wilson. Vic. Nat. Vol. VI, No. 4, p. 69. On bushes, Warrnambool.

12. R. pollinaria, *Ach.* s. *R. unilateralis*, Wilson. Vic. Nat. Vol. VI, No. 4, p. 69. On twigs of Bursaria spinosa, Victoria.

13. R. polymorpha v. emplectans, *Ach.* s. *R. tenellula*, Wilson, *in lit.*

14. R. inflata v. gracilis, *Mull. Arg.* s. *R. horizontalis*, Wilson, *in lit.*

Tribe V.—Parmelieæ, Mull. Arg. Lich. Genève, p. 31.

15. Stictina intricata v. Thouarsii, *Nyl.* s. *S. pustulosa*, Wilson. Vic. Nat. Vol. VI. No. 4, p. 60. On bark of Melaleuca, Gippsland.

16. S. crocata f. esorediata. *Mull. Arg.* No. 236, Wilson. Mount Macedon.

17. S. Mougeotina v. aurigera, *Nyl.* No. 247 b., Wilson.

18. Sticta dichotomoides, *Nyl.* s. *S. stipitata*, Wilson. On fallen fern-tree, Mount Macedon. Proc. Roy. Soc. Qd., Vol. VI• Part 1, 1889.

19. S. Shirleyana, Mull. Arg. s. *S. stipitata*, Wils.; juvenile form. On fallen fern-tree, Mount Macedon. Proc. Roy. Soc. Qd., Vol. VI. Part 1, 1889.

20. Parmelia tinctorum, *Nyl.* s. *P. splendida*, Wilson, *in lit.*

21. P. saxatilis v. signifera, *Mull. Arg.* s. *P. tenuirima*, Wilson. Mount Macedon, at 4,000 feet. Vic. Nat. Vol. IV. No. 6, p. 87.

22. Xanthoria parietina v. spinulosa, *Krph.* s. *Theloschistes velifer*, Wilson. Vic. Nat. Vol. VI. No. 4, p. 69. On Hymenanthera Banksii by the Yarra, near Melbourne.

23. Physcia stellaris v. acrita, *Nyl.*, Nos. 275 and 275 (b), Wilson. Botanical Gardens, Geelong.

Tribe VI.—Psoromeæ (*Psoromei*, Nyl. Syn. II. 21).

24. Psoroma sphinctrinum, *Nyl.* s. *P. contortulum*, Wilson. No. 300. Vic. Nat. Vol. VI. p. 61.

Tribe VII.—Parmeliellcæ (*Pannariei*, Nyl. Syn. II. 27).

25. Parmeliella caerulescens, *Mull. Arg.* s. *Pannaria molydodes*, Wilson. Vic. Nat. Vol. VI. No. 4, p. 61. On mossy trees, Warburton.

25*a*. Coccocarpia pellita v. incisa, *Mull. Arg.* s. *Obryzum myriopus*, Wilson. Vic. Nat. Vol. VI. p. 60.

Tribe VIII.—Psoreæ, Mull. Arg. Lich. Genève, p. 40.

26. Psora dactylophylla, *Mull. Arg.* s. *Phyllis melacarpa*, Wilson. Vic. Nat. Vol. VI. No. 4, p. 68. On tree trunks and decaying logs in sub-alpine localities.

27. Thalloidima australiense, *Mull. Arg.* s. *Pycnothelia papillaris*, Wilson. Vic. Nat. Vol. IV. No. 6, p. 86. On sandy cliff, Brighton.

Tribe IX.—Lecanoreæ, Mull. Arg., Bot. Socot., p. 359.

28.—Rinodina australiensis, *Mull. Arg.* On Banksia serrata, Cheltenham, Wilson.

29. Diploschistes actinostoma, *Zahl.* No. 511, Wilson. On basaltic rocks, Little River.

30. D. scruposus, *Norm.* No. 499, Wilson. On slates, Glenmaggie.

31. Phlyctella Wilsoni v. sparsa, *Mull. Arg.* No. 830, Wilson. Mount Macedon.

Tribe X.—Lecideeæ, Mull. Arg. Lich. Genève, p. 50.

32. Buellia myriocarpa, *Mudd.* s. *Trachylia exigua*, Wilson. On old rails near Melbourne.

Tribe XI.—Graphideæ, Mull. Arg. Graph. Feé, p. 13.

33. Opegrapha varia v. heterocarpa, *Mull. Arg.* No. 858 (b.) On Banksia serrata, near Melbourne.

34. Phaeographis australiensis, *Mull. Arg.*, Wilson, Gippsland.

35. Graphis assimilis, *Nyl.*, Wilson. Gippsland.

36. G. tenella, *Ach.*, Wilson. Gippsland.

37. Arthonia dispersa, *Nyl.*, Wilson. On elm-trees, Geelong.

38. Chiodecton grossum, *Mull. Arg.*, s. *C. encephalodes*, Wilson. On Eugenia Smithii, Gippsland, Wilson. Vic. Nat. Vol. VI. No. 4, p. 61.

ON THE AUSTRALIAN CASSOWARY

(Casuarius australis).

By A. MESTON.

[*Read before the Royal Society of Queensland, 19th May,* 1894.]

The first cassowary described in Australia was shot by an aboriginal who accompanied Kennedy's expedition from Rockingham Bay to Cape York in 1848. This native was known as "Jackey Jackey" to the white men, and as "Galmarra," or the composer of songs," to his own tribe on Patrick's Plains, Hunter River, New South Wales. In the history of Australian exploration there is no name more honourably entitled to undying remembrance. But for that brave and faithful savage not a soul would have survived that fatal expedition.

On the 17th August, 1857, the first cassowary brought to Sydney was landed there by Captain Devlin of the cutter *Oberon*. This bird came from the island of New Britain, where the natives called it "Moorook." The Australian emu, originally, was named by Latham *Casuarius Novæ Hollandiæ*, or the "New Holland Cassowary." (Salvadori describes nine species of cassowary in New Guinea and the neighbouring islands).

In the Journal of Carron, one of the survivors of Kennedy's party, we find the following entry for November 14th, 1848:— "This morning 'Jackey' went to examine a scrub through which we wanted to pass, and while out he shot a fine cassowary. It was very dark and heavy, not so long in the legs as the emu, and had a larger body, shorter neck, and a large red, stiff, horny comb on top of the head. Mr. Wall skinned it, but from the many difficulties with which we had to contend, the skin was spoiled before it could be properly preserved." This was near Weymouth Bay, seven days before the party divided. The first description of this cassowary appeared in the *Illustrated*

Sydney Herald on June 3rd, 1854. In 1866, Walter Scott, of the Herbert River, got a bunch of cassowary feathers in a blacks' camp and sent it home to Dr. P. L. Sclater, who exhibited it to the Zoological Society. At the meeting of that Society, on June 11th, 1868, Sclater exhibited a complete skin received from Walter Scott, and taken from a bird shot by Henry Stone at Herbert Vale Station. The first skeleton was also sent home by Scott, and given by Sclater to the Royal College of Surgeons in 1871. The first Australian cassowary in England was sent in the ship *Ramsay*, care of Captain Cave, by the Marquis of Normanby in October, 1874. This bird was obtained at Cardwell by Lord Henry Phipps from Mr. and Mrs. Conn, who were afterwards murdered by the blacks. On March 16th, 1871, W. J. Scott again wrote from the Valley of Lagoons, telling the Zoological Society that a planter named Haig, on the Lower Herbert, had caught a full grown specimen, and was desirous of presenting it to the Society. This is the first recorded capture of a Queensland cassowary. Dr. E. P. Ramsay, Curator of the Australian Museum, obtained two young ones while at Cardwell in March, 1874, and the second one received in England was sent home by him to the Zoological Society and delivered on May 28th, 1875.

The Australian cassowary is found only in North Queensland on the east coast from the Cardwell Range to Cape York. A correspondent informed me that one was seen within 12 miles of Charters Towers, but this requires confirmation. The Cardwell blacks say the cassowary has rambled farther south since the advent of the white man, and a solitary bird may have even wandered along the coast range, and through the scrubs of the Burdekin to within 12 miles of Charters Towers, impelled by the same restless spirit that sent a Port Essington buffalo to the plains of the Flinders.

The cassowary is an inhabitant of the dense tropical jungle that clothes from base to summit the coast ranges of the Cape York Peninsula. This jungle also covers the level country between the mountains and the seabeach from Cardwell to Cooktown. It crosses the range and extends, in places, for some distance on the western slopes. The cassowary follows that jungle to its outer edges, east and west, but I possess no record of any being seen on the rivers running to the Gulf of Carpentaria. The favourite habitat of the bird includes the Johnstone, Russell, Mulgrave, Mosman, Daintree, and Bloomfield rivers. North of Cooktown it inhabits the belts of jungle on the east coast from Princess Charlotte Bay to Newcastle Bay.

A full-grown cassowary stands from five to six feet in height and weighs from 150 to 200lbs. One shot by my son during the Bellenden-Ker expedition, in 1889, and weighed in presence of the Colonial Botanist, was 184lbs. This bird is now in the Queensland Museum. The second bird in the museum was shot by me on the Barron River, and weighed 170lbs. One shot by John Nairne on Freshwater Creek, near Cairns, weighed 250lbs., and I have seen specimens that must have stood six feet six inches and weighed nearly 300lbs.

So large a bird requires an enormous quantity of food, and a full-grown one must eat at least a hundred pounds of fruit daily. Wild fruits of many kinds grow in great abundance in the scrubs inhabited by the cassowary. Every bird has a favourite feeding-ground, and comes year after year to some particular tree or trees, generally the oil nut (*Aleurites Moluccana*), pencil cedar (*Lucuma galactoxylon*), *Omphaleas*, *Cryptocaryas*, or Davidsonian Plum (*D. pruriens*). The cassowary is also fond of the Burdekin Plum (*Pleiogynium Solandri*), which grows alike on good soil and the open forest sandy belts near the seabeach. About twenty different fruits are eaten by the cassowaries on the Russell, Mulgrave, Barron, and Daintree rivers. In captivity they are very impartial in their diet, displaying uncontrolled omnivorous propensities, and swallowing with equal satisfaction boiled sweet potatoes, raw liver, fresh eggs, dead rats, and glass marbles. I never knew anything seriously disorganise the epigastric region of a cassowary except a tin of red lead. The digesting apparatus, which yields excellent pepsine, is a large digestive sac, *not* the ordinary gizzard of a bird. Connected with this sac is a single large intestinal canal like that of a tiger, and the digesting process is effected with astonishing rapidity. All food is imperfectly assimilated, the harder fruits occasionally showing very trifling changes. A young cassowary will at times retain his food not more than an hour. Though chiefly frugivorous, the wild cassowary also eats beetles, rats, mice, young birds, tender bulbous roots, and small fish stranded in floods or left in evaporated pools. If man ever acquires the appetite and digestion of the cassowary, the whole human race will soon be exterminated by famine.

Even the best stuffed specimen gives but a poor representation of this magnificent bird. The taxidermist has, so far, failed to reproduce the beautiful scarlet and orange colours, and marvellous opalescent shades of light and dark blue on the head and neck. Absent also are the proud imperious carriage, the measured stately stride, the sonorous ventriloquial voice, and the deep dusk fire of the dark lustrous malign eyes. The two long wattles on the throat are found on both male and female. Some are destitute of this appendage, like one of those in our museum. On the top of the head is a ridge-shaped helmet about four or five inches in height, one of Nature's wonderful adaptations to the necessities of environment. Without that helmet a cassowary would have to live in the open forest, for the lawyer vine of the jungle would tear his head and neck to pieces the first time he ran from an enemy. When running in the dense scrub he extends his head and neck in front in a horizontal position, and the vines glide from his helmet on to his shoulder and thence harmlessly along the plumage of the back. When scared by a sudden surprise, the bird will rush through the undergrowth with a noise like a scrub bullock, tearing vines and breaking bushes, but if he has sighted you quietly he will vanish through the densest mass of tangled vegetation in a manner apparently miraculous. He is a much heavier and far more powerful bird than an emu, and is dangerous to approach when wounded or "bailed up." One of the three toe-nails reaches a length of over four inches, and I have seen a cassowary tear the side out of a dog and disembowel the animal with one kick. When two males fight they spar like boxers and kick like lightning in three directions—sideways, straight in front, and out behind. I have seen two large birds strike each other simultaneously, the recoil throwing both on their backs.

At night they camp between the flanges at the root of a tree, or stand, or crouch on the breast, in a patch of lawyer vines or undergrowth. If approached by a man with a bull's-eye lantern they will not attempt to run and can be lassooed or knocked down.

A full-grown cassowary has no fear of a dingo or a tame dog. A tame dog's first interview with a cassowary, especially a conceited dog, is a comical spectacle. The dog suddenly sniffs the unusual trail, makes a wild rush forward, catches sight of a six feet cassowary quietly picking up pencil cedar plums, gives a sort of canine "Hooray! here's something grand!" and advances to the charge with all the supercilious arrogance which contemptuously underestimates the resources of an adversary. The next scene shows an astonished and terror-stricken dog, with no visible tail, flying for his life in a cloud of dead leaves, pursued by a cassowary, with his plumes all standing erect and a voice that sounds—to the dog—like a fog-horn blown by Lucifer on the shores of Acheron. When the cassowary is out of sight the dog sneaks back to his master's heels and meekly enquires, in the plain language of looks, if he saw "that red-headed earthquake?"

The hen cassowary lays from two to six eggs on the bare ground, usually in some secluded part of the scrub, in a thicket of lawyers or stinging tree, and she and the male divide the responsibilities of incubation, sitting alternately on the eggs for about five weeks. After hatching, the young birds are placed entirely under the control of the male bird, and I have never seen the female in charge of her family.

In three or four days the young birds are strong enough to run at a considerable pace, and when danger is announced they hide under logs, dive into holes at the roots of trees, or squat in a heap of leaves, and lie perfectly still until the old bird calls them together. Up to two years of age the plumage is grey, and thenceforth it darkens to a bright black colour at five years. When out on the ranges, on the north branch of the Mulgrave River, in 1885, I saw a very large and beautiful white cassowary, evidently an albino. He had no wattles, nor any of the usual gorgeous colours on the neck. This noble bird walked leisurely across the dry bed of a watercourse, and vanished in the dense brush. Maturity is attained in seven years.

The voice of the young birds is a plaintive whistle; that of the grown bird varies from a deep boom to a harsh hiss. He adopts this tone when chasing a dog.

Cassowaries are very fond of bathing, and I have seen them frequently plunging and fluttering their plumes, and throwing somersaults in shallow pools. Occasionally they are attacked and killed by crocodiles. They are frequently caught and drowned in the valleys by the sudden floods in the creeks and rivers. Many were drowned on the Mulgrave River in the flood of 1890. Several bodies of large cassowaries were found after the waters subsided.

On the Johnstone, Russell, Mulgrave, and Barron rivers, the cassowary is known to the blacks as "Boondarra," "Keendadja," "Bomba," "Boomboom," and "Goombijan." The bird is eaten in all stages, from the egg to the full-grown specimen. In the tribe of "Bolambi," on the Mulgrave River, I found one class had the cassowary as a totem, and of course was prohibited from eating the egg or the flesh. The class was named "Keendadja" after the bird.

The New Guinea natives make daggers and spear butt-ends from the leg bones, and use the plumage for decorative purposes. The North Queensland natives rarely use the plumage, and make no use of the bones.

The cassowary accumulates an immense amount of oil, especially from November to March, and I have obtained six or seven quarts from one bird. The skin is covered by fat and very difficult to preserve. The oil rather increases than prevents rust on articles of steel. It is extremely effective for stiff joints or contracted muscles.

Professor Owen regarded the cassowary as the nearest living representative of the ancient *Palapteryx*, or *Dinornis*, a genus of extinct-gigantic birds which included the Moa of New Zealand. The present living representatives of the once mighty order of *Ratitæ*, are the African ostrich, the South American rhea, the Australian emu, the New Zealand apteryx, and the cassowary.

Two species of *Dromaius* (*D. patricius and D. gracilipes*), contemporary with the Diptrodon, have been found on the Darling Downs, and named by Mr. De Vis of the Queensland Museum, but no fossil cassowary remains have been recognised in Australia.

ON THE PREVALENCE OF CANCER IN AUSTRALASIA.

(FIRST AND SECOND PAPERS).

By EUGEN HIRSCHFELD, M.D.,

Honorary Bacteriologist to the Brisbane Hospital.

[*Read before the Royal Society of Queensland*, 12*th August and* 17*th November*, 1893.]

In perusing the report of the "Mortality Experience of the Australian Mutual Provident Society, 1849-88," the following passage arrested my attention :—" After phthisis, cancer is the most fatal of the constitutional diseases. To this cause 257 deaths—232 males and 25 females—are due. These represent 4·63 per cent. of the total deaths, and 0·04 per cent. on the exposed to risk. For the period ended 31st December, 1878, deaths from cancer were only 3·03 per cent. of the total deaths, and 0·02 per cent. on the exposed to risk. There has, therefore, been a very marked increase during the ten years—1879-88. Cancer is, as a rule, a disease of middle and old age, consequently the increase in the rate of mortality from this cause would be partly accounted for by the increased age of the office. This does not, however, explain such a great increase as is here shewn. A larger proportion die from this disease in this society than in either the Mutual Life Insurance Company of New York or in the Scottish Widows' Fund. We do not know how to account for this very unfavourable feature of our mortality statistics, but we hope that the further investigations we have suggested will throw some light on it."

This experience of the Australian Mutual Provident Society entirely coincides with the experience of medical men in this colony, both in hospital and private practice. One cannot help being impressed with the fact that the number of cases of cancer coming under our observation are out of proportion to the ratio they generally bear to other diseases, and are decidedly on the increase. Under these circumstances a more minute inquiry into the prevalence of cancer in Australasia seems to be all the more interesting since the Vital Statistics of the different Australian colonies furnish a material sufficiently ample to base our investigations upon. More particularly at the present time, where the theory of the parasitic origin of cancer leads us to suspect a miasmatic influence, the study of the distribution of malignant tumours may to some extent contribute towards the elucidation of this obscure subject.*

Of course I am aware of the objections which may be raised against the use of vital statistics for the purpose of determining the prevalence of any disease. The compulsory notification of births and deaths in all the Australian provinces, the quinquennial census, and the certification of the cause of death, furnish the basis for the vital statistics. You will notice from an inspection of the plates, that I tried to avoid the fallacies and errors of the indiscriminate use of mortality tables by classifying the deaths in different age groups, by comparing them with the mortality of people above five years of age, thus avoiding the disturbing influence of a fluctuating birth rate and mortality of infants, by separating the returns as to sex, etc. There is also another point I wish to allude to. Since all cases of cancer which are not operated upon terminate fatally, the number of deaths recorded indicate more fully than in most other diseases, from which recoveries take place in varying numbers, in typhoid fever for instance, the real prevalence of the disease.

The number of cases that form the subject of these investigations is very considerable. They comprise more than 20,000 deaths caused by cancer in the different Australian colonies during various periods extending from 1861 till 1891, namely:—Victoria, 9,900; South Australia, 1,807; New South Wales, 4,501†; New Zealand, 1,943; Queensland, 1416; Tas-

* It is unquestionable that carcinomata also approximate to the category of miasmatic affections. Although less pronounced than malaria or goître, the endemic character of cancer is still a fact that has often struck observers. The frequency of these malignant tumours is far from being equal in all countries. By the side of regions of the globe which are exempt, or very nearly so, from this disease (Faroë Islands, etc.), there are others where carcinomata are very common.—Remarks on Carcinomata and Corridia, by Elias Metschnikoff, M.D., *British Medical Journal*, Dec. 10th, 1892.

† The statistics of New South Wales comprise 445 deaths returned under the heading of Tumours.

mania, 593; Western Australia, 131. It is, perhaps, not quite correct to accept without qualification the statement that cancer has been the cause of death in all these cases. There is no doubt that a certain proportion of deaths classified under the heading "Cancer" have in reality been caused by a different class of tumour, mostly Sarcomata. For practical purposes, however, it is quite impossible to make such a distinction. They are comparatively rare, and equal cancer as far as malignant progress is concerned. The differential diagnosis can only be established by microscopical examination, which I am afraid has not so far, even to a small extent, formed the basis of the returns of any Registrar-General. It might be, perhaps, more appropriate to use the term "malignant tumour," which covers both classes.

I do not intend to deal in this paper with all the details of this important subject, but I shall restrict myself to the principal outlines. In a series of future papers these details, for which the material is already contained in the accompanying tables, will be treated separately, so as not to disturb or complicate a clear general view.

The results of the investigations to which I want to draw your attention to-night are the following:—

1. The rapid increase of cancer in all the Australian colonies.

2. The unequal distribution of the disease amongst males and females.

3. The unequal prevalence of cancer in the different Australian provinces.

It goes without saying that with the increasing population and consequent increasing number of cases of deaths the number of cases caused by any specific disease like cancer must be far greater now than it was twenty years ago. But the increase in cancer has been out of proportion to the growing population and to the cases of death due to other diseases. Let us take, for instance, Victoria. In 1861 not quite fifteen persons died from cancer amongst 100,000 living, while in 1891 more than four times this number (61) succumbed to it. The difference becomes still more considerable when we consider its prevalence amongst males and females separately. In 1862 the proportion was 9 per 100,000 men ; in 1891, 67 per 100,000. In other words, while in 1862 one person died of cancer in Victoria, in 1891 7 died from it. The smallest number of females was 19 in 1863, which increased to 59 in 1889. That is a proportional increase of 1 to 3. The increase has been a gradual one. It was interrupted in some years by a decline, but generally followed by a steeper increase.

The statistics of the other colonies do not allow us to go back so far, as has been the case in Victoria, but the increase is noticeable in every one of them. In New South Wales we find cancer causing 13 per 1,000 deaths of females in 1876 and 33 in 1888 ; computed per 1000 deaths above five years of age, to exclude the fluctuating infantile mortality, the corresponding numbers are 25 (1876) and 63 (1888). In the same space between 1875 and 1888, the returns of the male population show 16 (resp. 26) in 1876 and 24 (resp. 41) in 1888.

In Queensland the statistics for the last 20 years furnish the following results :—

In 1873	Cancer	caused	10·1	per cent. of the deaths.
In 1892	,,	,,	24·7	,, ,, ,,
In 1873	,,	,,	16·4	deaths per 100,000 living.
In 1892	,,	,,	31·3	,, ,, ,,

The number of cases of cancer has, therefore, been doubled in Queensland within 20 years.

New Zealand shows 28·7 deaths from cancer amongst 100,000 living in 1882, and 47·5 in 1890.

In South Australia the proportion was in 1873 20·5 per 100,000 living ; in 1891, 48·3, or an increase of about 2·40 per cent.

Western Australia shares in the growing frequency of malignant tumours ; but it would be hardly safe to draw any conclusions from the returns of this province, the total number of cases (131) being too small.

Tasmania exhibits very small fluctuation, especially as the space of time from which the returns were available was comparatively brief (9 years), 49·7 per 100,000 living in 1882, and 55·0 in 1890.

What is the reason of this enormously increased prevalence of cancer in Australia? It may be contended that this increase is only apparent. In former times the population consisted largely of people who had emigrated to Australia mostly in the prime of their life, at a period of age in which the susceptibility to cancer was naturally very small, since far the greatest liability shows itself at a time past middle age. Therefore, the increasing average age of the inhabitants would be naturally accompanied by a corresponding greater tendency to a disease peculiar to elderly people. However, this explanation cannot hold good. Take Victoria as an instance: While the growth of the population in the first ten years of our period of observation was considerably augmented by the influx of immigrants, who were mostly adult persons, the natural increase by the excess of births over deaths began to prevail more and more every year. Consequently the increased age of the immigrant portion was more than counterbalanced by the much greater increase of young children, amongst whom malignant tumours are conspicuous by their absence. Mr. Hayter, the Government Statist of Victoria, furnishes us with a table in which the numbers of males and females of different age-groups are compared in 1881 and 1891.

From these figures it becomes apparent that the number of males aged between 20 and 35 had increased by more than 80,000 persons in these ten years, while between 40 and 55 an actual decrease of more than 10,000 persons had taken place. Under these circumstances we naturally would expect a falling off in the deaths from cancer instead of an increase. Viewed in this light the rapid elevation of the death rate from cancer is all the more striking.

Another explanation that may be brought forward is that the augmentation of the cancer cases is attributable to the greater accuracy of diagnosis and a stricter system of classification introduced into the Registrar-General's Department by doing away with such general terms as atrophy, debility, marasmus, inanition, &c., and demanding a more exact description of the cause of death. This supposition seems to be confirmed by the fact that the increase of cancer has been greater amongst males than females, carcinoma in women being more easily diagnosed because of its localisation on parts more accessible to examination, while in males it makes its appearance more frequently in internal organs that might escape superficial observation. I do not believe that much weight can be attached to this reasoning. While I am quite ready to admit that malignant tumours of the internal organs may be overlooked at the onset of the disease we must remember that we have to deal here only with the deaths occasioned by it, and with few exceptions it is difficult to mistake then the cause of death. On the other hand there is no doubt that the progress of surgical science in the last twenty years has given aid to a certain number of cancer patients, and has diminished (by more successful operation and by more accurate diagnosis of the early stages with the aid of the microscope) the number of persons eventually dying from it ; so that also from this standpoint the increase in the death rate from cancer cannot be accounted for.

Moreover, as the statistics of New South Wales show, the increase in the death rate of cancer has in this province been actually higher amongst females (18·33) than amongst males (16·24).

The hereditary transmission of tumours, or of the tendency to such, is a fact well established. In a certain proportion of cases of cancer the family history of the patient shows that either father or mother or other relatives had been affected by carcinoma, or died of it. Now carcinoma is essentially a disease that manifests itself in elderly persons. Take for instance Queensland: Of 1000 persons that die between 25 and 35 years of age, cancer is the cause of death in about five, while between 50 and 65 one-thirteenth of the deaths (seventy-five out of 1000) are occasioned by it. Victoria furnishes still more striking figures. Of the total number of cases of death from cancer persons under 30 years of age furnished a contingent of only 3·7 per cent., while in the same space of thirty years between 45 and 75 the percentage was nearly 80 (79·6). Under these circumstances it is clear that in the vast majority of cases cancer manifests itself after marriage, so that any tendency to it will be unconsciously propagated. Thus : "In the case of a disease such as tubercular phthisis, which in a large proportion of cases manifests itself before the age of marriage, there will be at any rate to a certain extent a constant, if an insufficient, weeding out from the candidates for matrimony of those who are most seriously liable to this disease; but in the case of cancer there will be no such preservative influence, and so long as persons with this inherited tendency marry practically without let or hindrance of any kind, there must be a constantly growing proportion of the population that shares in the constitutional defect." But though there is no doubt that this argument explains increase of cancer to a small extent it is quite insufficient as a reason for this enormous increase (seven times as much in the male population and treble for the whole of it), within the comparatively short space of thirty years.

We are, therefore, forced to the conclusion that the rapidly and greatly increasing prevalence of cancer in the Australian colonies cannot be accounted for by an increase out of proportion of that part of the population which is most liable to malignant tumours (aged persons), nor by greater accuracy of diagnosis even by a certain small natural increase in consequence of hereditary transmission; that on the contrary the improved diagnosis of the earlier stages, together with the advancement of surgical treatment, should warrant a diminution instead of an augmentation of the cases of death caused by cancer.

You will have noticed that so far I have pursued the rather unusual course of stating the reasons that were not responsible for the increase in the death rate from cancer. But this course was absolutely necessary in this case. As regards cancer we are not in the same satisfactory position, as for instance in phthisis, where our knowledge about the causation of the disease is perfectly exact. The actiology of cancer is still obscure, and it is not advisable, by hastily jumping to conclusions, to bring forward reasons for the increase of cancer in this country. After having the whole material sifted I shall be in a better position to do this, especially as soon as the influence of localisation, age, sex, climate, race, seasons, years, &c., has been investigated, as I intend to do in my next paper.

The next point I wish to draw your attention to to-night is the greater prevalence of malignant tumours amongst the female part of the population compared with the males. As you see from the accompanying tables the curve of the cancer rate amongst females is much higher than in males. The average for Victoria within the last thirty-one years has been 36 per 100,000 males and 40 per 100,000 females. However, it is important to note the fact that the relative increase in cancer has been considerably smaller amongst females than males, so that they are nearly equal in the latter years of observation.

Correspondingly we find that, compared with 1000 deaths from all causes, cancer furnishes a higher percentage in women than in men. Here the increase in the last twenty-one years has been about equal for both sexes; but the increase itself is very noticeable. On the other hand, in New South Wales the increase of the cancer mortality is far more conspicuous amongst females than males. Within our period of observation—from 1875 till 1888—the percentage per 1000 deaths was 16 and 33 women and 17 and 24 men. The increased liability of the female sex to malignant tumours is also evidenced by the statistics of European countries; Scotland, for instance, shews the following figures:—

	Per 1000 Deaths.			Per 100,000 Living.		
	Males.	Females.	Both.	Males.	Females.	Both.
1868	13.2	26.7	19.9	30	55	43
1889	27.5	45.2	36.4	51	81	67

I purposely abstain from quoting too many figures. All these facts are far better illustrated by looking over the diagrams and tables than by a long and wearying description of their details.

The third very interesting fact is the distribution of cancer in the different Australian provinces. Taking the average for the last nine years we have the very satisfactory result that Queensland is at the bottom of the list; only 26 out of 100,000 living die from cancer annually in this colony. The second best is New South Wales with 32, then comes South Australia with 35, and New Zealand with 38, Western Australia shows 39, but I do not attach much weight to the statistics of that colony, the population being too small to allow any binding conclusions to be drawn from it. Tasmania and Victoria head the list with a mean average of 50 per 100,000 living. These facts show that climate has certainly a more important influence on the prevalence of cancer than was hitherto attributed to it. Victoria, Tasmania, and New Zealand, the coldest countries, show the highest average, while New South Wales and Queensland are the lowest. The rate in Tasmania is nearly twice as large as that in Queensland (50, 26). I shall deal more extensively with this subject when inquiring into the reasons for the increase of cancer as previously mentioned. In spite of the difference in the distribution the fact remains that cancer has increased in all the colonies without exception.

Compared with England and Scotland we find that the average in these countries is higher than in Australia, but the relative increase has been considerably smaller at home than out here, as the curves show.

I do not wish to conclude my paper without expressing my sincere admiration for the great care and skill with which the statistics of the Australian colonies, more particularly of Victoria and Queensland, have been compiled—thus furnishing a most valuable fund of information. It has, nevertheless, been found impossible to present the tables of the various colonies in a uniform manner, since not only do the returns of the various colonies, which are the work of different Registrars-General, differ from one another, but in the same colony the returns are constantly being altered and enlarged with the rapidly increasing population.

DEATHS FROM CANCER IN VICTORIA—1861-1891.

Year.	Males.	Females.	Total.	Total per 100,000 Living.	Per 100,000 Living.	
					Males.	Females.
1861	52	50	102	18·9	16·0	23·3
1862	30	50	80	14·6	9·3	22·2
1863	58	45	103	18·3	17·8	19·0
1864	55	72	127	21·7	16·4	28·7
1865	81	70	151	24·7	23·3	26·5
1866	52	64	116	18·4	14·7	23·3
1867	63	57	120	18·7	17·5	20·0
1868	95	88	183	27·6	25·8	29·8
1869	85	99	184	26·8	22·4	32·2
1870	109	105	214	30·0	27·8	32·7
1871	100	93	193	26·2	24·8	27·9
1872	130	96	226	30·0	31·8	27·9
1873	122	128	250	32·7	29·6	36·3
1874	146	122	268	34·5	35·0	33·8
1875	168	140	308	39·1	40·0	37·9
1876	150	153	303	38·0	35·5	40·9
1877	169	160	329	40·7	39·5	42·0
1878	182	132	314	38·2	42·0	34·0
1879	205	178	383	45·9	46·7	45·0
1880	202	181	383	45·0	45·2	44·8
1881	172	179	351	40·4	37·7	43·4
1882	208	165	373	41·9	44·5	39·0
1883	234	216	450	49·4	49·0	50·0
1884	221	225	446	47·8	45·1	50·9
1885	234	211	445	46·4	46·4	46·6
1886	247	249	496	50·2	47·5	53·6
1887	275	252	527	51·7	51·1	52·6
1888	276	245	521	49·4	49·4	49·4
1889	324	305	629	57·0	56·2	59·5
1890	338	288	626	56·0	57·4	54·4
1891	407	297	699	60·9	67·7	54·4
Total ..	5190	4710	9900	Average	35·9	38·1

VICTORIA—MALES.

YEAR	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891
Deaths from Cancer ..	109	100	130	122	146	168	150	169	182	205	202	172	208	234	221	234	247	275	276	324	338	407
Deaths from Tumour	10	11	5	11	6	13	8	6	15	12	15	16	14	14	18	22	16	7	12	6	12	14
Deaths from Cancer and Tumour ..	119	111	135	133	152	181	158	175	197	217	217	188	222	248	239	256	263	282	288	330	350	421
Total Number of Deaths	6114	5845	6308	6565	6994	8563	7716	7345	7179	7033	6610	7024	7900	7410	7675	8300	8575	9213	9385	11064	10369	10666
Deaths from Cancer per 1,000 of all Deaths ..	16	17	21	19	21	20	19	23	25	28	31	24	26	32	29	28	29	30	29	29	33	38
Deaths from all causes above 5 years ..	3589	3387	3644	4001	4180	4741	4785	4548	4548	4493	4194	4656	5138	5018	5007	5506	5707	6008	6117	6884	6990	7223
Deaths from Cancer per 1,000 deaths above 5 years ..	30	30	36	30	35	35	31	37	40	46	48	37	40	47	45	42	43	46	45	47	48	56

VICTORIA– FEMALES.

Year	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891
Deaths from Cancer ..	105	93	96	128	122	140	153	160	132	178	181	179	165	216	225	211	249	252	245	305	288	292
Deaths from Tumour	10	13	14	20	15	17	15	14	13	11	26	12	20	24	30	34	24	14	12	7	11	8
Deaths from Cancer and Tumour ..	115	106	110	148	137	157	168	174	145	189	207	191	185	240	255	245	273	266	267	312	299	300
Total Number of Deaths	4306	4073	4523	4936	5228	6724	5845	5431	5523	5087	5042	5278	5734	5596	5830	6061	6377	6792	6902	8328	7643	7963
Deaths from Cancer per 1000 of all Deaths	24	23	21	26	23	21	26	29	21	35	36	34	29	39	39	35	39	37	35	37	38	37
Deaths over 5 years from all causes ..	2173	1958	2162	2596	2849	3287	3364	3065	3136	2987	2987	3240	3402	3559	3582	3677	3825	4091	4156	4707	4624	4890
Deaths from Cancer per 1000 deaths above 5 years ..	48	48	45	49	43	43	45	52	42	60	62	55	48	61	63	57	65	62	59	65	62	60

Total Female Mortality increased from 1870 to 1891 in proportion of 10 : 18·5
Above 5 years ,, ,, ,, ,, ,, ,, 10 : 22·5
Cancer ,, ,, ,, ,, ,, ,, 10 : 28

Total Male Mortality increased from 1870 to 1891 in proportion of 10 : 17
Above 5 years ,, ,, ,, ,, ,, ,, 10 : 20
Cancer ,, ,, ,, ,, ,, ,, 10 : 37

VICTORIA—MALES.

Number of cases of death from Cancer at various age-groups—1880-1891.

Year.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	Upw.	Total
1880	1	1	1	—	1	—	1	9	12	25	41	34	32	20	13	7	4	202
1881	3	—	2	—	2	2	4	5	11	14	29	30	29	16	14	5	6	172
1882	1	3	—	1	—	—	5	8	16	24	34	31	28	26	13	9	8	208
1883	—	—	2	2	3	2	4	11	12	31	34	40	39	17	19	12	4	234
1884	1	—	1	—	3	7	—	9	14	28	37	44	28	21	15	8	5	221
1885	3	2	2	1	1	2	6	9	8	19	35	52	31	26	14	11	8	234
1886	1	—	—	3	—	2	8	9	6	16	43	48	39	30	25	9	7	247
1887	4	—	1	1	2	7	7	3	12	27	41	47	52	33	18	14	6	275
1888	1	3	2	1	2	4	5	5	14	24	37	40	53	41	23	15	5	276
1889	4	1	2	2		7	1	5	17	31	42	60	63	41	27	14	6	324
1890	1	1	—	2	2	2	7	7	11	32	27	57	75	51	35	21	7	338
1891	2	1	1	1	4	2	7	13	18	27	56	68	77	61	42	19	3	407
Total	22	12	14	14	23	37	55	93	141	308	456	551	546	382	258	144	69	3138
Proportion per 100 cases of all ages	0·7	0·4	0·4	0·4	0·7	1·1	1·7	3·0	4·5	9·8	14·5	17·5	17·4	12·2	8·2	4·6	2·2	100·0

VICTORIA—FEMALES.

Number of cases of death from Cancer at various age-groups—1880-1891.

Year.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	Upw.	Total.
1880	—	1	—	2	2	1	11	16	24	24	26	33	19	10	7	4	1	181
1881	2	—	1	1	2	7	6	14	15	34	20	21	26	15	9	2	4	179
1882	—	1	—	1	1	3	11	12	13	22	30	23	20	9	12	3	3	165
1883	1	—	—	—	4	3	4	16	21	32	33	34	25	23	11	6	3	216
1884	2	3	—	—	1	2	7	16	15	35	42	28	25	22	12	12	3	225
1885	3	3	1	2	1	4	6	7	20	35	28	30	25	24	14	7	1	211
1886	3	—	—	—	5	3	10	15	22	36	35	35	28	23	25	5	4	249
1887	2	1	—	4	—	4	6	17	27	26	31	44	44	28	10	4	4	252
1888	—	—	2	1	2	8	5	13	22	26	35	41	30	28	13	12	7	245
1889	1	1	1	3	2	9	10	16	25	44	42	47	33	22	23	16	10	305
1890	1	1	1	2	2	8	9	9	23	24	33	52	46	41	25	7	4	288
1891	1	—	—	—	2	6	7	12	24	33	37	45	36	33	28	17	11	292
Total	16	11	6	16	24	58	92	163	251	371	392	433	357	278	189	95	55	2608
Proportion to 100 cases of all ages	0·6	0·4	0·2	0·6	0·9	2·2	3·6	6·3	9·7	14·3	15·1	16·6	13·8	10·7	7·3	3·7	2·1	100·

VICTORIA—MALES—ALL CAUSES.

Ages at Death, 1880—1891.

YEAR.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	Upw.	Usp.	Total.
1880	2416	208	129	176	198	177	195	241	284	393	510	383	391	305	241	178	156	26	6610
1881	2368	176	124	186	254	221	207	232	336	429	536	466	460	342	299	172	200	16	7024
1882	2762	205	175	197	278	255	213	284	334	456	570	494	529	357	338	218	220	20	7900
1883	2392	218	142	192	286	262	214	251	333	443	532	494	519	351	289	257	198	37	7410
1884	2668	225	132	201	291	262	217	231	298	423	517	512	502	408	343	212	221	9	7675
1885	2794	199	152	207	305	288	245	251	305	402	593	622	545	449	384	255	289	15	8300
1886	2868	223	136	215	339	370	262	268	276	398	607	595	569	483	359	283	309	15	8575
1887	3205	223	145	234	377	402	295	250	289	388	534	617	603	568	402	365	295	21	9213
1888	3268	285	132	209	344	385	313	311	322	431	532	591	660	571	397	284	344	6	9385
1889	4180	336	171	275	425	481	389	322	345	394	534	664	770	588	499	340	337	14	11,064
1890	3379	354	189	231	406	487	440	346	314	384	469	613	834	606	557	390	359	11	10,369
1891	3443	253	145	196	379	399	362	332	335	405	509	704	914	692	662	439	492	5	10,666

VICTORIA—FEMALES.

Ages at Death, 1879—1889

Year.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	Upw.	Usp.	All ages.
1879	2100	251	138	190	216	205	206	225	254	246	183	177	200	157	131	109	102	3	5087
1880	2105	191	117	179	231	189	205	236	231	247	205	186	211	135	137	124	106	7	5042
1881	2038	201	115	210	263	219	219	247	274	269	235	185	193	174	162	114	158	2	5278
1882	2332	189	147	202	266	248	214	255	242	262	262	206	234	184	192	133	160	6	5734
1883	2037	193	156	240	268	283	204	251	238	287	291	235	235	202	172	135	157	9	5596
1884	2248	224	116	213	321	281	215	235	219	274	281	217	244	219	198	167	157	1	5830
1885	2387	196	116	205	281	344	213	235	233	257	276	256	244	237	207	172	198	4	6064
1886	2550	216	136	182	300	338	272	229	242	249	296	279	267	236	217	156	208	4	6377
1887	2701	235	128	267	310	348	260	245	265	261	288	276	275	281	223	188	236	5	6792
1888	2746	250	140	231	325	350	260	258	241	253	288	315	314	280	228	184	238	1	6902
1889	3621	294	191	265	380	406	313	251	259	284	329	341	318	287	289	218	276	3	8328

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VICTORIA.

Death rate at each age—1871-80 and 1881-90.

	MALES.											FEMALES.										
Ages	5	10	15	20	25	35	45	55	65	75	Gen.	5	10	15	20	25	35	45	55	65	75	Gen.
1871-80 ..	77·3	6·1	3·3	4·0	5·4	7·6	12·1	18·7	31·2	60·5	16·4	42·2	6·0	3·3	4·3	5·4	8·5	11·8	14·3	24·2	48·1	14·1
1881-90 ..	44·8	4·1	2·6	4·0	6·3	7·7	11·2	19·3	33·2	61·1	16·5	31·5	3·9	2·6	4·2	5·8	7·9	10 9	14·8	23·5	50·3	13·6
Increase ..	..	..	..	..	1·0	0·1	..	0·6	2·0	0·7	0·1	...	..	..	..	0·4	..	..	0·5	..	2·2	..
Decrease ..	2·5	2·0	0·6	0·9	..	..	0·9	..	..	..	..	2·7	2·1	0·7	0·1	..	0·6	0·8	..	0·7	...	0·6
1891	45·3	3·9	2·4	3·4	5·9	6·8	11·9	20·3	38·1	73·5	17·7	41·3	3·4	2·2	3·3	5·3	7·7	12·2	14·5	25·8	62·2	14·6

NEW SOUTH WALES—MALES.

Deaths from Cancer.

Year	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891
Deaths from Cancer	..	..	...	..	..	107	103	102	100	93	147	120	118	124	123	148	171	209	208	..	..	..
Tumour ..	..	..	..	..	..	14	11	20	5	20	17	22	23	15	17	23	5	8	8	..	..	..
Total	..	..	..	..	..	121	114	122	105	113	164	142	141	139	140	171	176	217	216	..	..	..
Total Mortality ...	..	..	..	..	..	6245	6508	5877	6284	6082	6638	6753	7596	7116	8325	8900	8507	7776	8435	..	..	..
Deaths from Cancer per 1000 ...	..	..	..	..	..	17	16	17	16	15	22	18	16	17	15	17	20	27	24	..	..	..
Deaths over 5 years...	..	..	..	...	..	3611	4021	3548	3745	3740	3960	4173	4682	4292	4965	5381	5128	4782	5100	..	..	..
5-10 ..	..	..	..	..	..	280	344	179	297	157	157	135	186	195	247	272	197	250	226	..	..	.
10-15 ..	..	..	..	..	..	107	143	97	127	115	119	91	128	118	137	134	132	135	132	..	..	..
15-20 ..	..	..	...	..	..	136	135	115	120	128	139	129	182	144	179	194	187	180	192	..	..	..
Above 5 per 1000 ..	..	..	..	..	..	30	26	29	27	25	37	29	25	29	25	27	33	43	41	..	..	..

NEW SOUTH WALES—MALES.

Deaths from Cancer at different age-groups.

Year.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	Upwards from 75.	U.S.P.
1875	—	—	—	1	1	—	—	3	0	9	—	15	13	21	15	15	—
1876	—	—	—	1	—	—	2	6	8	14	10	14	17	13	7	10	1
1877	—	—	—	—	1	—	5	4	6	6	14	15	17	12	8	14	—
1878	—	2	—	2	1	1	4	6	5	10	14	12	20	9	7	7	—
1879	—	—	1	—	—	2	—	4	9	9	15	13	13	16	6	4	1
1880	3	—	—	1	1	—	4	7	7	11	12	24	27	14	22	12	2
1881	—	—	—	1	—	1	4	5	13	12	15	16	12	13	17	10	1
1882	—	—	—	2	2	—	3	4	8	12	17	14	11	19	11	14	1
1883	2	2	1	—	—	3	—	6	7	13	16	12	22	16	13	10	1
1884	1	—	—	—	2	—	2	9	9	12	17	20	10	22	8	11	—
1885	2	—	—	—	—	1	3	4	6	20	20	21	17	12	22	18	2
1886	—	—	—	2	2	6	4	7	15	14	27	26	21	17	15	15	—
1887	—	2	—	1	2	2	7	3	9	18	30	36	30	22	23	24	—
1888	—	1	—	—	1	2	9	13	12	18	26	23	35	22	21	25	—
Total	8	7	2	11	13	18	47	81	121	178	240	261	265	228	195	189	9
	0·4	0·4	0·1	0·6	0·7	1·0	2·5	4·3	6·5	9·5	12·8	13·9	14·1	12·2	10·9	10·1	0·5

NEW SOUTH WALES—FEMALES.

Deaths from Cancer.

Year	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891
Deaths from Cancer	..	..	..	..	..	74	63	65	91	78	92	96	97	91	110	119	162	145	196	..	..	..
Tumour	..	..	..	..	..	14	19	16	7	22	21	26	18	26	28	33	4	11	2	..	..	..
Total	..	..	..	..	..	88	82	81	98	100	113	122	115	117	138	152	166	156	198	..	..	..
Total Mortality	..	..	..	..	..	4526	4685	3992	4479	4110	4593	4783	5220	5123	5895	6382	6086	5672	5955	..	..	..
Deaths from Cancer per 1000	..	..	..	..	..	16	13	16	23	19	20	20	19	18	19	19	27	26	33	..	..	..
Deaths over 5 years	..	..	..	..	..	2202	2501	2028	2134	2099	2361	2474	2682	2647	3027	3289	3165	3034	3101	..	..	..
5-10	..	..	..	..	..	248	321	175	156	144	140	124	151	181	221	242	179	194	221	..	..	..
10-15	..	..	..	..	..	80	155	114	108	95	84	102	108	107	122	142	96	118	118	..	..	..
15-20	..	..	..	..	..	134	117	118	154	99	134	137	137	142	173	174	168	180	162	..	..	..
	..	..	..	..	..	34	25	32	43	37	39	39	36	34	36	36	51	48	63	..	..	..

NEW SOUTH WALES—FEMALES.

Deaths from Cancer at different age-groups.

Year.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	Upw. 75	U.S.P.	Total.
1875	1	—	—	—	1	3	2	2	10	11	12	14	9	6	2	1	—	74
1876	1	1	—	—	—	—	1	10	13	9	9	5	6	3	1	4	—	63
1877	—	1	—	1	—	1	3	6	7	7	4	15	6	5	1	8	—	65
1878	—	—	1	—	1	3	3	8	13	10	14	13	10	10	3	2	—	91
1879	—	—	—	—	1	1	6	5	13	4	12	10	13	7	2	4	—	78
1880	—	—	—	—	—	4	5	7	15	14	13	10	10	9	4	1	—	92
1881	1	—	—	1	1	2	5	5	8	12	20	11	6	11	9	4	—	96
1882	—	—	—	—	1	—	9	9	13	14	13	11	12	2	9	4	—	97
1883	1	—	—	—	—	—	—	6	7	13	20	12	13	11	4	4	—	91
1884	—	1	—	—	2	2	4	7	14	20	11	13	12	8	12	4	—	110
1885	2	—	—	—	—	5	8	6	14	19	12	18	8	12	5	8	2	119
1886	—	—	—	—	—	4	12	8	17	21	22	24	15	21	8	10	—	162
1887	—	—	—	—	2	1	3	9	19	21	19	22	16	11	10	12	—	145
1888	—	1	—	2	1	6	10	14	15	31	26	26	20	14	13	15	2	196
Total	6	4	1	4	10	32	71	102	178	206	207	204	156	130	83	71	4	1479
Per 100	0·4	0·3	0·1	0·3	0·7	2·2	4·8	6·9	12·0	13·9	14·0	13·8	10·4	8·8	5·5	4·8	0·3	100·

DEATHS FROM CANCER IN QUEENSLAND—1873-1892.

Year.	Deaths from Cancer.	Per 10,000 Deaths.	Per 100,000 Living.	Population.	Deaths (General).
1873	23	101	16·4	140,122	2,250
1874	28	100	18·1	155,103	2,794
1875	35	85	20·3	172,402	4,104
1876	36	104	19·6	184,194	3,467
1877	45	133	23·1	195,092	3,373
1878	54	128	26·0	206,797	4,220
1879	39	121	18·2	214,180	3,207
1880	51	169	23·0	221,964	3,017
1881	65	199	29·4	221,011	3,320
1882	54	126	22·7	237,611	4,274
1883	70	139	24·6	267,865	5,041
1884	94	137	31·4	298,694	6,861
1885	53	85	16·6	318,415	6,235
1886	92	165	27·7	332,510	5,575
1887	81	157	22·8	354,777	5,166
1888	88	159	23·3	377,201	5,529
1889	130	212	32·7	397,061	6,132
1890	117	209	28·2	414,716	5,638
1891	134	259	33·1	404,772	5,170
1892	130	247	31·3	415,813	5,266

DEATHS FROM CANCER IN QUEENSLAND—MALES.

At various age-groups.

Year.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	Upw.	M.	F.
1870	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	9
1871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	6
1872	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	8
1873	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	11
1874	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	13
1875	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1876	2	1	—	—	2	—	1	2	—	2	3	—	1	—	1	1	20	16
1877	—	—	—	—	1	1	3	3	2	—	4	2	3	2	1	—	24	21
1878	1	—	—	—	—	1	3	2	4	3	4	4	2	2	—	1	27	27
1879	—	—	—	—	—	1	2	—	3	3	3	2	3	2	—	—	19	20
1880	—	1	—	1	2	—	2	1	2	4	7	4	2	1	—	1	26	25
1881	—	1	—	—	—	—	—	1	9	7	10	2	7	4	—	1	39	26
1882	1	—	—	1	2	—	—	1	4	4	1	1	7	2	2	2	34	20
1883	1	—	—	—	1	2	1	1	6	3	6	4	3	2	—	—	32	38
1884	1	1	—	1	2	4	1	2	5	7	8	5	3	3	3	1	44	49
1885	—	—	1	1	2	2	2	4	3	3	6	7	2	1	2	2	39	14
1886	—	—	—	3	1	1	2	5	5	5	9	6	5	3	2	3	51	41
1887	—	—	—	—	—	1	4	—	1	4	3	9	13	5	6	4	50	71
1888	—	—	—	—	1	2	1	6	4	4	6	11	3	6	3	—	47	41
1889	1	—	—	—	2	—	1	5	7	12	11	11	12	5	7	2	76	54
1890	1	1	—	—	1	1	2	3	5	6	15	9	9	4	3	2	62	55
1891	—	—	1	—	—	2	1	1	5	11	14	11	9	7	3	5	70	64
Total ,, ..	8	5	2	7	17	19	29	39	58	75	110	88	34	49	33	25	723	589
Percentage ..	1·2	4·8	0·3	1·1	2·6	2·9	4·5	6·0	8·9	11·6	17·0	13·6	13·0	7·6	5·1	3·9	13	12 totl.

DEATHS FROM CANCER IN QUEENSLAND—FEMALES.

At various age-groups.

Year.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	Upw.	Tot.	M.&F.
1876	1	—	—	1	—	2	2	3	1	—	1	—	5	—	—	—	16	36
1877	—	—	—	—	—	—	1	2	1	4	7	1	4	—	—	1	21	45
1878	1	—	1	—	—	1	3	5	3	1	4	2	3	2	—	—	27	54
1879	2	—	—	—	—	—	—	5	4	2	1	—	4	2	—	—	20	39
1880	1	—	1	—	1	—	1	—	2	8	5	1	3	2	—	—	25	51
1881	—	—	—	—	1	1	3	7	3	6	—	—	—	—	—	—	26	65
1882	1	—	—	—	1	1	1	—	2	4	2	2	2	2	2	—	20	54
1883	3	—	—	—	—	—	1	3	4	4	8	5	2	2	3	2	38	70
1884	—	—	—	—	2	3	4	7	7	7	4	2	6	5	2	—	49	94
1885	—	—	—	—	—	—	1	3	3	2	1	1	—	2	—	1	14	53
1886	—	—	—	—	—	1	2	3	5	8	9	9	3	1	—	—	41	92
1887	—	—	—	—	—	2	1	2	7	4	8	1	4	2	—	—	31	81
1888	—	—	—	1	—	4	—	2	2	6	9	6	6	4	—	1	41	88
1889	—	—	—	—	—	1	3	8	7	9	11	5	4	3	1	2	54	130
1890	—	—	—	—	1	—	4	6	6	13	11	5	2	3	3	1	55	117
1891	—	—	—	—	—	2	4	5	3	10	10	7	13	5	2	3	64	134
Total	9	—	2	2	6	18	31	61	60	88	91	51	61	35	13	11	534	
Percentage ..	1·7	0·0	0·4	0·4	1·1	3·3	5·8	11·3	11·1	16·3	16·8	9·5	11·3	6·5	2·4	2·0		

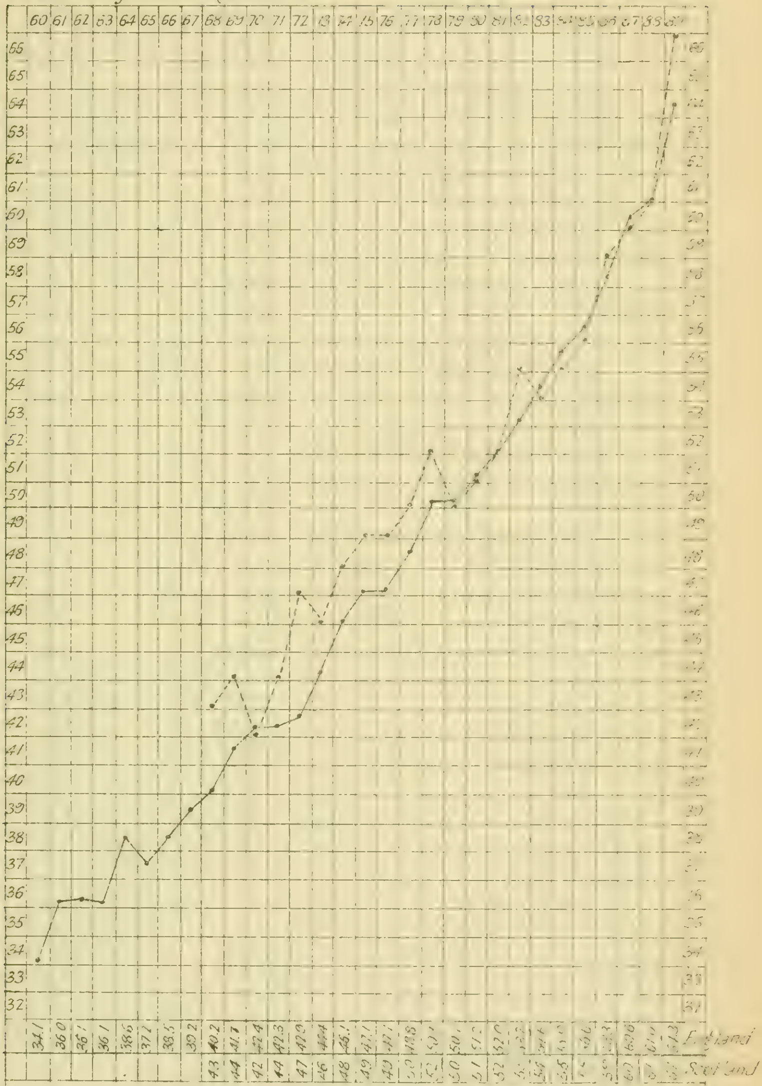
NEW ZEALAND. ENGLAND.

Deaths from Cancer per 100,000 living.

Year.	Males.	Females.	Both.	
1881	22	32	27	52
1882	28	30	29	53
1883	27	32	30	55
1884	33	37	35	56
1885	28	34	31	57
1886	37	37	37	58
1887	40	40	40	61
1888	42	45	43	61
1889	35	41	42	64
1890	47	48	47	—

NUMBER OF DEATHS FROM CANCER.

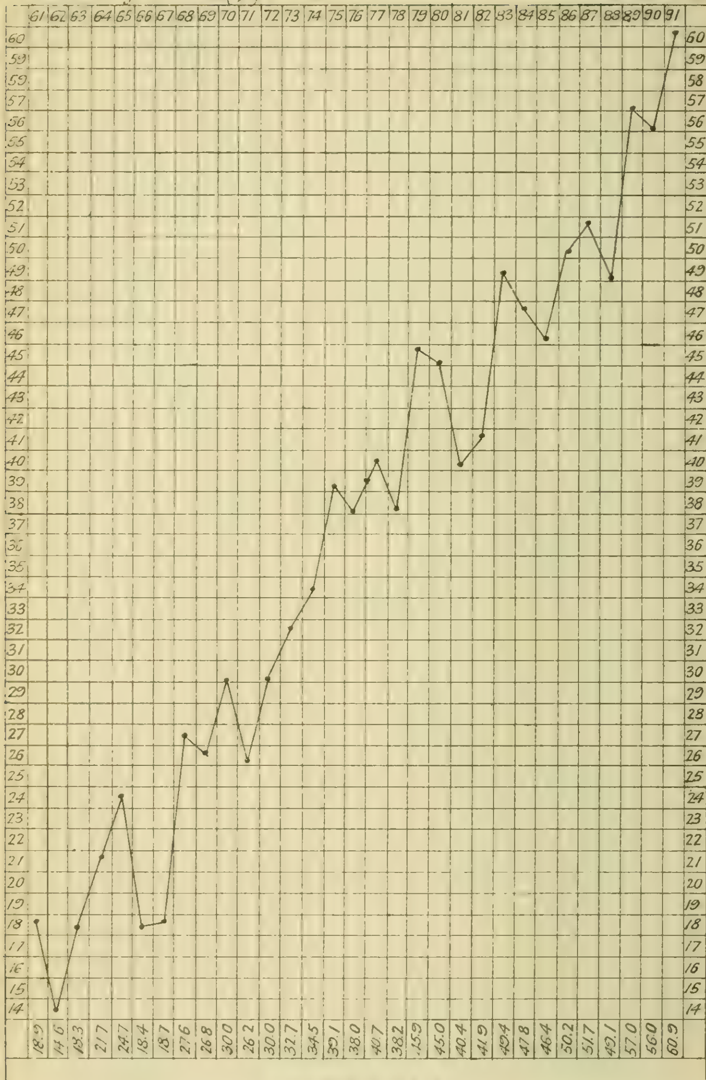
Year.	Victoria. Number.	Victoria. Per 100,000 living.	New South Wales. Number.	New South Wales. Per 100,000 living.	Queensland. Number.	Queensland. Per 100,000 living.	South Australia. Number.	South Australia. Per 100,000 living.	Western Australia. Number.	Western Australia. Per 100,000 living.	New Zealand. Number.	New Zealand. Per 100,000 living.	Tasmania. Number.	Tasmania. Per 100,000 living.
1882	373	41·9	215	27·1	54	22·7	89	30·7	9	29·6	147	28·8	60	49·7
1883	450	49·4	215	25·8	70	26·1	86	28·8	10	32·0	158	29·9	67	53·9
1884	446	47·8	233	26·5	94	31·9	109	35·3	10	30·9	191	34·8	65	50·6
1885	445	46·4	267	28·7	53	17·1	100	31·9	17	49·9	177	37·3	60	45·4
1886	496	49·4	333	34·0	92	26·8	104	33·3	15	39·4	214	36·3	57	43·7
1887	527	51·8	354	35·2	81	23·4	110	35·4	17	40·8	238	39·9	67	50·1
1888	521	49·4	404	39·0	88	24·4	116	37·1	18	42·5	263	43·4	68	49·6
1889	577	57·7	393	36·9	130	34·7	133	42·4	20	46·5	260	42·5	70	49·9
1890	560	56·0	392	35·6	117	30·3	129	40·8	15	31·5	295	47·5	79	55·0
Mean	501	50·4	312	32·5	87	26·8	108	35·2	15	38·7	216	37·6	66	50·2



ENGLAND & SCOTLAND.

Deaths from Cancer per 100,000 living.

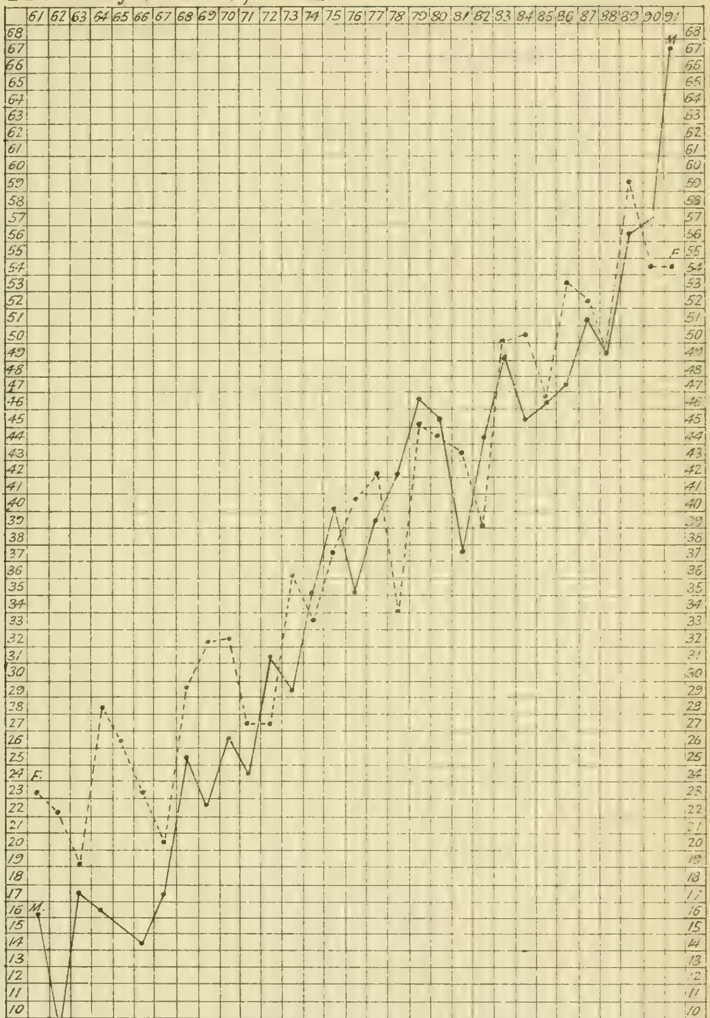
H.W. Fox. Lith. Brisbane 1894.



VICTORIA

Total number of cases of death from Cancer in proportion to 100 000 living during 1861–1891.

H. W. Fox. Lith. Brisbane, 1894.

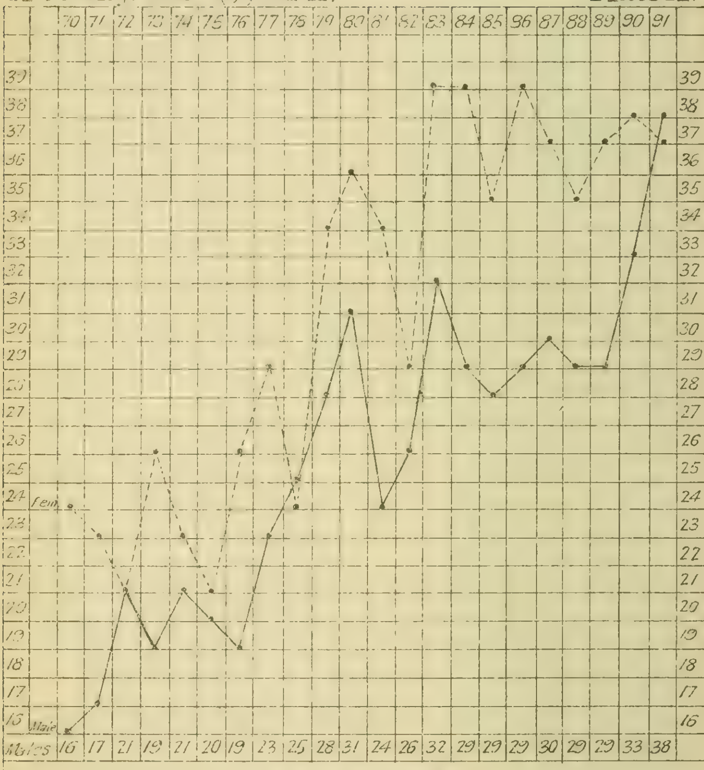


VICTORIA

Males and Females

Deaths from Cancer per 100 000 living

H. W. Fox. Lith. Brisbane, 1894.



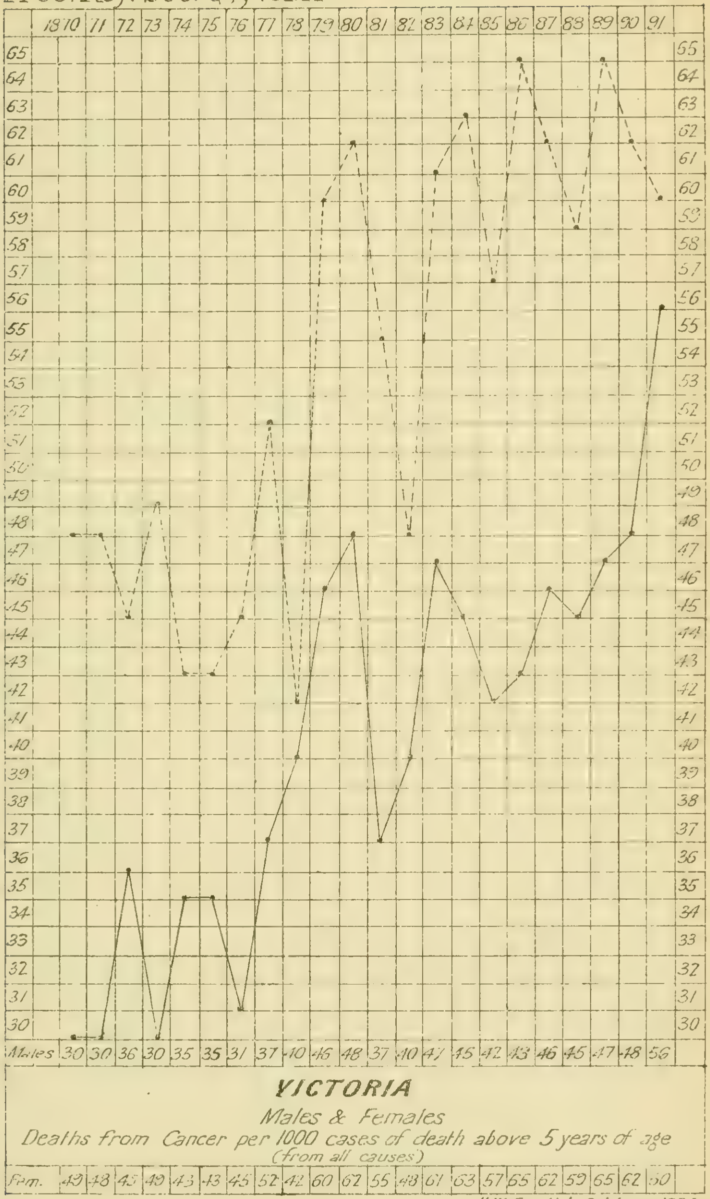
VICTORIA

Males & Females.

Deaths from Cancer per 1000 cases of death from all causes.

Fem.	24	23	21	26	23	21	26	29	24	35	36	34	29	39	39	35	39	37	35	37	38	37

H. W. Fox. Lith. Brisbane 1894.



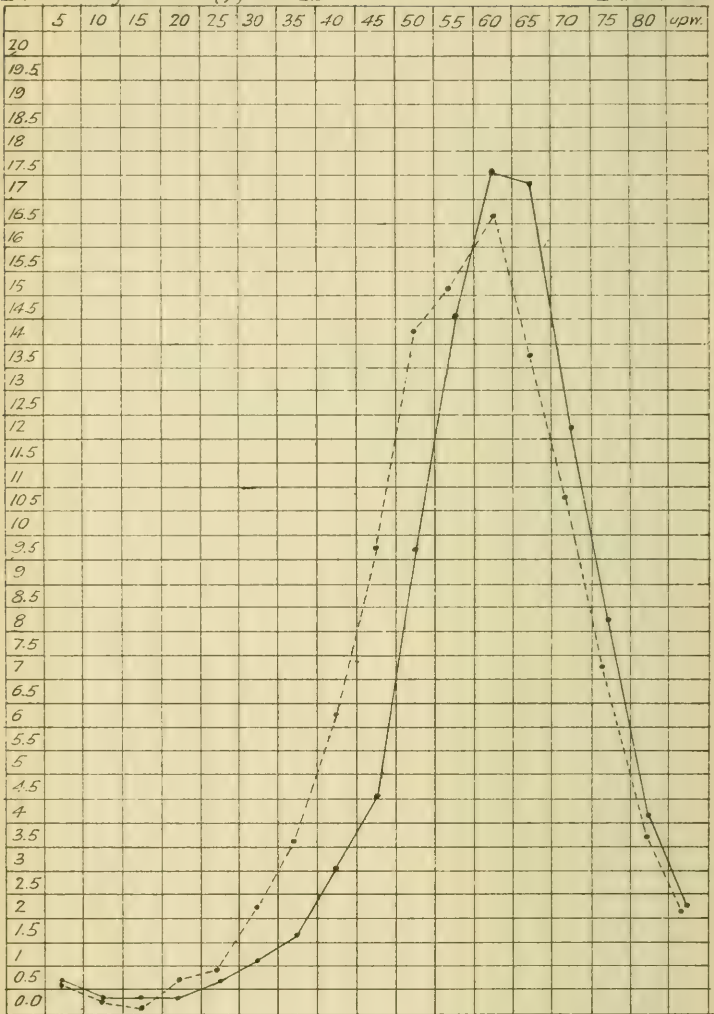
VICTORIA

Males & Females

Deaths from Cancer per 1000 cases of death above 5 years of age

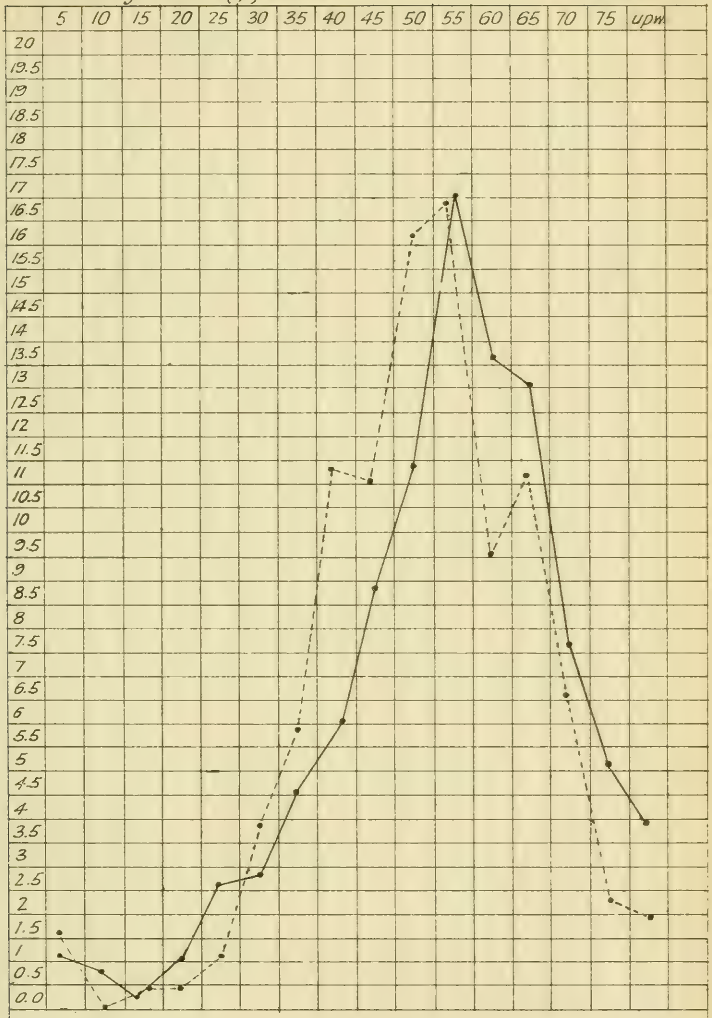
(from all causes)

H.W. Fox. Lith. Brisbane, 1894.



Distribution of Cancer amongst the different age groups
Males & Females
VICTORIA.

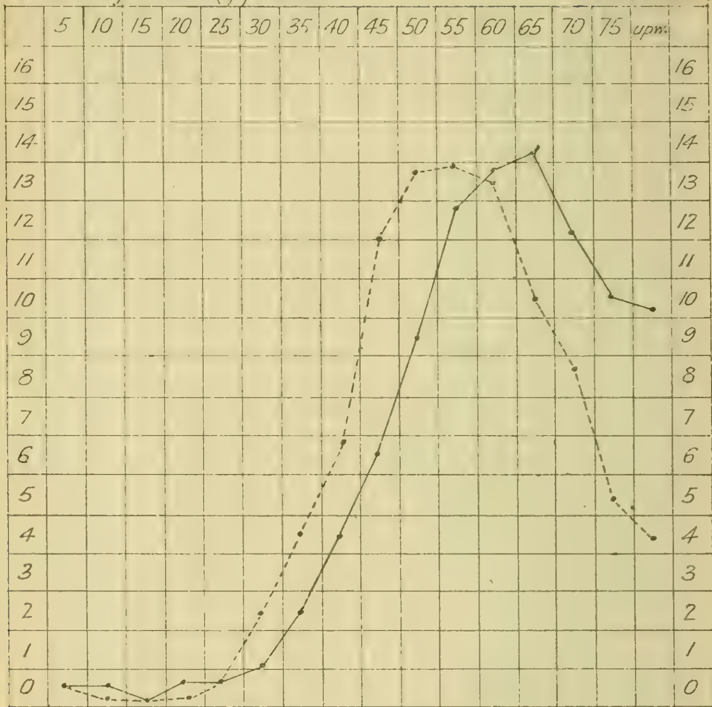
H. W. Fox. Lith. Brisbane, 1894.



Distribution of Cancer among the different age groups Males & Females,

QUEENSLAND.

H.W. Fox. Lith. Brisbane, 1894.

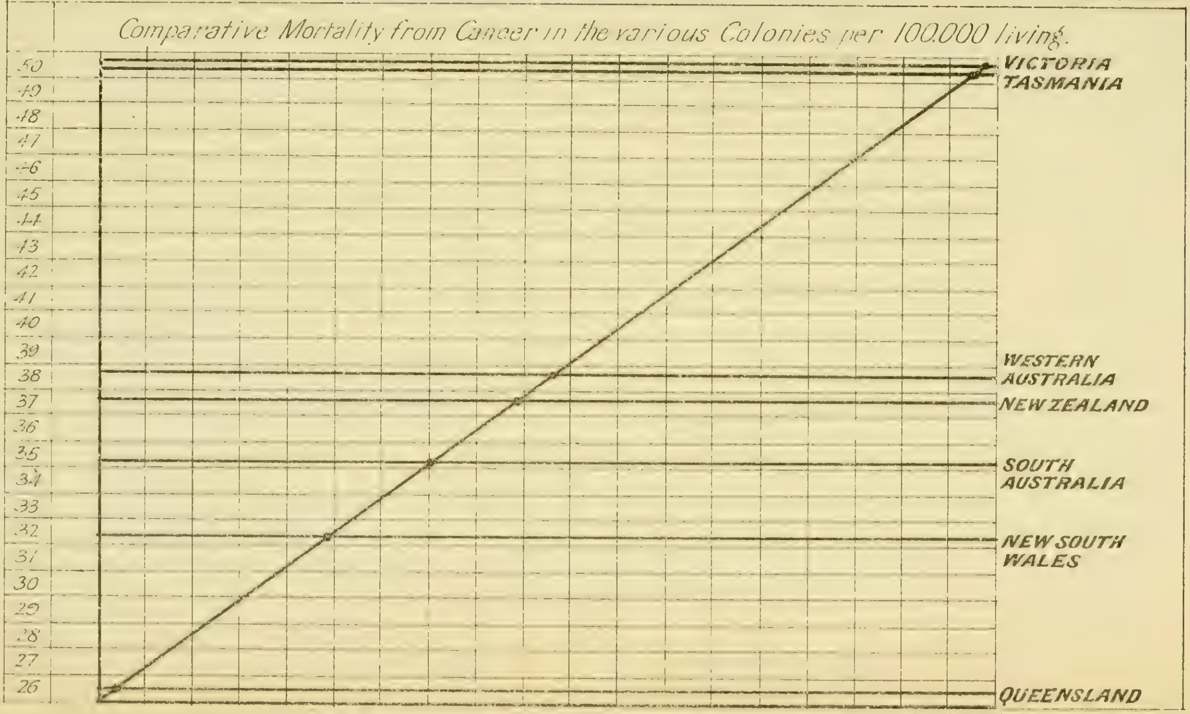


NEW SOUTH WALES.

Males & Females.

Percentage distributed among age groups.

H.W. Fox. Lith. Brisbane 1894.



H. W. Fox Lith Brisbane, 1894.

ON THE PREVALENCE OF CANCER IN AUSTRALASIA.

[THIRD PAPER.]

By EUGEN HIRSCHFELD, M.D.

Honorary Bacteriologist to the Brisbane Hospital.

[*Read before the Royal Society of Queensland*, 19*th May*, 1894.]

It has been pointed out in previous papers read before this Society that all attempts to establish a definite theory on the causation of cancer generally have failed to furnish a thorough and satisfactory explanation of all the phenomena presented by this formidable disease. Hereditary transmission, preceding injury, and parasitic infection—every one of these factors bear a relationship to a certain number of cases of cancer which it would be impossible, even for a sceptical observer, to assign to mere coincidence. But in a series of other cases the same factor is apparently without any influence whatever on the production of the tumour—the characteristics of which are the same as previously. In contradistinction to this multitude of alleged modes of origin, the uniformity of its anatomical appearances, its clinical symptoms and its fatal termination, make it evident that the factors hitherto considered exercise a predisposing influence only just in the same manner as heredity, confinement in close rooms, infection with certain diseases—measles, whooping cough, and prolonged lactation predispose people to become consumptive. With reference to consumption, however, we are, through the discoveries of Professor Koch, thoroughly acquainted with its real cause, the tubercle bacillus; while as to the real cause of cancer we still remain in ignorance despite the many theories brought forward. Under these circumstances it is of great importance to collect all the facts furnished by experience for the purpose of examining what influence they have on the prevalence of cancer.

Age.

Cancer is pre-eminently a disease of middle-aged and aged people, though its occurrence among young people is by no means very rare. When affecting individuals before 40 years of age it is generally distinguished by its more malignant and rapid course. Sarcomata, the other class of malignant tumours, attack with predilection persons upwards from 20 years, whereas children and aged people are not so liable to this form of new growth.

Compared with this experience in European countries, we find the following results in Australia.

A relative immunity from the liability to malignant new growths is noticeable amongst people below 30 years of age in all the Australian Colonies, though not to the same extent. While in New South Wales and Victoria, for about 25 cases of cancer occurring beyond 30, only 1 occurs below this limit; the corresponding proportion in Queensland is 1 to 11 among males and 1 to 17 among females. After that age has been reached, the susceptibility to cancer increases rapidly until it becomes greatest in the decennium between 50 and 60 years, where it remains stationary for a little while (until 65) and then decreases, though the decrease is less rapid than the increase. An example will illustrate these facts more clearly. Out of a total of 4,700 males below 30 years who died in Victoria in 1891, 11 succumbed to cancer, which thus only caused 1 out of 430 deaths. However, in the same year, 1,214 persons died between 50 and 60 years, out of which number cancer was responsible for 124, or a proportion of 1 in 10. The liability to malignant new growths is, therefore, 43 times greater between 50 and 60 than below 30. This remarkable distribution of the susceptibility to cancer amongst the different age-groups is a fact which it is very difficult to explain. The theory generally brought forward which has been accepted, I presume, *à faute de mieux*, is that the organism and tissues of young individuals offer a greater resisting power to the formation of new growths than old persons. The supporters of the theory of the hereditary transmission of cancer say the inherited cancer-cell, which is born with the infant, remains inactive during youth and early manhood; as the person grows older the resistance of the tissue, where the cell is situated becoming weaker, affords an opportunity for its multiplication and transformation into a real cancer. Although nobody has yet seen this slumbering cancer-cell, and its existence is purely hypothetical, our experience in other parts of pathology does not tend to support the above explanation. Let us take, for instance, consumption. The hereditary transmission of the predisposition to this disease is admitted on all sides. According to the views just mentioned we naturally would be led to expect by analogy that, owing to the great resisting power of the organism, the predisposition would not operate until people had become old, when they would succumb most readily to consumption of the lungs. What do we find, in reality? The overwhelming majority of cases of consumption occur during youth and early manhood. It is, therefore, to say the least, improbable to contend that the increased prevalence of malignant tumours amongst aged people is due to the weakened resisting power of the organism. Moreover, I should like to draw attention to the fact that the persons generally affected by cancer have, in every other respect, been up to the beginning of their disease healthy and robust individuals. The relative frequency of cancer among the farming community in Queensland seems to point in the same direction.

Attempts have been made in the last few years to attribute the causation of cancer to parasitic infection with Sporozoa, or Cancer Amoebae. It is difficult to conceive why the Sporozoa should limit their attacks to old people, or should be harmless to persons below 30 years of age, although almost every other infectious disease—acute or chronic—attacks, as you are aware, with predilection young individuals. To call in aid a hypothetical weakened resisting power is out of the question. We, therefore, must content ourselves with having established the curve of the distribution of cancer among the different age-groups in the Australian Colonies, so that we may be able to connect them with any other facts that may be elicited with regard to this subject. It is perhaps of interest to mention that, among the small number of cases of malignant new growths which are occasionally found in childhood and early youth, the majority affects infants or children below 5 years of age. The reason for this occurrence is that some of these tumours are already in existence when the child is born and then rapidly terminate fatally.

I purposely refrained from quoting many figures to avoid wearisome description. All the details are better illustrated by the accompanying diagrams, which exhibit the prevalence of cancer among divisions, each of which embraces five years up to 80 years of age.

Sex.

It has already, in a previous paper, been mentioned that males and females are not in an equal degree liable to malignant new growths. Going more fully into the subject we may state, as the result of our investigations, the following facts.

Let us first turn to Victoria, which with its ample material of nearly 10,000 cases of cancer deserves the greatest attention.

1. Within the space of 31 years, extending from 1861 to 1891, 5,190 males and 4,710 females, together 9,900 persons, died of cancer.

2. Computed per 100,000 living, the average mortality of cancer was, during this time, 86 men and 88 women.

3. The increase of deaths from cancer has been more rapid among males than females. It increased more than 7 times among men and not yet 3 times among women. It is, of course, understood that all these numbers do not refer to the actual population, but are all computed per 100,000 living, so that it is possible to institute comparisons independent of the fluctuation of the population.

4. In proportion to 1000 cases of death, cancer is responsible for 26 deaths of males (25·8) and 31 of females (30·8). To avoid the complicating influence of the great fluctuations of infantile mortality we took, in another table, into consideration only the deaths above 5 years of age, and found the proportion then 41 (40·6) per 1000 deaths of males and 54 (53·7) per 1000 deaths of females.

We, therefore, see that women show a greater liability to malignant tumours than men. There the objection may be raised that the greater liability of women is only apparent, this being due to the fact that cancer in females is generally situated in organs which are more easily accessible to the correct diagnosis than in men, where cancer frequently affects the internal organs. And this view seems to be corroborated by the fact that owing to the constantly improving methods of diagnosis the increase had been less rapid among women than among men, where formerly they had been overlooked in consequence of defective diagnosis and classified in the returns of the Registrar-General under other headings. I may here mention that this more rapid increase of cancer in males has also been noticed in several European countries, and that the above reason was the explanation of the phenomenon. However, when we go more fully into the matter, we are forced to come to different conclusions. Drs. Ogle and Grims have shown that, as far as England was concerned, all the seats of the disease have participated in the increase, not only the more occult ones. Dr. Roger Williams made an analysis of 2,669 cases of cancer occurring in males, which came under treatment in four large metropolitan hospitals in London, and came to the conclusion that it was erroneous to assume that most male cancers are situated in inaccessible regions. He found of per 100 26·3 affecting tongue and mouth, 14·3 the skin, 12·2 the lower lip, and 6·8 other parts of the surface. Thus more than 60 per cent of cancer affect parts of the body in which it may be diagnosed by mere inspection where an error of diagnosis is hardly possible. As regards Australia we have to remark that, though Victoria exhibits a more rapid increase of male than of female cancer-cases, we observe the converse fact to occur in New South Wales, as demonstrated by the following figures. Increase per 1000 deaths from 1875 to 1888 :—Males, 17 (1875) to 24 (1888) ; females, 16 (1875) to 33 (1888).

It is interesting to note that women succumb to cancer at an earlier age than men generally do. The greatest liability to malignant new growths is exhibited by women between 45 and 55 years, while that of men is from 55 to 65. And here I should like to draw your attention to a very remarkable fact. **The more we go towards north the lesser seems to become the resisting power of the female organism.** In Queensland women are fully five years earlier affected by cancer than the women of New South Wales, and they again are in a more unfavourable position compared with

Victoria. To give you an instance. While in Victoria between 35 and 40 cancer is still a comparatively rare affection of the female sex, the women of Queensland show almost double the liability at the same age; the exact proportion is 63 to 11. As regards men there is also a difference noticeable, but not to so great an extent as in the female sex.

This seems to support the opinion generally prevalent that one of the effects of the hot climate on white people is that they age more quickly under it and are consequently affected by diseases peculiar to old people at an earlier age, although on the whole the hot climate diminishes the frequency of cancer. Compared with the returns of European countries we find that both in England and Ireland the liability to cancer is greatest between 55 and 65 and between 65 and 75 years of age. At the latter age-group the Australian curve shows already a very considerable decline. This comparison is all the more interesting since it proves that the early susceptibility to malignant new growths is not due to an inheritance of race.

Race.

There seems to be very little reason to doubt that certain races show a greater predisposition to cancer than others. Of course there are a good many difficulties in strictly proving the influence of the race. Generally speaking, the difference of race also implies a difference of both climatic and social conditions, of customs, habits, food, etc. Each of these factors may exercise a certain influence on the production of cancer, though it might be difficult to exactly circumscribe it. Keeping this in view, I give the annual death-rate from cancer, per 100,000 living, in various countries, from 1881 to 1884, as follows:—

Switzerland	84·6
Italy	61·3
Holland	58·2
England and Wales	53·5
Massachusetts	53·0
Scotland	52·6
Austria	42·3
Ireland	36·9
Prussia	31·3

Of these figures the most interesting are those concerning England and Ireland. It is easier to institute comparisons between these two countries, which do not show an appreciable difference in climate. While England and Wales have a mortality of cancer of 54 per 100,000 living, that of Ireland only amounts to 37. It may be contended that, perhaps owing to the less careful certification and registration of deaths in Ireland, a certain number of cases of cancer are overlooked and returned under another classification. But may I be allowed to point out that the same argument may be made to apply also in the opposite direction. Is it not likely that a faulty certification will attribute to cancer a good few deaths which have been caused by other obscure diseases, thus unduly swelling the returns under the heading of Cancer, and I believe that the latter eventuality is of not too infrequent occurrence, because cancer is really a common cause of death with the general public. But even admitting the possibility that a certain number of cases are not diagnosed, it is utterly out of question to put this forward as the sole explanation of the vast difference, as it is shown by our figures. Moreover, despite the improved methods of diagnosis of the last ten years, the increase in Ireland has been smaller than in England during the corresponding period, and stands now (1891) 46 to 69.

What is the cause of this relative immunity of the Irish people? One of the first ideas that suggest themselves is that it may be a difference in diet, owing to the small quantity of meat that is being consumed in Ireland. This view seems to be confirmed by the fact that Prussia, where the consumption of meat on account of its high price is very limited, exhibits even a lower percentage than Ireland (31). But on the other hand the percentage in Italy is high, though very little meat is eaten by the vast mass of its population; while some of the Australian Colonies, as New South Wales and Queensland, who cannot be accused of abstemiousness in meat, occupy a still more favourable position in the cancer mortality than Ireland. However, the increase of malignant tumours is very rapid in Australia, and some of the colonies have already succeeded in outstripping the mother country—as Victoria and Tasmania.

Though I do not feel inclined to entirely disregard the view that excessive preponderance of meat may predispose to cancer, I must confess that there are great difficulties in assigning a reason for it. Cancer, though fairly common in dogs and horses, is rarely found in cattle, so that the idea of its direct transmission is quite out of question. However, the want of an explanation does not invalidate fact.

Climate.

Before concluding I should like to make some remarks on the influence of the climate on the cancer mortality. The totals of the different Australian Colonies furnish abundant evidence of two facts—

(1) People, especially females, are affected at an earlier age in hot climates by malignant tumours;

(2) The number of cases of cancer in hot climates is considerably smaller than in colder latitudes. Victoria and Tasmania have a mortality of 50 per 100,000 living; New Zealand comes next with 38; then South Australia with 35; while New South Wales has 32. Queensland is at the bottom of the list with only half the mortality of Tasmania and Victoria, namely 26; nor has the increase in the mortality rate been as rapid in late years in Queensland as in Victoria.

NATIVE MEDICINAL PLANTS OF QUEENSLAND

By JOSEPH LAUTERER, M.D.

PART I.

[*Read before the Royal Society of Queensland*, 15*th June*, 1894.]

If we read the reports of the unlucky fate of the Australian explorers Burke and Wills, who died in 1861 from starvation near Cooper's Creek, in a place where at that time a large tribe of aboriginals lived, and where to-day the German Missionary Station, Bethesda, is prospering, we certainly wonder why those highly educated people belonging to superior race were so far behind their black brothers in the struggle for life, and we can see in their instance the great value of experience and of a good knowledge of a country and its natural products. Quite a similar flight of thoughts found many times its way to my soul when in New South Wales. I had to go far away to a patient on the Lachlan or Macquarie, and when I found him dying, or half dead in his slabhouse, on the threshold of which I saw the very plant growing which could have saved him. This, our country of Eucalypts and Epacrideæ where God Jupiter (as Horace has it) gives us a long spring and a mild winter, and where we need not envy the wine-god for the lustily growing grape—this our sunshiny country is one of the most healthy spots on the face of the earth in spite of the contrary assertions of inexperienced scribblers. Many of the diseases of the old world are totally absent here, or are of a much milder character, a fact which will be acknowledged by every medical man who has had occasion to practise for a series of years in both parts of the world. In central and eastern Europe we have from the end of December up to the middle of April widely spreading epidemies of croupy inflammation of the lungs, with alarming symptoms, ending in a sudden crisis for the better on the seventh day, but often ending fatally. These epidemic pneumonics are never met with in Queensland, and many other instances of a similar nature could be pointed out before a medical public. Now, if we have less diseases here we ought to be satisfied with our old European remedies, and ought not to look for more. It is true; but there are two reasons why we ought to investigate our native medicines. Their commercial value must for the first reason be utilised for a country where money is scarce just now. Some Australian plants have already a world-wide renown. The oils of the Eucalypts are sold all over Europe and America, and they are largely used in diseases of the respiratory organs. I am sorry to say that on the European markets the oils are chiefly judged by the percentage of eucalyptol, which does not dry up as a varnish when heated. All oils not containing a high amount of eucalyptol are rejected, and our Queensland oils are poor of it. The gums of Eucalypts are more and more praised in Europe for their astringent properties, and the leaves of Duboisia myoporoides, in Martindale's Extra Pharmacopœia—"erroneously termed Pituri," are imported as an eye remedy into all civilised countries. A second reason for investigating our native medicines is given by the fact that we can always obtain them at a lower price and in a fresh state, and besides we might have the good luck to find something which could prove more useful than the drugs of the old country. Might not some truth be contained in the doctrine of my world-renowned long-named countryman Philippus Aureolus Theophrastus Bombastus Paracelsus von Hohenheim who lived 400 years ago? Every country, he said, has its diseases and every disease has its best remedy growing near the place where it occurs. The Almighty has given us reason and senses to find the medicine and it is useless to import it from other parts of the world. As a starting point for fresh investigation we may try to improve the knowledge of the native remedies already used, and the Eucalypts have to stand in the first rank. Their dried leaves possess many medicinal properties. They do not contain any alkaloidal principle, their action is due only to the essential oil. They can be used for smoking in cigarettes for some cases of chronic bronchitis and asthma. The leaves of the peppermint trees (*E. amygdalina, &c.*) give an infusion closely resembling to, and being as useful as those of the European peppermint. Small bags of soft washed calico stuffed with recently dried and powdered leaves of the strongly smelling kinds of Eucalypts, can be used like sponges and compresses for much discharging wounds, as their essential oil is a powerful antiseptic more than three times stronger than carbolic acid in destroying bacteria. In the bush hut, where diphtheria patients are lying, or where an acute case of bronchitis with troublesome cough is to be soothed, the dry air of the sick-room is much improved, if a big bunch of fresh twigs of Eucalypt is dipped in hot water and then hung up in a corner or on the ceiling. Of an immense value for the bushman are the gums (erroneously styled "kinos") of the Eucalypts. They were introduced into Europe as early as 1810, when the gum of our common ironbark (*E. siderophloia*) was collected by the convicts under the name of "Botany Bay kino." Whereas the ironbark was termed by Cunningham *E. resinifera*—a name which to-day is reserved for the Jimmy Low. The European Pharmacopœias erroneously still enumerate *E. resinifera* as the plant which yields the Botany Bay kino. When I left Europe, twelve years ago, there was a great demand for Eucalypti gum, and its superiority over the other vegetable astringents was pointed out by German investigation to be due to their power to adhere firmly and kindly to the mucilaginous membranes of the body. In this country Dr. Joseph Bancroft, to whom Queensland is indebted for so many fine and useful researches, has been the first scientific man who had a closer look to the native medicines, especially to the kinos of the Eucalypts. In 1886 he gave a contribution to the pharmacy of "Queensland" for the Colonial and Indian Exhibition in London, in which paper many kinos were examined, and their properties and qualities stated. Following in his footsteps, I have during the last eight years gathered much experience respecting the subject. There are some gums quite useless for internal use, owing to the admixture of sour or nauseous principles. The forest mahogany (*E. microcorys*), for instance, yields a dark gum, containing some free acid, of a nasty taste and quite unfit for medicinal purposes. The spotted gum (*E. maculata*) exudes a great abundance of a yellow-brownish gum, containing a resin soluble in spirits, and swelling up and softening in hot water so as to give a nice emulsion. It differs widely in this respect from shellac, to which the late Mr. Staiger used to compare it, who also averred that the gum contained benzoic acid in an impure state, although it is not possible to elicit this latter by dry distillation. For external use this gum resin is good enough, and some years ago I found an old man in the bush who used it with apparently good effect for chronic cystitis. According to the notions prevalent in Europe about the kinos, those must be considered of the highest value which contain about 50 per cent. of tannic acid and which are entirely or nearly entirely free from any acid, bitter, oily, or resinous additions. In this respect the kino of the ironbark deserves the foremost place. In a fresh state it dissolves easily in water. The colour of this kino is darkened through the influence of ammonia or alkali, and lightened or turned into yellow by the action of acids. For medicinal purposes (diarrhœa, throat diseases, bleeding) it is the very best astringent. Next to this in value ranges in Queensland the red gum of the bloodwood (*Eucalyptus corymbosa*). It dissolves entirely in hot water, but makes a sediment when the solution gets cool and is allowed to stand. The bright-red colour of this gum and its solutions is changed into a dark-brown when alkalies are added. Acids restore and enhance the bright red. Its action is less beneficial to the system than that of the ironbark gum. Still, it is an excellent bush medicine for all diseases where profuse discharges have to be checked. Nearly all other Eucalypts near Brisbane yield only a small quantity of gum, mostly of a bitter taste, and not fit for a profitable gathering or export. Dr. J. Bancroft found an ingenious method to obtain the kinos in a purified state. He dissolves them in water and lets the solution evaporate on hot tin. He obtains very nice "scale preparations," resembling in appearance the citrate of ammonia and iron or the same double salt of iron and quinine, but sometimes the scales get insoluble by overheating. Besides the Eucalypts there is another genus of Myrtaceæ yielding gum. Angophora lanceolata, by timber-getters mistaken for spotted gum, exudes larger quantities of a gum which proves very useful where a strong astringent is required. The powdery deposit in cold solutions is of a resinous nature but free from a nauseous smell. Australia is much richer in astringents than any other part of the world. Nearly all myrtaceous plants give as good infusions as the roots and herb of Polygonum, Potentilla, Geum, &c., still used and prescribed in the old country, and none of them is poisonous. The leaves and young shoots of all species of Leptospermum are at least of the same service to the urinary organs and against gravel as those of the European Uva ursi. The twigs of the native cherry-tree (*Exocarpus cupressiformis*) prove as good a bitter tonic and astringent as the South American Rhatany (*Krameria triandra*). Passing over to another class of remedies, we find our native senna leaves (*Cassia australis*) efficacious enough, and the same holds good for the native Gratiola peruviana in the swamps. Many of our plants are as rich in mucilage as the marsh-mallow, and could be used for the same purposes as this ; for instance, the species of Sida, Plagianthus, and Hibiscus. Acacia dealbata yields a gum as good as gum tragacanth and gum arabic. A great variety of essential oils is yielded by our native plants. They can be used for many purposes, but I leave the continuation of this paper for another meeting.

A TRIP TO THE DARLING RIVER, NEW SOUTH WALES, IN THE YEAR 1859.

By Hon. A. NORTON.

[*Read before the Royal Society of Queensland*, 15*th June and* 14*th July*, 1894.]

NOTES ON FRESH QUEENSLAND PLANTS.

By F. M. BAILEY, F.L.S.

[*Read before the Royal Society of Queensland*, 14*th July*, 1894.]

OBITUARY NOTICE OF DR. JOSEPH BANCROFT.

By EUGEN HIRSCHFELD, M.D.

[*Read before the Royal Society of Queensland, 14th July*, 1894.]

It is with deep regret that we have to record the death of Dr. Joseph Bancroft, which took place at his residence in Ann Street, on June 16, at the age of 58 years.

Dr. J. Bancroft, who was a member of the Royal Society from its inception and President of the Society in 1884-5, was born in Stretford, near Manchester. He practised first in Nottingham, England, for five years, during which time he made experiments having for their object the transmission of eggs of the *salmonideæ* to New Zealand and Tasmania; he actually assisted in packing for transit the first batch of trout eggs that reached the colony alive. Ever since his arrival in Queensland in 1861 he took a lively interest in the introduction of plants of economic value. Hybridisation of plants was with him a favourite pastime; he succeeded in producing new varieties of the strawberry, castor oil, and the grape, some of which have proved very useful and are extensively cultivated.

He was instrumental in demonstrating the important fact that wheat, rye, and rice could be successfully grown in the vicinity of Brisbane, and that sugar-cane and the banana could be cultivated here free from disease. His investigations into the pharmacology of the native flora are numerous and well-known.

Dr. Bancroft's name, however, will be particularly remembered in connection with his fundamental researches on *Filiaria sanguinis hominis* and the discovery of the properties of the leaves of *Duboisia myoporoides* and the subsequent introduction of Duboisin into the Pharmacopœia.

The eminently practical character of his investigations, both biological and medical, has, by the results he achieved, erected to him a true "monumentum aëre perennius."

TUBERCULOSIS.

By The Hon. A. NORTON.

Read before the Royal Society of Queensland, 18th August, 1894.

"CATTLE suffer from tuberculosis, and this may be communicated from the bovine to the human subject." This is the alarming assertion with which nervous people are made uncomfortable at the present time Not long since cancer was the bogie with which we were entertained; this was but a bogie, as has now been admitted, but for several years the public were warned that the beef they eat or the milk they drank might introduce into the system the germs of this terrible disease. It may be considered presumption on the part of a non-scientist to oppose such statements when they have the support of medical men. Presumptious or not, I ventured to dispute the accuracy of the assertion *re* Cancer, because I knew that many animals which suffered from what was often spoken of as cancer were slaughtered and their flesh used for food without any bad result to those who eat it. At last it has been shown that what was commonly spoken of as cancer in cattle is not cancer at all; that bovine cancer, instead of being quite a common disease, is very rare; and that bovine cancer is not at all the same as human cancer! The cancer bogie, therefore, has been dismissed, let us hope for ever. Ah! but then cattle suffer from tuberculosis, and this may be communicated from the bovine to the human subject!

So far as this statement is concerned, it has the support of scientists of the highest standing. Young children to whom the unboiled milk of cows is given may contract the disease by that means. Similarly, those persons who eat the underdone flesh of tuberculous animals may contract the disease by ingestion. High scientific authorities, whose knowledge is not, I believe, called in question, particularly warn us of the danger to which they are exposed who use the unboiled milk or the underdone flesh of tuberculous animals. Notwithstanding the strong terms in which they refer to this great danger, however, I have been unable to find in any of their published works with which I am acquainted that they regard the danger of communication by such means as greater than that which is associated with quite different circumstances. I shall endeavour to show in this paper that some of them hold quite an opposite opinion, for the opportunities of contracting the disease from other human subjects are infinitely more easy and more frequent. Before proceeding further I desire to point out that if there is a danger that human beings may contract tuberculosis from cattle, so also is there a danger that cattle may contract the disease from human beings, and upon the whole I am tempted to believe that the cattle incur as great a risk as we do. It seems now to be generally conceded that the tumours which are so commonly found in cattle, and which frequently involve the salivary glands, are one of the manifestations of tuberculosis. Dobson, in 1864, described these under the term "Tuberculous disease," and since I obtained (in 1865) a copy of his book on "The Ox: his diseases and their treatment," I have been accustomed to so regard them. These "lumpy" cattle, as bushmen call them, do not improve with keeping. If the salivary glands are involved the growth of the tumours is often so considerable that they mechanically interfere with respiration. Under any circumstances, unless they are removed with the knife, the result is a loss of condition, a gradual pining accompanied in many cases by chronic diarrhœa. To "save" the animal, therefore, as it is sometimes suggestively explained, the appearance of a lump furnishes a reason for putting him into the cask. Many hundreds of lumpy cattle are so disposed of, and of my own knowledge I can say that the milk of lumpy cows has been sometimes used even for young children; and yet I venture to think there are fewer tuberculous persons who contract the disease in the country, where these things are of everyday occurrence, than in the towns where much more care is exercised to prevent them. But then, we are told, people who live in the country and are continually in the fresh air are much less prone to disease than those who live in the impure atmosphere of the towns and spend their days in shops and offices. Let us admit all this; but, with respect to the impurity of the atmosphere, this may bring about an unhealthy condition which makes persons an easier prey to disease of whatever kind; but, thanks to Pasteur and others who have followed up his discoveries, we know now that the living germ, the *causa causans*, of disease must be present before the disease, whatever may be its nature, can be originated. It is not because the atmosphere of crowded cities is merely unhealthy, it is not because some persons may perchance use the unboiled milk, or insufficiently cooked flesh of tuberculous animals that so many of them are attacked by tuberculosis. It is because the bacilli are abundant and find their way without such instrumentality into the mouths of their victims, that so many develop tuberculosis. May we not also attribute its frequency in a very considerable measure to heredity, or at least to telegony, as Weismann calls it, *i.e.*, infection of the germ—notwithstanding the disputations of scientists on this subject? Leaving out of consideration the strong arguments in favour of the transmission of disease from parent to child, which have been brought forward by learned and profound thinkers; setting aside, too, the evidence of family diseases—diseases which appear in particular families from one generation to another—can we overlook the fact that one loathsome disease is certainly passed down from vicious parents to their innocent but unfortunate offspring? Or, again, are we justified in refusing to believe in heredity or germ infection, when Pasteur has shown that the germ is contained in the eggs of moths affected by the disease called "pebrine," and develops in the silkworms which are hatched from those eggs? The evidences in support of the heredity of disease are at least too strong to be lightly discarded, and I think I should be amply justified were I to press this as an argument to show that ingestion by the means already referred to is not the greatest danger with which poor mortals are threatened. I intend, however, to look for other sources of infection, the great danger of which cannot be disputed.

At one time it was customary in all countries in Europe to allow phthisical patients in hospitals to occupy the same wards as others and to hold free communication with them. Since bacteriology has become a science, the necessity for keeping them apart has been recognised. In advanced cases, when the breaking-down of the tissue begins, the breath of phthisical patients conveys into the air which is breathed by other persons innumerable tubercle bacilli; the saliva which they discharge is loaded with the living seeds of disease; and the bacilli are so protected by the sputum of their host that they retain their vitality when this has become perfectly dry, and may be conveyed with the dust in the air to the mouth and lungs of their destined victim. So fully is this danger recognised by pathologists of the present day that in continental hospitals, and I believe also in those of Great Britain, not only are phthisical patients kept apart from others, but vessels containing water are set beside them for the reception of their saliva, and every care is exercised to prevent the sputum from drying on handkerchiefs, cloths, &c., which they make use of. Carl Fraenkel has as much to say in his Textbook of Bacteriology as other pathologists of the dangers of unboiled milk and insufficiently cooked meat, and his warnings are no doubt wise; but after all he relegates these dangers to a very obscure back corner—"If it be remembered," he says, "that the very expectoration of tubercular persons usually furnishes the richest supply of rods, and if it be borne in mind how carelessly and heedlessly this dangerous matter is almost everywhere treated, how it is strewn and scattered about, it will be found a source of infection flowing, unfortunately, so copiously that other sources need hardly be looked for." Then, referring to Cornet's "beautiful and significant investigations," he says—"Cornet ascertained that the tubercle bacilli are by no means scattered all about us without choice or difference (as was formerly supposed); that they are not ubiquitous; but that they are only met with in definite narrowly-circumscribed regions, the centre of which is regularly a tuberculous and phthisical person." Then, in concluding his remarks on Tuberculosis, he says—"If we may state our view of these in brief, we declare that tuberculosis is an infectious disease, caused by a specific bacillus, and transmitted to man mostly through inhalation of dried sputum of the lungs of phthisical persons."

Sims Woodhead, in "Bacteria and their products," also insists very strongly upon the danger arising from the use of tuberculous milk and flesh. He and others have inquired closely into these subjects, and, especially in examination of milk of tuberculous cows, they have found Koch's bacillus tuberculosis; and when tests have been made with these bacilli, tuberculosis has resulted. With reference to tuberculous flesh I will introduce here the following quotation in which he refers particularly to this branch of the subject:—"There can be little doubt that in those cases where the disease is localised to any one of the viscera at the time of the death of the animal, there is little danger to be anticipated from eating the well-cooked flesh from other parts of that animal; and if we could be absolutely certain that the localisation was complete, all would be well." Even in cases where the flesh is taken from animals in advanced stages of tuberculous disease there would be a certain proportion of cases in which no evil results would follow, and one observer who made sixty-two experiments with such flesh boiled for ten or fifteen minutes, found that only 35·5 per cent of the inoculated animals became tuberculous. Even in cases of generalised tuberculosis Nocard failed in thirty-nine out of forty cases to transmit the disease by means of raw muscle-juice injected into the peritoneal cavity of guinea pigs, but he succeeded in the fortieth. Other observers, however, have been more successful, and in two rabbits I was able to produce tuberculosis by injection into the peritoneal cavity of the raw juice expressed from the intercostal muscles of a tuberculous cow after all tuberculous pleura had been carefully "stripped"; whilst the juice taken from the muscle of the thigh injected into two other rabbits was perfectly innocuous. The danger of infection by the consumption of meat from tuberculous cows may have been much exaggerated, but that there is a very appreciable danger must most certainly not be lost sight of by our medical officers of health, and the Veterinary Inspectors of the Board of Agriculture. With reference to the danger which arises, especially to young children, from the use of unboiled milk, the same authority is equally explicit. The alimentary canal is an important channel of infection. The evidence of this lies in experiments which are regarded as satisfactory, and "in the ulceration of the intestine that is so frequently met with in phthisical patients." And he adds—"In children this mode of infection is comparatively common, and tubercular ulceration of the intestines, or tubercle of the glands connected with the intestinal tract is of frequent occurrence." In connection with the mortality amongst infants Dr. Woodhead quotes his own experience as follows :—"In 127 cases of tuberculosis in children that I examined this tubercular ulceration was found in 43; whilst in 100 cases, or nearly 79 per cent. of the whole, the glands were in some stage or other of degeneration. It would thus appear that tuberculosis connected with the intestine is of frequent occurrence in children, and we should therefore argue that the infection, in these cases at any rate, frequently takes place by the alimentary canal. The age at which these tubercular glands were found is very significant; during the first year of life there were 4 cases; from 1 to 2½ years, 33; from 3 to 5½ years, 29; from 6 to 7½ years, 12: from 8 to 10 years, 13; and from 11 to 15 years, 9 cases. In 14 cases these glands only were affected." The result of a much more extensive investigation, during which the bodies of 2,576 children were submitted to a *post mortem* examination, is given in detail, and of these 424 cases, or 16·4 per cent. were tubercular. The tables show that children still-born and up to four weeks old were free from tubercle; from 5 to 10 weeks, those affected were 0·9 per cent.; from 3 to 5 months, 8·6 per cent.; 6 to 12 months, 18·3 per cent.; 1 to 2 years, 26·8 per cent.; 2 to 3 years, 33 per cent.; 3 to 4 years, 29·6 per cent.; 4 to 5 years, 31·8 per cent.; 5 to 10 years, 34·3 per cent.; 10 to 15 years, 30·1 per cent. These figures agree so far as the large percentage at from 2 to 3 years or thereabouts is concerned. Dr. Woodhead's greatest number being from 1 to 2½ years, while Bolitz's tables show 33 per cent. from 2 to 3 years. Woodhead's percentage decidedly decreases after this age, whereas with Bolitz the percentage never goes so low as during the second year of life. I have been particular in quoting these figures because they form the basis of the arguments as to the great danger of feeding children with unboiled cows' milk. Let me quote Woodhead once more:— more:—"As regards the possibility of bacillus tuberculosis being in the intestinal canal, it should be remembered that the class of patients amongst whom abdominal tuberculosis is most rife, consists of infants, which during the first year of their life, and sometimes for a longer period, are suckled at the breast; after this, however, the diet is extremely mixed, and as a rule it is extremely unsuitable; but it is in by far the larger proportion of cases, even amongst the poorer classes, partially, at any rate, composed of cows' milk. During this first year of their life, children with tuberculosis of the mesenteric glands, or of those glands connected with the intestines, form a very small proportion of the cases of infantile tuberculosis. Whilst the child is suckled by its mother there is little tubercle, but after the first year there is a very rapid rise in this mortality from tubercle. It is a somewhat singular fact that although tuberculosis is frequently met with in young married women, tubercular disease of the breast is extremely rare—so rare, indeed, that Dr. Hubermaas, who took great interest in this subject, was able to collect the records of only some eight cases. In cattle, on the other hand, where the mammary gland carries on its functions when the animals are placed under conditions which are far from healthy, or at any rate far from normal, this tubercular disease of the milk gland is not by any means of infrequent occurrence."

Having quoted this learned authority so fully in connection with the danger of using insufficiently cooked flesh and unboiled milk of tuberculous cows, I must point out that he is too well informed and too honest to represent that these means of infection are so important as we are sometimes asked to believe by persons who represent one side of the case only. All he says is that the alimentary canal "is probably the next most important channel of infection." *Probably the next most important!* The most important channel of all he shows, as Carl Fraenkel also does, is the phthisical person with whom so many others come into contact. He refers to the experiments of Dr. Ransome, Dr. Williams, and more particularly Dr. George Cornet, which leave no doubt whatever as to the infection which a phthisical patient distributes. Referring to these, he says—"The bacilli are not only exhaled, in small numbers no doubt, but he finds that they are also contained in very considerable numbers in the dried sputum obtained from handkerchiefs, bed linen used by phthisical patients, and in the sputum which has made its way on to the floor and walls through the dirty habits of many of the patients. His experiments extended over a very considerable period, and to the rooms of private patients in hospitals, in lunatic asylums, &c.; he even found bacilli in the streets and open spaces in a certain proportion of cases where tuberculous patients were collected together. These results have the greater value from the fact that in no case did he consider his experiments complete unless the dust with which he was experimenting, when inoculated into animals, produced the disease."

I think I am justified in saying that in the opinion of the highest authorities we incur a greater risk of infection from phthisical patients than from any other source. August Weismann, in his volume on the "Germ Plasm," expresses the opinion that the transmission of abnormal predispositions and infection of the germ or telegony, as he prefers to call it, might combine to bring about the transference of a disease from one generation to another; and he adds :—"Without desiring to enroach upon the domain of pathology, I am inclined to suppose that this is the case as regards 'hereditary' tuberculosis; there is no doubt about the occurrence of a 'tuberculous habit'—that is, a certain complication of structural peculiarities which is commonly connected with the disease, such as narrowness of the chest, for instance." The same writer, in his volume on "Heredity," quotes in a footnote an interesting case which I may mention here as follows :—"A direct transmission of the germs of disease through the reproductive cells has lately been rendered probable in the case of tuberculosis, for the bacilli have been found in tubercles in the lungs of an eight-months' fœtal calf, the mother being affected at the time with acute tuberculosis. However, it is not impossible that infection may have arisen through the placenta." Chauveau's anthrax experiments do not, however, support this suggestion; on the contrary, they seem to indicate that the placenta is a natural filter which is impervious to bacilli. Fraenkel, on the same subject, says—"Not a single indubitable case of congenital tuberculosis (established before or during birth) has thus far been observed in man. Johne and Malvoz have, it is true, found tubercle bacilli twice in cattle in the organs of embryos." Whether then there be true heredity or not, may we not assume that there is at least a hereditary habit? I know members of families which have been afflicted from generation to generation with diseases that are popularly spoken of as "hereditary" from the fact that so many individuals of them are similarly afflicted; others must be able to recall similar cases, and many learned authorities might be quoted, were it necessary, in support of this view. I refer to the subject here in connection with the figures I have already quoted of mortality amongst children because I am disposed to think the danger which is said to be incurred from using unboiled cows' milk, like that connected with the use of tuberculous flesh, has, to use Dr. Woodhead's words, probably been "much exaggerated." It by no means follows because tuberculous disease of the breast in young married women is extremely rare that the tubercular germ is conveyed to children by means of cows' milk. Many mothers, I am told, use preserved milk in preference to fresh cows' milk; but, in any case we must not overlook the indisputable fact that many mothers, and many others who come in contact with young children, are phthisical. The milk from a phthisical mother's breast may be quite free from tubercal bacilli, but she and the father and their other children, as well as servants and numberless friends rapturously kiss "the baby's" lips, breathing into its very lungs, if any of them be phthisical, the germs of death. As for the infection of the intestine or the glands connected with the intestinal track, which in children is so common, Woodhead suggests how this may come about when, referring to cases of ulceration of the intestine, he adds—"which appears to be due to the action of bacilli contained in the sputum passing down the gullet through the stomach in cases where the gastric juice is not very active, and so to the intestine in which ulceration occurs in the course of the tubercular process as the result of the pathogenic activity of the bacilli." Fraenkel also, referring to the same subject, says—"Similar changes are frequently observed with phthisical patients who swallow their sputum, thus affecting the intestinal canal." A child so unfortunate as to have been born with an inherited tuberculous habit would, of course, be exposed to a maximum danger of becoming infected, not perhaps through its own sputum, but through the anxiety of mother or nurse to protect it. As already stated, the breath of any phthisical person who kisses the child's lips may convey infection to its lungs; and in kissing it is quite possible that a trace of bacillus-bearing sputum may be left on the child's lips, and be afterwards swallowed. So, too, the tasting of food before allowing the child to take it lest it should be too hot, may leave bacilli in the spoon or on the mouthpiece of the feeding bottle, and these would be conveyed with the food to the intestine which seems to be a favourite point of attack. Similarly the apparently harmless practice of wiping a child's mouth with a handkerchief or sponge which has been used by a tuberculous mother or nurse may have results which will prove fatal. These are only some of the means by which the disease may be conveyed to children by those who are most attached to them; but they are sufficient to show that infection from cows' milk may be much less frequent than some persons would have us believe.

I pass on now, however, to the arguments which seem to justify the conclusion that, although infection may be conveyed to man from cattle, probably the cattle are as frequently infected by man. If these arguments are sound, they will still further support my opinion that the danger of infection through using cows' milk has been much exaggerated, and that, in the case of infants especially, "all the possibilities of transmission of tuberculous poison are surpassed in importance by the infection by respiration;" that another very great danger arises from the accidental swallowing of tuberculous sputum; and yet another from the sucking of wounds, as in certain circumcision cases which have been well authenticated, by persons suffering from tuberculosis.

Tuberculosis is spoken of by Woodhead as "one of the most widespread diseases with which we have to deal, not in this country only (*i.e.*, Great Britain), but in the whole of Northern Europe." Fraenkel says:—"Almost one-seventh of all deaths are due to tuberculosis." Bland Sutton speaks of it as "a disease of world-wide distribution," and he adds—"Writing concerning that common manifestation of this disease—pulmonary consumption, Hirsch, in his admirable *Geographical and Historical Pathology*, states that it has held at all times and amongst all civilised peoples a foremost place amongst the national diseases, and that it extends over every part of the habitable globe, and may be designated ubiquitous in the strictest meaning of the term." None of these authorities have even hinted that the disease originated with cattle, and was by them transmitted to man in all parts of the "habitable globe"; nor have any of them suggested that it causes so great a mortality in cattle as that in man spoken of by Fraenkel. In the Australian colonies what is commonly believed to be tuberculosis in cattle has without doubt increased very appreciably in recent years, but it is difficult to believe that the death-rate has yet reached even a third of the "almost one-seventh" which Fraenkel names as the human death rate from this cause. It must not be supposed, however, because bovine tuberculosis has been so commonly referred to, that the ox is the only animal other than man that suffers from the disease. "Among other mammals," says Bland Sutton, "the disease has a peculiar distribution; it is very common among cattle under the name of grape disease, or its German equivalent, *Perlsucht*. Monkeys living in confinement in this country (Great Britain) are occasionally attacked by it, but not so frequently as was formerly supposed. Among grain-eating birds the disease is a perfect scourge." Rabbits, guinea pigs, and field mice, according to Fraenkel, were successfully inoculated by Koch with his artificial tuberculosis cultures. The marmot and a rodent very common in Southern Russia, are also susceptible, the latter, according to Metschnikoff's investigations, exceedingly so. Horses and dogs must also be added to the list; and two instances of tuberculous snakes have been recorded!

Looking at the subject from a general point of view, and having regard only to the results of experiments and observations which have demonstrated the fact that tuberculosis may be transmitted from man to cattle and from cattle to man, it might be supposed that the disease is transmissible from any susceptible animal to any other that is susceptible, but this is not the case; and, even in those cases where transmission is effected, the character of the disease sometimes undergoes very marked changes. Fraenkel refers briefly to these as follows:—"The microscopic picture differs greatly according to the animals infected. We may find an extensive necrosis without actual cheesy degeneration (liver and spleen of guinea pigs), or rapid softening and formation of thin liquid purulent secretion (tubercle of monkeys), or simultaneous consolidation and cheesy deposits (murrain of cattle), or formation of compact tumour masses with imbedded lime concrements (tuberculosis of the hen), &c. But these general apparent differences appear alike on microscopic examination, and the histological structure is in all cases the same." Woodhead, however, goes further into the inquiry and arrives at other conclusions. "Klein," he says, "in a series of experiments reported in 1886, finds that it is possible to inoculate successfully with tubercle taken from the human subject; also that it is possible to inoculate from a guinea pig to a cow, but when inoculation is made from a cow to a fowl the experiment breaks down, and there is no tubercle produced, so that, not only can one modify the activity, and the power of growth of these bacilli outside the body by altering the temperature at which they grow, but it is also within the range of possibility to modify the bacilli by introducing them into different animals whose normal temperatures and other general metabolic conditions are different. This modification has more than nominal value, for it has been proved experimentally that, although the organisms in human and in bovine tuberculosis are morphologically identical, they are not absolutely the same in all their vital and pathogenic characteristics. For instance, tubercle bacilli taken from a phthisical patient, and introduced into the tissues of a cow, will soon set up an acute general tuberculosis, whilst bacilli taken from a case of *perlsucht*, or ordinary bovine tuberculosis, almost invariably gave rise to the *perlsucht* form of tuberculous disease, and rarely or never to the acute generalised form." On the same subject Bland Sutton says: "In quadrumana and man the disease runs a similar course, whilst in cattle the lesions are so different that it would be difficult to believe that it is in any way related to the tuberculosis of *Primates*, were it not for the existence of identical micro-organisms, and this again applies equally to birds in whom the lesions differ from those in man and cattle." Here I may also quote from Steel, the third edition of whose volume, "Diseases of the Ox," was published in 1890—"Quite recently," he says, "Virchow has decided that human tubercle is not the same as the disease in the ox; and in the *Lancet* for 19th June, 1880, Dr. Creighton gives this matter a new aspect by stating that in the human subject two tuberculous diseases occur, one of these being the true pathological equivalent of bovine tuberculosis, bearing to it the same relations which human 'glanders' bears to equine." And in a footnote he adds, referring to Koch's discoveries—" Organisms have been found similarly in Perlsucht of the ox, so the question arises as to whether the organism in man differs from that found in the ox. The strongest evidence seems to be in favour of their identity, but the question is still *sub judice* The following report is interesting in this relation: Sutton considers Perlsucht distinct from human tuberculosis, its variations and ultimate effects being very different from those seen in man. Klein has shown that the bacilli in the bovine form differ morphologically and in their distribution from Koch's bacillus. Heneage Gibbes inclines to the same view."

I will now make a further quotation from Woodhead, who, after referring to some experiments made by Nocard and Roux, continues:—" It is possible, therefore, that the higher temperature that is met with in cattle along with other conditions there present may have a distinct effect in diminishing the virulence of the organism, whilst at the same time it may play an important rôle in causing its parasitic and vegetative activity to be increased within the body of these animals, though this is not necessarily accompanied by increased vegetative activity outside the body. As Koch pointed out at the International Medical Congress, of 1890, the tubercle culture from fowls were quite distinct and could not be passed on as such from animals to animals of different species or by growth at different temperatures, and he concludes that although nearly related to the ordinary tubercle bacillus they are specifically distinct." Notwithstanding this statement by the greatest German authority, we must not jump to the conclusion that fowls stand in no danger of contracting the disease from man. The contrary, indeed, has been proved to be the case. I must once more turn to Woodhead for information. " That the sputum contained the elements which were the existing causal agents of the disease had been experimentally proved, even before the actual discovery of the bacillus was made, and dogs, which had been in the habit of taking up the sputum of tuberculous persons, had been known to contract the disease, an observation that was fully corroborated by further experiments. Similarly it has been related how barn-door fowls in a country district, which for a long time were perfectly healthy, were suddenly attacked by an outbreak of tuberculosis after a phthisical patient had come to live at the farm. The expectorations of this patient were voraciously devoured by the fowls, with the result that tuberculosis of a most virulent nature broke out in a most extraordinary fashion amongst the brood. Feeding experiments were also made to corroborate this accidental experiment; and more recently similar accidental experiments have been recorded both in France and in this country."

In dealing with this subject I have tried to submit the whole question, and not one side of it only. I have quoted freely from the highest authorities to show how distinctly they warn us against the danger which attends the use of tuberculous milk and flesh, and have explained in their own words the circumstances which have induced them to give us the warning. They have exaggerated nothing; only irresponsible persons who probably are not well informed even in the literature connected with this question have done that; for the authorities quoted, and many others quoted by them, treat the danger of infection through the use of unboiled milk and underdone flesh as a small matter compared with that which is always associated with a phthisical person. But I wish to point out that the evidences of danger from the use of milk and flesh are theoretical only; because tubercle bacilli have been obtained from the milk and flesh of tuberculous cows and the disease has been communicated to other dumb animals by inoculating with them, it is assumed that man, and children more particularly, may be infected in the manner indicated. Human subjects cannot be subjected to such experiments, and, plausible as is the reasoning in favour of infection by this means, I have pointed out another channel of infection which is almost always beside us, and which menaces every man, woman, and child who comes near a phthisical person. This is really the danger of dangers, and the horror of it consists in the fact that even a loving mother's caresses and her careful preparation of food may, if she be phthisical, be the means of conveying the tuberculous poison to the lungs or the intestine of the child. We have no positive evidence that a tuberculous cow can infect man ; but we have direct and positive evidence that, whereas the transmission of tuberculosis from cattle to cattle produces only the ordinary bovine form of the disease, and whereas inoculations of cow virus to a fowl (a most susceptible subject), produce no tubercle, when cows are inoculated with the human virus the disease is reproduced in its acute form, and dogs and fowls which eat the sputum of a phthisical patient are subjected to a sudden and acute attack of tuberculosis, although they were perfectly healthy until the consumptive person came amongst them. With the more highly organised human subject, the tubercular poison is most virulent ; but in the inferior susceptible animals there is apparently a tendency in the direction of diminished activity. Such being the case, may we not reasonably believe that the inferior animals are more in danger of the virulent poison of human tuberculosis than human beings are of the modified—I had almost ventured to say attenuated—poison of the inferior animals ?

As for cattle, it is a fortunate thing for them and their owners that the opportunities of infection by means of the sputum of phthisical patients are not so frequent as is the case with fowls and dogs. We must not, however, lose sight of Fraenkel's opinion already quoted as to the manner in which we men may contract tuberculosis by inhaling the dried sputum of phthisical persons. If, as he says, this " will be found a source of infection flowing, unfortunately, so copiously that other sources need hardly be looked for," how can our cattle escape the danger ? These copious expectorations are not, by any means, limited to houses and streets, nor even to railway smoking carriages, and carriages that are not reserved for that purpose ; they are distributed as freely and as heedlessly over the pastures where cattle are kept, and the unfortunate animals can scarcely avoid the bacilli when these are there ; for the life of an ejected bacillus is not limited to a few hours or days. In France and Germany, Woodhead tells us, observers " very early pointed out that putrefaction and drying could exert but little influence on the number of the bacilli ; whilst drying alone interfered only slightly with their virulence, as it was quite easy to inoculate rabbits with sputum that had been dried at a temperature of 30 degs. C. Later, Galtier found that maceration and putrefaction for a period of five days, and even intermittent freezing and melting, did not interfere with the transmission of the disease by means of the bacillus. Other observers have demonstrated that the bacillus remains virulent after it has been exposed, in sputum, for forty days, and even after 186 days if it is carefully protected from the action of the air." It seems probable that cattle as a rule are infected by each other, the result in that case being an attack of ordinary bovine tuberculosis; but the acute form which we sometimes hear of as suddenly appearing in certain localities, if a reliable opinion may be formed from the experiments recorded by Woodhead, is in all probability brought about by the copious expectorations of some phthisical patient whose ejected bacilli, protected from the air by their coating of sputum for more than a month in dry weather, retain their vitality and adhere to the blades of grass which in a fully-stocked paddock are liable to be sooner or latter eaten by the cattle. In town and suburban dairies the danger which the cattle are exposed to is very much greater. No precautions are taken to prevent phthisical persons from engaging in dairy work, and if the bacilli of tuberculosis are conveyed to children and others in the milk, it is by no means improbable that these have gained admission to the cans through the handling of them by persons whose tuberculous condition makes them a centre from which the disease is distributed. Nor should it be forgotten that the material with which dairy cows are fed, if handled by tuberculous persons, may convey the bacilli from them to the cows. Whatever, therefore, may be the danger to human beings of infection from cattle, it is obvious that this is small as compared with that of infection from each other, that cattle are exposed to a similar danger of infection from man, and that in this case it is the acute form of the disease which commonly develops itself and causes very great suffering to its bovine victims.

Hitherto we have been asked to regard this important question as one which is closely associated with the public health. I go further than this; for the authorities who tell us that we *may* contract tuberculosis indirectly from cattle by using unboiled milk and insufficiently cooked flesh, have also *proved* by recorded experiments, the reliability of which nobody disputes, that cattle, dogs, and fowls are attacked by tuberculosis in its worst form if they be inoculated with the poison or devour the sputum of tuberculous persons. The owners of cattle may well consider whether they ought not to prevent phthisical patients from working amongst their stock; and the authorities may yet find it necessary to forbid the employment of such persons in connection with the distribution of milk, in butcher's shops, and in every other occupation which makes it easy for articles of food to be poisoned by their breath—laden, as it must be, with the germs of so fatal a disease.

ON A NEW QUEENSLAND LOCALITY FOR *ZYGOMATURUS*, MACLEAY.

By ROBERT L. JACK, F.G.S.

[*Read before the Royal Society of Queensland, 22nd Sept.*, 1894.]

THERE have recently been added to the Queensland Museum a skull and other bones of an animal which Mr. C. W. De Vis recognises as belonging to the large marsupial for which Mr. W. S. Macleay erected (*a*) the new genus *Zygomaturus*. The remains in question were found by Mr. C. Woodland in the bank of the Leichhardt River, near Floraville Station.

The matrix of the Floraville bones is a cemented gravel or conglomerate in which the pebbles are such as might have been derived from the Palæozoic rocks of the neighbourhood. It agrees in this respect with the matrix of some of the King's Creek fossils which I have recently had an opportunity of seeing, and, as far as I can make out from Daintree's description (*b*), with the matrix of the Maryvale fossils.

The Hon. A. C. Gregory, speaking (*c*) of the Darling Downs bone drifts, points out, what is undoubtedly the fact about most of the Darling Downs localities, that "one remarkable feature of the older alluvium is that the fossil bones are only found in the detritus of the basaltic rocks," and observes that "this may have resulted from the superior fertility of the basaltic lands, which would be capable of producing abundance of food, while the comparatively sterile soil derived from the older formations would not furnish suitable vegetation for the maintenance of the massive quadrupeds of that era." I quote this for the purpose of pointing the contrast between the Darling Downs

(*a*) Description in a Sydney newspaper, probably in September, 1857, quoted in Q. J. Geol. Soc., XV (1858), p. 168.

(*b*) Q. J. Geol. Soc., 1872, XXVIII, p. 274.

(*c*) Geological Features of the South-eastern District of Queensland. Brisbane: By authority: 1879.

and Floraville. I have not been down the Leichhardt below Mittigoody Creek (forty miles above Floraville), but I know enough of the country to say that the Lower Cretaceous limestones last seen at Kamilaroy become, as one follows the river down, more and more buried beneath sandy drifts, and that I have never heard of any basaltic rocks in the district.

In "Geology and Palæontology of Queensland," page 608, I wrote, in 1892:—"Taking the Maryvale, Peak Downs, and Darling Downs localities, from which remains of the extinct mammalia have been obtained, it will be seen that all these places are at considerable elevations, none of them being less than 900ft. above the sea level. Caiwaroo, where Mr. Cotter's fossils have been obtained, must be about 400ft. above the sea. The doubtful instance of Gogango Creek would, however, bring the fossils down to 315ft. The only instance of which I am aware of remains of the extinct mammalia having been obtained near the sea level is that of the Eight-Mile Plains, near Brisbane."

While the work was going through the press, I added a note (page 740):—"The only organic remains yet identified are those of *Ceratodus Fosteri* and *Pallimnarchus pollens*—a fish and a reptile, both of living species. (*d*) The case, then, still stands thus, that the known remains of extinct mammalia have all been derived from comparatively high levels, whatever significance the fact may have."

The significance of the supposed fact was, of course, that the reason for the absence of the extinct mammalia from lower levels than, say, 315ft. (Gogango), was that, at the period when the fauna in question flourished, the land stood, say, 315ft. lower than at present, or in other words that since then it has risen 315ft. This is disproved by the recent discovery of *Zygomaturus* at Floraville, which is probably not over 100ft. above the sea level.

I may mention that in May last Mr. A. Gibb Maitland and I carefully collected from the King's Creek bone beds the molluscan fauna associated with the bones. These were sent to Mr. R. Etheridge, jun., of the Australian Museum, Sydney, my

(*d*) I am obliged to add further corrections. Mr. De Vis informs me that he is not certain of the specific identity of the *Ceratodus* with *C. Fosteri*. *Pallimnarchus pollens* was erroneously referred to as a living species, although elsewhere classed with the extinct (*Op. cit.* p. 638).

collaborator in "The Geology and Palæontology of Queensland," who handed them for determination to Mr. C. Hedley. Mr. Hedley reported:—"I am unable to match the ponderous inflated *Unio* with either figure or specimen. Accepting the value of the species admitted in Smith's Monograph on the Freshwater Shells of Australia, it would equally approach *U. australis*, *U. ambiguus*, and *U. Shuttleworthi*. I should like to see it figured as a phase of *U. australis*. The remaining shells correspond exactly with recent South Queensland examples of *Corbicula nepeanensis*, Lesson, *Melania balonnensis*, Conrad, and *Hadra jarvisiensis*, Quoy and Gaimard, var. *Gilberti*, Pfeiffer."

It may be frankly admitted that the association with the extinct fauna of four species of freshwater molluscs, all or almost certainly all, still extant in this same geographical area, does not prove that the extinct fauna was not living in Queensland some way back in Tertiary times, but the fact shifts the *onus* of proof to the shoulders of those who claim a greater antiquity for the fauna than post-Tertiary.

It is well known that Sir Richard Owen did not admit the genus *Zygomaturus*, and regarded the animal described by Macleay as belonging to the genus *Nototherium*. (*e*) Mr. De Vis, on the other hand, (*f*) considers Macleay's genus Zygomaturus as valid. Mr. R. Lydekker agrees (*g*) with Sir Richard Owen in referring Macleay's *Zygomaturus* to *Nototherium*. Professor Huxley, in 1862, wrote (*h*) as follows:—

"I employ Mr. Macleay's generic name *Zygomaturus* for the fossil skull which he originally described, because, until a lower jaw has been discovered in connection with such a skull, and that lower jaw turns out to be generically identical with the mandible upon which Professor Owen founded his genus *Nototherium*, the identity of *Nototherium* and *Zygomaturus* cannot be considered to be proved."

Fortunately, the lower jaw is present in the Floraville specimen, and Mr. De Vis will have an opportunity of forming an opinion in the light of the new material.

(*e*) Q. J. Geol. Soc., XV. (1858), p. 168.
(*f*) Proc. Roy. Soc. Queensland, 1888, V., part 3, p. 111.
(*g*) Ann. and Mag. Nat. Hist,, 1889, III., p. 149.
(*h*) Q. J. Geol. Soc., XVIII, p. 424.

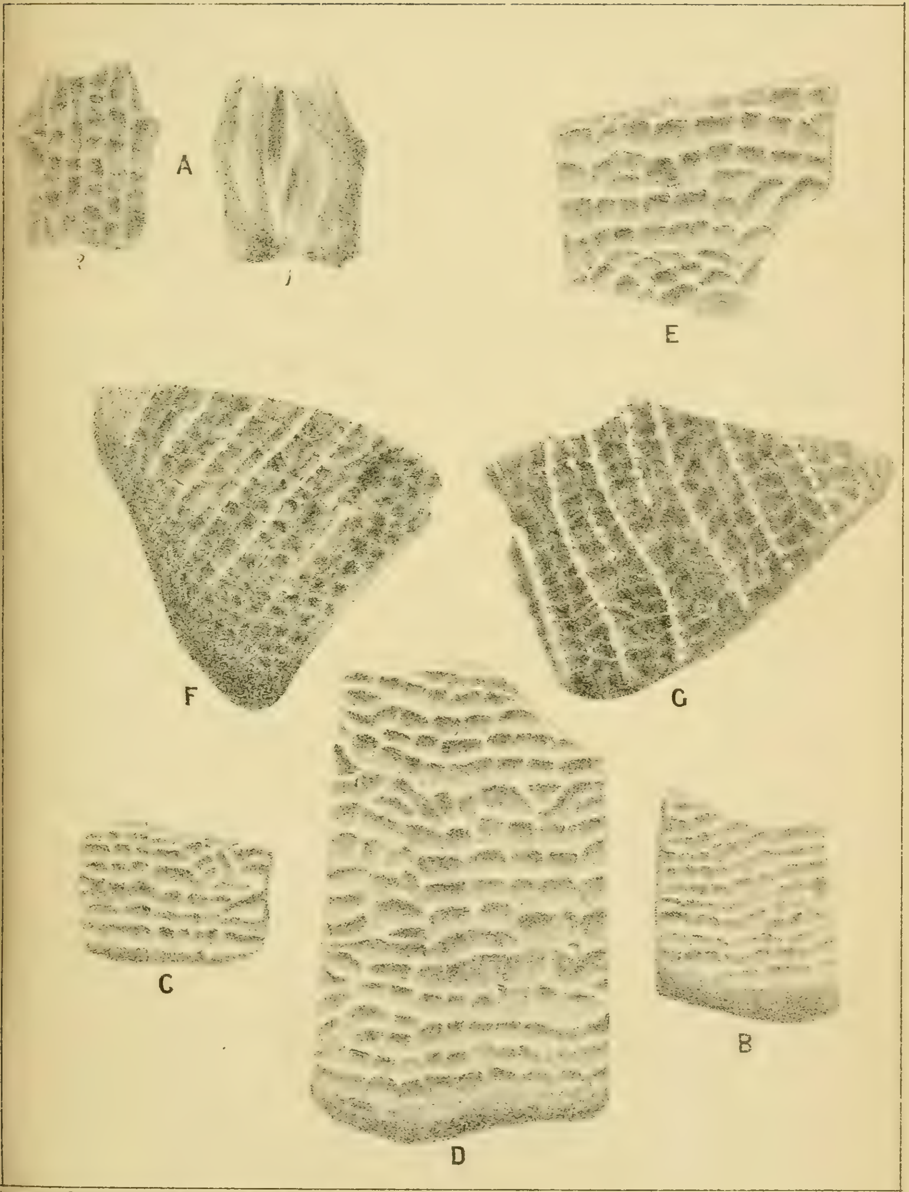
THE LESSER CHELONIANS OF THE NOTOTHERIAN DRIFTS.

By C. W. DE VIS, M.A.

[*Read before the Royal Society of Queensland, 22nd Sept.*, 1894.]

Remains of freshwater tortoises, accompanying bones of Nototherium or its associated vertebrates, have been found on the Warburton River (in flood-time a continuation of the Diamantina), on Crinum and other creeks which help to drain the Peak Downs, on the Darling Downs generally but most abundantly at Chinchilla, and, finally, on a site (the Eight Mile Plains) a few miles distant from the present channel of the Brisbane River. With one partial exception they are disconnected fragments, scattered abroad by the invasion of running water into their previous burial-places. It is obvious that on a few only of such fragments we cannot safely base any determinations, unless we happen to find among them characteristic portions of known species; and further, that the value of any enquiry into the whole subject will be proportionate to the number of such fossils submitted to examination. Chelonian remains have been collected on the Darling Downs for several years, but as the writer was not, at the outset, fortunate enough to meet with a fragment indubitably belonging to a recent tortoise, he thought it his duty to wait until material had been collected in sufficient quantity to confirm or correct the judgment. It would be unprofitable to ascertain the actual number of fossils of this kind now in hand; it is enough to say that by measurement they would be equal to about five cubic feet. They have, it is hoped, proved a sufficient guide to the dominant forms of the period; twice their number would not throw sufficient light on the rarer kinds. We have, indeed, very much to learn respecting even those species which seem to be most fully represented. Perhaps the writer may have committed no great error in distributing to each the fragments derived from it, but his attempted restorations of carapaces and plastrons are as like as not inaccurate representations of their natural form. But this risk was inevitable, since the relative proportions of the several constituent pieces of a carapace or plastron are clearly not to be ascertained from any number of fragments of all ages and kinds commingled. If, however, these sketches enable anyone to assign his fossils to their natural position in the shell, or test as it may be better termed, one useful end will have been served by them.

As the divisions of the tegumentary layer of the test by no means correspond with those of the bony stratum beneath, it would be well if zoologists who are concerned with the former only and osteologists whose observations are extended to the latter would devise and adhere to a distinctive terminology for each superficies; much confusion and contradiction would be thereby avoided. The osteologist necessarily finds in the Chelydidæ a "nuchal" plate, at least a plate constant in that position which cannot be called other than nuchal; the zoologist may or may not find in a species of the family a "nuchal" shield marked off on the surface of the integument; if not, he must contradict his colleague, who, moreover, has to include in his "nuchal" plate a part of each of the surrounding shields of the zoologist to the dire misunderstanding of each observer. So of every other part. The marginals of the one are not the marginals of the other. The zoologist sees vertebrals which do not exist in the bone beneath; the greater part of the last "vertebral" has no more to do with vertebræ than has the "nuchal," and so on. The present writer presumes to complain of all this, but not to remedy it for others. At the same time he does not think it unreasonable that, in the present unsettled use of terms, he should, for the purposes of the following descriptions, employ those which seem to him convenient, rather than continue the use of ambiguities. In speaking of the carapace he will therefore call the anterior plate "lophial" instead of nuchal, the rib-plates "pleural" instead of costal, the hindmost plate of the dorsum "pygal," the hindmost of the periphery "uropygial" rather than pygal or caudal, the other



Drawn on Stone from the originals by H. [illegible]

edging plates "peripheral" to distinguish them from the superficial marginals. In the plastron of the tortoises with which we have mostly to deal, the "episternal" is covered by the jugal, part of the interjugal when present, more or less of the humeral, and part of the azygous shield; the "brachiosternal" plate underlies the rest of the humeral and all the pectoral; the "merosternal" plate most of the abdominal shield; the "sacrosternal" plate the rest of the abdominal and all the ziphisternal shield. The term "neural" is retained for the plates over the line of vertebræ in Trionyx.

It is hardly necessary to say that although the osteological elements of the test are too important, both in theory and practice, to be confused even nominally with the dermal shields, the value of the latter in determinative work may not be underrated; the grooves cut by their edges into the bone beneath are indispensable guides to the zoological position of the source of any fragment under examination.

The zoologist, with the whole reptile before him, can afford to neglect to a great extent indications of specific identity or difference offered by the superficial sculpture of the test. Not so the enquirer who has but bone sherds to examine; he is compelled to have constant recourse to such evidence, frequently to rely upon it alone; and duly allowing for variability and abrasion, he can generally do so with comfort.

The writer's thanks are due to Mr. R. Etheridge, Palæontologist to the Mines Department of New South Wales,* for an opportunity of examining the chelonian amongst other fossils lately found on the Warburton River and sent to him by the head of the Geological Survey of South Australia, Mr. H. Y. L. Brown, and for permission to figure one of them.

Fam. TRIONYCIDÆ.

Gen. Trionyx.

Trionyx australiensis, *n.s.*

"In some of the creeks running more to the south-eastward from the Peak Downs, and like Theresa Creek, belonging to the Mackenzie River system (*e.g.*, Crinum Creek) occur bones of Trionyx and Crocodile. A year or two ago I forwarded some of these to my friend, Professor Huxley, whose determination I

* Now Acting Curator to the Australian Museum, Sydney.

have not yet received."‡ So far as the writer is aware, this is the only intimation we have had of the former existence of a Trionyx in Australia. The remains which he has to adduce in confirmation of Mr. Clarke's discovery consist of a neural plate, the left moiety of a similar plate, portions of four pleural plates from the mid-region of the test, and two posterior pleurals.

It will be convenient to commence with these last, since they offer the most salient features for recognition. The left plate (Pl. X., fig. F) is perfect, with the exception of a small piece lost from the upper angle. This plate is triangular in form; its line of suture with its fellow of the opposite side is nearly straight, and 38·5 mm. in length; that separating it from the pleural anterior to it is somewhat convex and 50 mm. in length; its free distal edge is undulatory and 47·7 mm. long. Its outer surface is traversed by six moderately strong nodular longitudinal ribs which extend nearly or quite to a marginal band without sculpture. In the distal half of their course the descending ribs are crossed by much narrower and more closely set undulating ridges which, towards the proximal angle of the plate, gradually become obsolete. The free margin is on the average 6·5 mm. broad; it is a little roughened by minute elevations of the surface which is convex and bevelled off to an obtuse edge. Attached to the inner surface of the plate and 5 mm. from the anterior edge is a portion of a rib 9 mm. broad and 21·5 mm. long, running parallel with the edge; the surface of attachment extended distad 6 mm. beyond the present broken end of the rib, as is shewn by the scar left on the surface of the plate, but for the remaining space of 9 mm. the rib was free from the plate above it.

An ultimate pleural from the opposite side of a different individual (Pl. X., fig. G) is of rather larger size, as its free border measures 53 mm. in length, but is more imperfect, its proximal angle being entirely lost. The ribs in this example are the same in number but much stronger in development: the transverse ridges, on the other hand, are but little larger; an additional rib descends for a short distance between the middle pair and a less distinct intercalated rib is recognizable between the second and third anterior ribs; the free border is considerably

‡ Rev. W. B. Clarke, "Geological Magazine," Vol. VI. 1869, p. 384.

narrower than in the previous example. On the inner surface the skeletal rib is somewhat narrower ; it is preserved in place to the end of its surface of attachment which is much further, 25 mm., from the free edge.

Each of the plates described is about 6 mm. in thickness. The nearest approach to the pattern of their sculpture is made by an American Eocene species figured by the U.S. Geological Survey ; vol. IV, Palæontology. p. 51, pl. 25, p. 10a.

The distal moiety of a right pleural plate 38·5 mm. broad at its free border and 34·5 mm. at a distance of 45 mm. from the border is shewn on Pl. X., fig. D. Near the border and parallel with it three undulating ridges pass from side to side ; on the rest of the upper surface similar but stronger ridges, preserving a generally transverse direction, become tortuous, interosculate, or, joined by fainter descending spurs, form with them an irregular network ; the free border is narrow and slightly shelving. On the inner surface the rib occupies the posterior half of the plate ; it is 22 mm. broad and is attached to the whole length of the surface above it ; the inner face of the free edge of the plate is bevelled off narrowly anteriorly but more broadly as it passes over the extended rib ; the bevelled surface is impressed by a shallow groove.

Part of the proximal end of a similar pleural plate, Pl. 20, fig. E, differs from the preceding chiefly in having its rib a little removed from its anterior edge. In the subject of fig. B we have the distal end of a pleural plate from a young carapace ; this also has the characteristic pattern of pleural sculpture, with a broad margin and a rib occupying the middle two-thirds of the inner surface. Fig. C represents a fragment of a pleural from near the free border.

The neural plate shown in fig. A, 1-2, is in form an unsymmetrical hexagon with anterior lateral sides shorter than the posterior laterals and the posterior side concave. The outer surface is covered with a network of low ridges ; the inner has the usual double ridge for the attachment of a vertebra. A left half of a second example of this plate is not figured.

Loc. : Darling Downs. One of the specimens was obtained by W. Hann's Northern Expedition in a locality unrecorded.

[*To be Continued.*]

INDEX.

POLE, OUTRIDGE & CO., PRINTERS, PETRIE'S BIGHT, BRISBANE.

PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

QUEENSLAND.

VOLUME XI.—PART I.

PRINTED AND PUBLISHED FOR THE SOCIETY
BY
POLE, OUTRIDGE & CO., PETRIE'S BIGHT, BRISBANE.

1895.

THE

PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

QUEENSLAND,

1895 AND 1896.

VOLUME XI.

PRINTED FOR THE SOCIETY
BY
H. POLE & CO., 95 ELIZABETH STREET, BRISBANE.

1895 AND 1896.

PROCEEDINGS

OF THE

ANNUAL MEETING OF MEMBERS,

HELD ON MONDAY, 7th JANUARY, 1895.

REPORT OF COUNCIL FOR THE SESSION 1894.

The Annual Meeting of the Society was held on Monday, 7th January, 1895. There was a good attendance, about sixty persons being present, Mr. R. L. Jack (President) occupied the chair. The following is the report of the Council for the Session 1894:—

To the Members of the Royal Society of Queensland.

Your Council have pleasure in submitting their Report for the year 1894.

There have been 16 meetings of the Council, *vide* Appendix A, and 11 monthly meetings of members. The latter have been fairly well attended and great interest has been taken in the proceedings. A list of papers read will be found in Appendix B.

In September the Society was able to publish another volume (X) of proceedings. This contained many valuable papers which through lack of funds had been held over since 1892. A part of Volume XI is now in the printers' hands, and the Council hope to publish the Proceedings regularly in future.

Three new members have been elected during the year, and six members have resigned. A list of the former will be found in Appendix C.

The Council have to record with deep regret the death of Dr. Joseph Bancroft, who was a member of the Society from its inception and was President for the year 1884-5. He was also one of the Society's trustees and always took a lively interest in the proceedings.

Early in the year a committee was appointed by the Council to arrange for the removal of live specimens of Ceratodus from the Burnett River to various places near Brisbane. The Committee waited upon the Colonial Secretary to ask for Government assistance, and were requested by him to prepare a scheme showing what was to be done and the probable cost. A scheme was drawn up and the Colonial Secretary has kindly placed at the disposal of the Society a sum of money sufficient to cover expenses, while the Railway Commissioners have promised to give every assistance, free of charge, with regard to the carriage of the fish. The Council have entrusted the work of procuring and distributing the fish to Mr. D. O'Connor, a gentleman well versed in the acclimatisation of fish.

The Council have to express their indebtedness to the Trustees of the Queensland Museum for the use of rooms in which to hold the monthly meetings and keep the Society's library. Since November the Conncil and monthly meetings have been held in rooms occupied by the Australasian Association for the Advancement of Science. The Council are anxious to keep on these rooms, which will be vacant in February next, and to enable them to do this they would request those members whose subscriptions are in arrear to kindly pay same and thus place the Society on a sound footing, so that a suitable meeting-place may be secured and the many valuable books now in the library may be readily accessible to the members.

The condition of the finances is shown in the Treasurer's Statement, Appendix D.

The Society and the Medical and Royal Geographical Societies are now making arrangements for giving a conversazione to the members of the Australasian Association for the Advancement of Science attending the meeting of the Association in January next. The expenses of this entertainment will not come out of the funds of the Society, but will be made up by private subscriptions.

Numerous and valuable donations have been received for the library, and the members now possess a collection of scientific literature of which they may justly feel proud. A list of the Societies and Institutions with which the Society exchanges publications will be found in Volume X of the Proceedings. The care of the library, which is still, owing to uncertainty regarding the tenure of the rooms in which the meetings are now held, housed in the Queensland Museum, is a matter of some anxiety to the Council. At the last annual meeting, the Hon. Librarian, Mr. H. G. Stokes, tendered his resignation on the ground that he had ceased to reside in Brisbane, but the Society being reluctant to accept the resignation of an efficient officer, induced him to continue in office in the hope that his absence would prove to be only temporary. The duties of Librarian were provisionally added to those of the Hon. Secretary, and it is now for the Society to consider (seeing that Mr. Stokes is still absent) whether a new Librarian should not be appointed, or Mr. Bailey be appointed Librarian.

The following officers, in accordance with the rules of the Society, retire :—

President, R. L. Jack, F.G.S.; Vice-President, E. Hirschfeld, M.D.; Hon. Treasurer, James R. Sankey ; Hon. Secretary, J. F. Bailey; Hon. Librarian, H. G. Stokes, F.G.S. Members of Council—Hon A. Norton, M.L.C., Richard Edwards, J.P., C. W. De Vis, M.A., Joseph Lauterer, M.D., F. M. Bailey, F.L.S.; Hon. Auditor, A. J. Turner.

These gentlemen, with the exception of the President and Vice-President, are eligible for re-election. It is now the duty of the Society to proceed to the election of officers for the ensuing year.

In consequence of the death of Dr. J. Bancroft it becomes necessary under Rule 21 for the Society at this meeting to elect a third trustee to act with the two surviving trustees, viz., the Hon. A. C. Gregory and Mr. W. Alcock Tully. It is open to any member of the Society to nominate gentlemen for this position, subject to their consent.

ROBERT L. JACK, *President.*

J. F. BAILEY, *Hon. Sec.*

APPENDIX D.

THE ROYAL SOCIETY OF QUEENSLAND.

Financial Statement for the year 1894.

RECEIPTS.	£	s.	d.	DISBURSEMENTS.	£	s.	d.	£	s.	d.
To Balance from last report	5	16	5	By Printing				49	0	6
,, Subscriptions..	60	17	0	,, Advertising				2	17	6
,, Entrance Fees	2	2	0	,, Petty Cash and Postage				9	3	6
,, Sale of Proceedings	0	8	0	,, Exchange				0	1	6
,, Exchange	0	1	0	,, Freight				0	8	6
				,, Gas				1	5	0
				,, Cheque Book				0	2	6
				,, Balance per Bank Pass Book ..	£4	3	5			
				,, Outstanding Cheque	2	2	0			
								6	5	5
	£69	4	5					£69	4	5

Jas. R. Sankey, *Hon. Treasurer.*

Examined and found correct, Alex. J. Turner, *Hon. Auditor*, Brisbane, 2nd Jan., 1895.

Liabilities—Printing, £24 14s. 6d,

APPENDIX B.

PAPERS READ DURING THE YEAR 1894.

No.	Date.	Title.	Author.
1	Feb. 23 ..	Queensland Wines	J. Lauterer, M.D.
2	Mar. 16 ..	The Discovery of Crater Lakes, and other evidences of volcanic activity in the Ban Ban District	Nugent W. Broun (communicated by R. L. Jack, F.G.S.)
3	Mar. 16 ..	An unpublished lecture by Dr. Leichhardt	Communicated by A. Meston
4	April 21 ..	Observations on extinct volcanoes in Victoria	Samuel McGregor (communicated by A. Norton)
5	April 21 ..	Field Naturalists' Excursion to Eumundi	F. M. Bailey, F.L.S.
6	April 21 ..	Some Victorian Lichens ..	John Shirley, B.Sc.
7	May 19 ..	The Prevalence of Cancer in Australasia, 3rd Part ..	E. Hirschfeld, M.D.
8	May 19 ..	The Cassowary and its habits	A. Meston
9	June 15 ..	Native Medicinal Plants of Queensland	J. Lauterer, M.D.
10	June 15 ..	A trip to the Darling River in 1859, 1st Part	A. Norton
11	July 14 ..	A trip to the Darling River in 1859, 2nd Part	A. Norton
12	July 14 ..	Notes on three Queensland Plants	F. M. Bailey, F.L.S.
13	Aug. 18 ..	Tuberculosis	A. Norton
14	Aug. 18 ..	Native Bread (Mylitta australis	F. M. Bailey, F.L.S.
15	Sept. 22 ..	A new Queensland locality for Zygomaturus	R. L. Jack, F.G.S.
16	Sept. 22 ..	The Lesser Chelonians of the Nototherian Drifts	C. W. De Vis, M.A.
17	Sept. 22 ..	The prevalence of Hydatids in Australia	Hon. A. Norton, M.L.C.
18	Oct. 20 ..	On the Mandible of Zygomaturus	C. W. De Vis, M.A.
19	Oct. 20 ..	The Serum Treatment of Infectious Diseases	E. Hirschfeld, M.D.
20	Nov. 17 ..	The resin of Araucaria Bidwillii	J. Lauterer, M.D.
21	Nov. 17 ..	Unpublished Songs and Corroborrees	J. Lauterer, M.D.
22	Nov. 17 ..	Descriptions of new Queensland Plants	F. M. Bailey, F.L.S.
23	Dec. 15 ..	The Sassafras trees of Queensland	J. Lauterer, M.D.
24	Dec. 15 ..	Water Supply for Domestic Use	Hon. W. F. Taylor, M.D., M.L.C.

APPENDIX A.

Attendance of Officers and Members of the Council at the 16 Council Meetings held during the year.

Office.	Name.	Number attended.
President	Robert L. Jack, F.G.S., F.R.G.S. ..	9
Vice-President ..	Eugen Hirschfeld, M.D.	11
Hon. Treasurer ..	James R. Sankey	2
Hon. Librarian ..	Henry G. Stokes, F.G.S.	0
Hon. Secretary ..	John F. Bailey	16
Members of Council	Hon. A. Norton, M.L.C.	11
	Joseph Lauterer, M.D.	10
	Richard Edwards, J.P.	11
	C. W. De Vis, M.A.	3
	F. Manson Bailey, F.L.S.	15

APPENDIX C.

New Members Elected during 1894.

Date.	Name.
19 May	W. A. Hargreaves, M.A., B.C.E., Brisbane
15 December ..	H. R. Nolan, M.D., Toowoomba
15 December ..	C. J. Pound, Brisbane

The adoption of the Report was moved by the Hon. A. Norton, seconded by Mr. W. Fryar, and carried.

The President then delivered an address entitled, "The Higher Utilitarianism."

The Election of Officers for the ensuing year (1895) then took place with the following result:—*President*, Hon. W. F. Taylor, M.D., M.L.C.,; *Vice-President*, W. H. Rands, F.G.S., A.R.S.M.; *Hon. Treasurer*, Hon. A. Norton, M.L.C.; *Hon. Secretary*, J. F. Bailey; *Hon. Librarian*, A. J. Norton; *Council*, F. Manson Bailey, F.L.S., Richard Edwards, J.P., R. L. Jack, F.G.S., F.R.G.S., Joseph Lauterer, M.D., John Shirley, B.Sc; *Hon. Auditor*, A. J. Turner. The Hon. A. Norton was elected as a trustee to fill the vacancy caused by the death of Dr. J. Bancroft.

PRESIDENTIAL ADDRESS.

JANUARY, 1895.

It has become the custom of late years for the president of such societies as this to review at annual meetings the history of recent investigations in some particular field of study. I might have bent myself to this task with special reference to the science in which I am most interested, but for the fact that the President of the Australasian Association for the Advancement of Science last year chose this subject for his inaugural address, and there is little to add to his thorough and masterly account of the progress of geology in Australasia. The circumstance that we hope for the first time this week to welcome the members of the Association to Queensland, suggests that I should so far depart from the usual custom as to endeavour to enforce the claims of science to be regarded as the higher utilitarianism.

While everyone is ready to admit, in a general way, the truth of the hackneyed adage that "Knowledge is power," it will be granted by most people that there are some exceptions, that there are some kinds of knowledge which are unprofitable. On the other hand, when we see even such an institution as the Australasian Association described by a satirical writer as the "Society for the Propagation of Useless Knowledge," we venture to plead that the aims of science can only be described in such terms through a species of mental myopia—an incapacity for seeing what lies beyond a narrowly circumscribed limit.

In these days there is an increasing number of those who, "wiser in their own estimation than seven men who can render a reason," arrogate to themselves the title of "practical men," whose idea is that nothing is worth doing which does not directly put money, or its equivalent, into somebody's pocket. With a little more culture they call themselves utilitarians. But the highest of authorities has laid it down that "Man shall not live by bread alone"; and to the utilitarian I would point out that science is a utilitarianism which takes no narrow view of its duties to itself, and yet is steadily making for the mental and physical advancement of the human race. It has struck me that the present is a peculiarly appropriate time for justifying the existence of this and similar societies devoted to the pursuit of science for its own sake.

It may be said that many scientific discoveries have been mere accidents, but such accidents only happen to, or are only available for those whose study to "know things by their causes," as Bacon said, "*vere scire est per causas scire.*" Thales, twenty-five centuries ago, made the first recorded observation on the electrical properties of amber, but seventeen more centuries had to elapse before the next step forward was made in the progress of electrical science. Now and again a happy inspiration may have helped such men as Galvani or Franklin to avail themselves of a hint thrown in their way by an apparent accident; but by far the greatest advances in science have been made by men who pursued their studies in philosophic calm, seeing perhaps as their goal some high end in view, although in many cases not even dreaming of the ultimate result of the truths they discovered. When Charles II. "mightily laughed" at the persistent efforts of the young Royal Society to "weigh ayre," as recorded in Pepys' Diary, neither the King nor the Historian nor the savants themselves could guess at the magnitude of the structure which, in two centuries more, would be raised upon the foundation the Royal Society was laying amidst the noisy laughter of the merry monarch who was so easily amused. Probably no European government in the beginning of the seventeenth century would have given five pounds for the information, and yet at the end of the nineteenth it is doubtful if the treasury of any existing state could purchase benefits equal to those which are known to have been derived from a correct estimation of atmospheric pressure, and the deductions which have been made from that datum.

Many inventions, again, are distinctly traceable to the earnest application of some well equipped mind to the supply of a specific want. Thus, the necessity for the propulsion of ships independently of winds and currents sets a practical man thinking. There lies prepared for his hand the already-known power of steam; and the paddle-wheel and screw propeller ultimately shape themselves in the mind of the inventor. But infinitely greater achievements have rewarded, although it may be indirectly, the efforts of those who only felt the one greatest need of all, the need of knowledge. It is no detraction from the merit of the inventor of the screw propeller to say that if he was the father of the invention, its ancestral line comprises a host of worthies who solved abstruse mathematical problems, weighed air, experimented on methods of controlling the expansive power of steam, investigated the laws of the mechanics of fluids, and so on and so on, for indeed the last of the line, like the apparition seen by Macbeth, seems to "bear a glass, which shows us many more."

Perhaps the mind of a young man is first induced to question the usefulness of science while he is painfully acquiring the rudiments of mathematics. Perseverance in the study, however, will soon convince him that he has come into possession of a tool which will open to him the doors of geography, astronomy and physics; that he can measure the heights of mountains on which no human foot has trod, or the distance of suns which sent off rays of light by which he detects their presence ages before he was born, and determine the form, the weight and the motion of his own and other worlds, or step down into the regions of every-day life among the "practical men" and gauge casks, survey land, or calculate the force exerted in any given operation, or the strength of material necessary for a certain duty. And the man so equipped finds, "as the day wears and door succeeds door," that he may "spend the whole day in the quest," "with such suites to explore, such closets to search, such alcoves to importune!" *

The advantages of a knowledge of chemistry are vaguely recognised even by those who themselves know little of its achievements or aspirations. Until quite modern times chemistry confined itself mainly to attempts to produce the precious metals, and pursued this object with an assiduity worthy of the praise of utilitarians, and the result was small. It was not till

* Browning.

thinkers began to lay aside sordid aims and devote themselves to the study of elements, atoms and molecules, without regard to their pecuniary value, that a light dawned on chaos. The light has now ceased to dazzle, and we begin to see clearly the benefit to be derived from a scientific knowledge of the composition of the articles used in our industries, foods and medicines, of the air we breathe, of the poisons that threaten us, nay even of the distant stars. Modern chemistry has showered benefits on the human race infinitely greater than if it had commuted lead into gold or revealed the secret of eternal youth. There are those who think they can see in synthesis the promise of food for a fully populated earth without the necessity for the cultivation and destruction of the animal or vegetable raw material, and who dream that the abolition of poverty and the solution of the economic and social problems which perplex the nineteenth century may after all come from this branch of science rather than from philanthropy.

Biology, somewhat arbitrarily divided into zoology and botany, appeals to what theologians call "the carnal mind" chiefly as the study of our own comforts, regarded for the most part under the heads of food, clothing and service. No one can over-estimate the value of these considerations ; but there are higher aspects of the study. Can it be denied that we are gradually attaining, by its aid, to juster views of the nature and origin of man ? We do not despise the study of the humblest of living organisms, and we are rewarded by the way, and with the generous help of sister sciences, by hints from which we learn to annihilate pain, to ward off disease, to increase the supply of food and to ameliorate in a hundred ways the conditions of life. This Society has bestowed a good deal of attention on zoology and botany, owing to the presence among its members of authorities eminent in both, and younger members can see the advantages to be derived from the study of biology for its own sake.

Geology is, to my mind, the most practical, as well as the most ambitious of modern sciences, and yet the term "geological" is frequently used as if it were the antithesis of "practical." If it be not practical to enquire into the causes of natural phenomena, then geology is not practical. If geologists grope and stumble, if they now and then make mistakes, I submit that, all the same, the honest attempt to "know things by their causes" is worthy of respect. It appears to me that much of the prejudice against geology on the ground of its not being practical, arises from a popular misunderstanding of its methods of work. To take the simplest of illustrations from my own daily life: When I visit a mine, I am often conscious that I am expected by the owner to confine my attention to what lies between the two walls of the lode, or at all events within the four corners of the lease, and when I begin to enquire if anybody has heard of fossils in the neighbourhood I see the smile of contemptuous pity for what is evidently regarded as a time-wasting "fad." But surely, if it were known that outside of the walls of the lode we look for the law which governed the deposition of the ore, that all-important evidence may lie beyond the boundary pegs, and that the fossils are the counters with which we reckon up the chances of the lode being subject to the laws governing similar deposits, the utility of the enquiry would hardly be called in question. Not that I reckon the immediate gain to be the chief end of geology. The science reaches back to the beginning of terrestrial things and to the origin of life on this and other planets; and it looks forward to the development and ultimate destiny of the earth and its inhabitants. In the meantime it strives to understand all that the other sciences can teach it of the processes carried on in the realms of organic and inorganic nature at the present time, believing that in the knowledge of the present lies the key to the history of the past and the prophecy of the future.

Illustrations of the ultimate usefulness of each and every science might be cited, and although such an argument would be superfluous in the presence of this audience, yet it cannot be denied that it needs to be brought home to the many who lightly cavil at the claims of science to be practical. There are many who say they cannot see why one should study beetles, or butterflies, or weeds; another attempt to lift the veil surrounding the North Pole; another turn night into day for the purpose of measuring the distance of a star; or yet another vex his soul over the isolation of a suspected element which must at the best be a chemical rarity. Such studies may seem "foolishness" and "a stumbling-block," but in most cases we can point at least to some immediate gain, can imagine many more, and can live in the faith that one day the "curious in God's handiwork" may emerge into lights undreamed of even by themselves.

We may endeavour to think out the lines along which science progressed before the dawn of history. Far behind the first Chaldean shepherd who watched the stars we may conjecture that the wants of primitive man sharpened his wits—under pain of extinction—to the point of devising some mechanical or metallurgical improvement in his implements or weapons. Then his wits, refreshed by the exercise, may have grasped the idea that they were themselves capable and worthy of improvement by further additions to his knowledge. The idea would be confirmed as it was found that proficiency in the observation of his surroundings was from time to time rewarded by a new discovery which gave him an advantage over his fellows and competitors. Then the natural bent of individual minds would induce one to study one kind of phenomena and another another. The early Abel would give his attention to the conditions affecting agriculture, while the early Cain would probably take to natural history in view of anticipated success in hunting. The earliest civilisations are found to have been equipped with no mean knowledge of mathematics and physics, as can be proved by the applications thereof evinced by the works they have left behind them. From this point history and archæology begin to help us to trace the progress of scientific ideas, and in modern times claims of priority in discovery are jealously watched and chronicled. We see, or we can imagine, each elementary science not only growing but also throwing out branches in every direction. Thus mineralogy becomes petrography, petrography becomes stratigraphy, and stratigraphy becomes geology. But to no single root can any modern science be traced downward. Thus palæontology cannot have been produced without a previous marriage of geology with biology. Although we may imagine the progress of science to have been along such lines as we have sketched, it may be said in general terms that the earliest ancestor of any human being is not more hopelessly incapable of being traced, than the first idea which led up to the modern developments of any given science.

This Society exists for the cultivation of pure science. We reckon no enquiry frivolous which has for its aim the elucidation of the methods of Nature. We endeavour to observe correctly and record faithfully, and we believe that facts so observed and recorded will have their value in time to come even if we do not see their immediate bearing or usefulness. We believe that no observation on the phenomena of nature, and no attempt to explain such phenomena, can be fruitless, although the fruit may indeed not be gathered by the sower of the seed or even by his children's children.

In older and larger communities the work of such societies as ours inevitably becomes subdivided. Geological, chemical, zoological, or botanical societies may be instituted to pursue definite lines of enquiry, as special tools must be devised for particular branches of handicraft. The process has begun in Australia and we welcome the addition to the working forces of science. At the same time, in a young community like ours, there is such a distinct advantage to be gained from the union of forces that I venture to hint at the danger of over-differentiation. The geological member of the Society may profit by listening to the engineer, the chemist to the botanist, and so on, *ad infinitum* ; and it is doubtful whether, until there is a larger class endowed with leisure and means for scientific pursuits, any better method of mutual instruction and encouragement could be devised than that offered by a united society.

In a few days the Australasian Association, which may be regarded as a federal council of the scientific workers of these colonies, will assemble in Brisbane. The meeting, I trust, will impress upon the community the usefulness of science more powerfully than argument or illustration. We look hopefully for better times and a more thorough mastery of the forces of Nature through a wider acquaintance with her laws ; and, as the greatest of modern philosophers has told us, in language destined to outlive "marble and the gilded monuments of princes," that "There is no darkness but ignorance," we claim as the logical converse that all knowledge is light.

PROCEEDINGS

OF THE

ANNUAL MEETING OF MEMBERS,

HELD ON SATURDAY, 25th JANUARY, 1896.

REPORT OF COUNCIL FOR THE SESSION, 1895.

The Annual Meeting of the Society was held on Saturday, 25th January, 1896. There was a good attendance, the Hon. W. F. Taylor, M.D., M.L.C. (President) occupied the chair. The Hon. Secretary read the following report of the Council for the Session 1895 :—

To the Members of the Royal Society of Queensland.

Your Council have pleasure in submitting their Report for the year 1895.

During the year there have been thirteen meetings of the Council. The attendance of officers will be found in Appendix A.

Ordinary meetings of members have been held monthly, and the attendance has been very satisfactory. A list of the papers read at these meetings is given in Appendix B. The Council consider that the Society is specially indebted to Dr. Joseph Lauterer for the valuable papers read by him during the year.

In June last, Part 1 of Vol. XI. of the Proceedings was published. It is anticipated that Part 2, which is now in the printer's hands, will be ready for distribution shortly.

The following new members have been elected during the year:—

Drs. Wilton W. R. Love, A. W. Orr, J. A. Wheeler, A. Jefferis Turner, and Messrs. F. A. Müller, A. S. Denham, F. Bennett, John Forrest, and S. B. J. Skertchly.

The Council regret that several members of the Society have resigned during the year. Among these was Mr. H. G Stokes, who was for some time Hon. Librarian, and only vacated that position in consequence of his departure from the city. The list now shows 98 Ordinary Members (including 23 Life Members), 1 Associate, and 10 Corresponding Members.

It is with regret that the Council have to record the death, in England, of Sir James Cockle, who was a Life Member of the Society. He was for many years President of the Queensland Philosophical Society, which was eventually merged in the Royal Society.

Mr. D. O'Connor has made several trips to the Burnett and Mary rivers for the purpose of collecting live specimens of *Ceratodus Forsteri*, and transferring them to waters near Brisbane. His report on the work done so far is attached hereto (Appendix C.). Mr. O'Connor has rendered these services gratuitously, and the Council consider that he has earned special recognition from the Society for undertaking and successfully carrying out a difficult and laborious task. The Council have to express their obligation to the Hon. the Colonial Secretary for kindly placing a sum of money at their disposal for carrying out this experiment; and also to the Railway Commissioner for supplying Mr. O'Connor with free railway passes for himself and fish-tanks. It may be mentioned that our late esteemed member, Dr. Joseph Bancroft, during the last years of his life constantly advocated the preservation of *Ceratodus*, by transferring live specimens as above stated, and advised that the same plan should be carried out with the "Barrimundi."

Since February last the Society has rented the room where the meetings are now held. Owing to the extra expense incurred a Rent Fund was started, to which nine members each contributed £1.

For some years the Society has been inconvenienced for want of space for the accumulating library. This difficulty has at last been overcome, and the library is now accessible to those members who wish to consult the many valuable works which it contains. During the year over 300 volumes, parts, and pamphlets have been received from kindred societies in various parts of the world. Thanks are due to Mr. A. J. Norton, the Hon. Librarian, who has worked hard to arrange and keep the library in order.

The sixth meeting of the Australasian Association for the Advancement of Science, was held in Brisbane during the month of January, 1895. The whole of the scientific societies of Brisbane united to make the gathering a success, and the part taken by the Royal Society in support of the Association deserves to be placed on record. The President of the Association, one of the Vice-Presidents, the local Treasurer, the two General Secretaries, nine Vice-Presidents of Sections, and six Secretaries of Sections are members or officials of the Royal Society; and a very fair quota of the papers read was also contributed by the scientific workers in our ranks. One of the principal functions of the Brisbane meeting—the *conversazione* at the Centennial Hall—was initiated by members of the Royal, Royal Geographical, and Medical Societies, and was pronounced by our visitors to be a complete success. The work performed by this Society received hearty commendation from His Excellency Sir Henry Norman, and in a parting interview with a deputation from our ranks these services were again acknowledged.

We have to record that in two consecutive years the highest honour in the gift of the Royal Society of New South Wales "for meritorious contributions to the Geology, Mineralogy or Natural History of Australia," viz., the Clarke Memorial Medal, has been bestowed on members of this Society. The medal was voted in 1895, to Mr. R. L. Jack and Mr. Robert Etheridge, Curator of the Australian Museum (none having been awarded in 1894, so that the award to two fellow-workers might be simultaneous); and in 1896 to the Hon. A. C. Gregory, C.M.G. The following is a list of previous medallists since 1878:—Sir Richard Owen, George Bentham, C.M.G., F.R.S., Professor Huxley, Sir F. McCoy, Professor Dana, Baron Von Mueller, Alfred R. C. Selwyn, C.M.G., F.R.S., Sir Joseph Hooker, Professor De Koninck, Sir James Hector, Rev. Julian E. Tenison-Woods, R. L. J. Ellery, F.R.S., Dr. George Bennett, Captain F. W. Hutton, Professor Thiselton-Dyer, C.M.G., F.R.S., and Professor Ralph Tate.

In June last the Society held a Microscopical Demonstration under the direction of Mr. C. J. Pound. This proved so successful that it is proposed next winter to hold similar demonstrations from time to time. Members, other than Government officials, are greatly handicapped in this branch of science by having to pay the high rate of 25 per cent. duty on microscopes. As these instruments are not manufactured within the colony, the Council have approached the Government with a request to reduce the duty. If this is complied with the concession will confer a great boon upon microscopists.

In August last a special meeting was held, and certain rules which the Council found did not work satisfactorily were altered.

The Council have to express their thanks to Mr. R. L. Jack, Government Geologist, for presenting mounted geological maps of Queensland and New South Wales; and also to Mr. N. W. Broun, who donated photographs of localities referred to in his paper on "Crater Lakes in the Ban Ban district."

Wishing to show their high appreciation of the public services and private worth of the late Governor, Sir Henry Norman, the Council, on behalf of the members, presented His Excellency with an address and a bound set of the Society's Proceedings, prior to his departure from Queensland.

The condition of the finances will be seen by reference to the Treasurer's Statement (Appendix D). Although the year 1895 began with a debt of about £18, the Council have pleasure in announcing that this year a small credit balance is shown. The Council would again remind members whose subscriptions are in arrear that they would greatly help the Society by paying same as early as possible.

In accordance with the Rules all the officers of the Society, viz. :—

President : Hon. Dr. Taylor, M.L.C.
Vice-President: W. H. Rands, F.G.S.
Hon. Treasurer : Hon. A. Norton, M.L.C.
Hon. Secretary : J. F. Bailey.
Hon. Librarian : A. J. Norton.

Members of Council: F. M. Bailey, F.L.S., R. Edwards, J.P., J. Lauterer, M.D., R. L. Jack, F.G.S., and J. Shirley, B.Sc.

Hon. Auditor: A. J. Turner

retire, but are eligible for re-election, with the exception of the President and Vice-President.

W. F. TAYLOR,
President.

J. F. BAILEY,
Hon. Secretary.

BRISBANE, *25th January, 1896.*

APPENDIX A.

ATTENDANCE OF OFFICERS AT THE THIRTEEN COUNCIL MEETINGS HELD DURING 1895.

Office.	Name.	Number attended.
President	Hon. W. F. Taylor, M.L.C.	7
Vice-President ..	W. H. Rands, F.G.S.	5
Hon. Treasurer ..	Hon. A. Norton, M.L.C.	6
Hon. Secretary ..	J. F. Bailey	12
Hon. Librarian ..	A. J. Norton	11
Members of Council	F. M. Bailey, F.L.S.	10
	R. Edwards	7
	R. L. Jack, F.G.S.	6
	J. Lauterer, M.D.	7
	J. Shirley, B.Sc.	6

APPENDIX B.

List of Papers Read During 1895 Session.

No.	Date.	Title.	Author.
1	Dec. 24, 1894	Water Supply for Domestic Use	Hon. Dr. Taylor, M.L.C.
2	February 16	Constituents of Resin of Ailanthus imberbiflora, var. Macartneyi	J. Lauterer, M.D.
3	,,	A New Method of Assaying Tannates	,, ,,
4	,,	Bunya Bunya Nuts	,, ,,
5	March 9	Native Astringent Medicines and Tanning Materials of Queensland	,, ,,
6	,,	The Supposed Descent of the Australians	J. Lauterer, M.D.
7	April 20	Permo-Carboniferous Fossils from Banana	F. Bennett
8	,,	The Domestic Water Filter	Hon. Dr. Taylor, M.L.C.
9	,,	Chemistry of Brigalow Gum	J. Lauterer, M.D.
10	May 18	The Conglomerate Rocks of Wild River	R. C. Ringrose (communicated by W. H. Rands, F.G.S.)
11	,,	Distilling Cognac from Sugar and Grape Juice	J. Lauterer, M.D.
12	June 8	Some Abandoned Goldfields of the Old World	F. H. Dodgson (communicated by R. L. Jack, F.G.S.)
13	,,	Chemistry of Some Undescribed Gums	J. Lauterer, M.D.
14	,,	Inspection of Meat	E. Hirschfeld, M.D.
15	July 7	Coloration of Insects	T. P. Lucas, M.D.
16	,,	Stratigraphical Notes on the Georgina Basin	R. L. Jack, F.G.S.
17	,,	Parasitic Phanerogams of Queensland	J. Lauterer, M.D.
18	August 10	The Discovery of Chicken Cholera in Queensland	C. J. Pound, F.R.M.S.
19	September 7	Investigations Concerning Caffein-yielding Plants	J. Lauterer, M.D.
20	October 5	Further Notes on Crater Lakes at Ban Ban	N. W. Broun (communicated by Hon. A. Norton, M.L.C.)
21	,,	A Fish Poison of the Aborigines	J. Shirley, B.Sc.
22	Nov. 16	The Poisonous Principle of Macrozamia spiralis	J. Lauterer, M.D.
23	Dec. 14	Aboriginal Cave Drawings on the Palmer Goldfield	R. L. Jack, F.G.S.
24	,,	A Parasitic Scourge of Warm Climates	A. Jefferis Turner, M.D.
25	,,	Comparative Grammar and Vocabulary of the Yögum and Yaggara Languages	J. Lauterer, M.D.

APPENDIX C.

Brisbane, 23rd December, 1895.

To the President and Council of the Royal Society of Queensland.

Gentlemen,

In accordance with your wishes that I should procure live specimens of *Ceratodus*, and deposit them in waters that are new to them, in the hope that the species may thereby be maintained, I made the necessary arrangements and have visited the Mary River four times. On the first occasion it was too late in the season, and operations had to be postponed for several months.

A total of 51 fish were captured, all of large size; most of them were caught by members of the Miva tribe of natives. Of the 51, eleven, which had been put in a pond near the river, escaped through a sudden rise in the river during the night; twenty arrived safely at their destination, eight died in transit between Miva and Brisbane, and twelve soon after they were caught.

The new habitats selected for the fish were the North Pine River, a lagoon near the Albert River, on the Messrs. Collins' property, and a suitable piece of water at Cressbrook, near Mr. J. H. McConnel's house.

These gentlemen, and Mr. Thomas Petrie, of North Pine, lent willing assistance, and will do their utmost to secure the success of the experiment.

To Mr. Atherton and his son, of Miva Station, also Mr. W. C. Wilson, of Bimbirrim, who aided the work materially, our best thanks are due; also to the various railway officials, who were at all times ready and willing to afford me every necessary help.

Having sufficient funds in hand I purpose going for some more which shall be taken to another district.

With the sincere hope that the experiment may prove successful,

I am, &c.,

DANL. O'CONNOR.

APPENDIX D.

THE ROYAL SOCIETY OF QUEENSLAND.

Financial Statement for the year 1895.

Dr. **Cr.**

RECEIPTS.	£	s.	d.	PAYMENTS.	£	s.	d.
To Balance from last Report	6	5	5	By Printing and Stationery	39	8	6
,, Subscriptions	64	2	0	,, Furniture	9	5	0
,, Entrance Fees	10	10	0	,, Advertising	3	5	0
,, Rent	4	16	0	,, Postage and Petty Cash	10	0	0
,, Donations to "Rent Fund"	9	0	0	,, Exchange	0	4	0
,, Sale of Proceedings	3	9	3	,, Gas	0	13	7
,, Sale of Shelves	0	2	6	,, Rent	21	13	4
				,, Cartage	1	7	6
				,, Balance in Bank	12	8	3
	£98	5	2		£98	5	2

Examined and found correct.—ALEX. J. TURNER, *Hon. Auditor.*

A. NORTON, *Hon. Treasurer.*

Brisbane, 4th January, 1896.

The President moved and Mr. R. Edwards seconded the adoption of the Report and Balance Sheet, which was carried unanimously. The election of officers for the ensuing year was then proceeded with and resulted as follows:—*President*, Joseph Lauterer, M.D.; *Vice-President*, P. R. Gordon; *Hon. Treasurer*, Hon. A. Norton, M.L.C.; *Hon. Secretary*, J. F. Bailey; *Hon. Librarian*, A. J. Norton; *Council*, F. Manson Bailey, F.L.S., Richard Edwards, J.P., R. L. Jack, F.G.S., John Shirley, B.Sc., Hon. W. F. Taylor, M.D., M.L.C.; *Hon. Auditor*, A. J. Turner.

The President then delivered the following Address:—

LADIES AND GENTLEMEN,

IN accordance with the usual custom, it becomes my duty this evening to address you as the retiring President of this Society, a duty which I find very difficult to carry out in the manner that you have been accustomed to in the past, following as I do in the wake of predecessors of well-known scientific knowledge and literary ability, and my task is rendered the more difficult by reason of the masterly and erudite manner in which my immediate predecessor, in his address of last year, treated his subject. I cannot possibly expect to rival those who have gone before me, and must therefore be satisfied with the hope that what I have to say may be found interesting, and possibly in some degree instructive—embracing as it does the result of observations carried out during a period of over twenty-five years' residence in different parts of this colony. In looking about for a subject on which to found my remarks, it has occurred to me, that possibly the influence of the climate of Queensland on its inhabitants of European origin, and their descendants, may afford matter of interest to some, and food for thought to others. Our population born of European parents, forming as it does a part of what is usually denominated the Australian natives, presents many distinctive features both physical and mental, so that in a few generations we may expect the development of characteristics more or less peculiar to it. The habits and mode of life of a people are determined to a very great extent, if not altogether, by the climatic conditions under which they live, as well as by the physical geography of the country, so that in dealing with the subject these two cannot well be separated. In the following remarks, therefore, it must be understood that the term climate is used in its widest sense to signify not only the temperature, rainfall, and prevailing winds, but also the effects of such on the soil and vegetation. These all influence the fauna of a country as well as the flora, and have a marked effect on acclimatised animals and their descendants. It is true that man may mitigate the effects of climate by employing the resources of science and art; nevertheless, such effects must, in the course of time, become manifest.

CUSTOMS AND DRESS.

European colonists, more especially those from the British Isles, are very slow to adapt themselves to the conditions of the country they may be transplated to. The habits and customs of their native land are adhered to with a tenacity which does more credit to the heart than to the head. The time-honoured hot mid-day meal is faithfully eaten under the burning sun of the tropics, and the clothing worn in the hottest time of the year differs but little from that worn in the coolest. A black silk hat and a black cloth coat are considered indispensable at all society functions of an exalted nature, no matter how hot the day may be, and in this respect, one may note of late years a reversion to European customs in our southern cities. When I first visited Melbourne in 1863, a black silk hat was not to be seen in the streets from one week's end to the other, and now it is as essential a mark of respectibility as in London. Sydney is rapidly following Melbourne in this particular, and there is strong evidence that Brisbane will soon awake to a due sense of its importance, and don the black bell-topper on Sundays and holidays, as well as on the occasion of a reception at Government House, and kindred functions. But possibly this is only an illustration of that imitativeness with which man is so largely endowed, and not an instance of reversion of type. Much discomfort would be avoided, and better general health follow a study of the climatic conditions under which the colonist finds himself, and an attempt to conform to such as far as possible. The subject of dress and food are not sufficiently considered, if considered at all, and the consequence is that the climate is abused and held responsible for much that is caused by ignorance or indifference. The average Britisher can adapt himself to almost any climate if he only takes the trouble to do so in a rational manner, and not act in defiance of natural conditions, as is too often the case. But we are to consider what our climate is like, and what effect it is likely to have on those who come after us.

TEMPERATURE AND RAINFALL.

Extending from York Peninsula to its southern boundary, Queensland embraces 18 degrees of latitude, viz., from the 11th to the 29th parallel, so that the greater portion is north of the Tropic of Capricorn, and consequently subject during half the year to the direct rays of the sun. The climate, therefore, of this portion, particularly along the coast, is tropical in every sense of the term. Inland, however, owing to the elevation above the sea, the climate is much less tropical in character, and towards the south approaches the temperate zone in its conditions. To the southward of the Tropic of Capricorn the climate of the coast districts, although partaking of a tropical character in summer, is cool and sometimes even cold for three or four months in the year.

The following, kindly furnished me by the Chief Weather Bureau, is a comparison of the mean maximum, the mean minimum, and the mean shade temperature of Brisbane, Rockhampton, Townsville, Hughenden, Barcaldine, and Roma, with the average annual rainfall, and number of wet days in each year for some years past. Owing to the short time our Weather Bureau has been established, the returns from some of these places are not so complete as I should have wished for, but such as they are they serve to illustrate plainly the general character of those places and their districts. The climatic conditions existing in Brisbane, Townsville, and Rockhampton, will serve to show the nature of the coast climate, while those obtaining at Hughenden, Barcaldine, and Roma may be taken as a fair example of the climate of the interior of Queensland.

Brisbane.

1. Mean maximum shade temperature for 8 years =77·3 degs.
2. ,, minimum ,, ,, ,, ,, =59·4 ,,
3. ,, shade ,, ,, ,, =68·4 ,,
4. Total mean annual rainfall last 9 years =59·2 ins.
5. ,, number of wet days per year for last 9 years =154

Roma.

1. Mean maximum shade temperature for 4 years = 77·9 degs.
2. ,, minimum ,, ,, ,, ,, = 52·0 ,,
3. ,, shade ,, ,, ,, = 64·9 ,,
4. Total mean annual rainfall last 7 years = 34·27 ins.
5. ,, number of wet days per year for last 7 years = 67

Rockhampton.

1. Mean maximum shade temperature for 6 years = 80·2 degs.
2. ,, minimum ,, ,, ,, ,, = 63·4 ,,
3. ,, shade ,, ,, ,, = 71·8 ,,
4. Total mean annual rainfall last 8 years = 50·4 ins.
5. ,, number of wet days per year for last 8 years = 115

Townsville.

1. Mean maximum shade temperature for 4 years = 80·9 degs.
2. ,, minimum ,, ,, ,, ,, = 68·9 ,,
3. ,, shade ,, ,, ,, = 75·0 ,,
4. Total mean annual rainfall for 8 years = 59·32 ins.
5. ,, number of wet days per year for last 8 years = 87

Barcaldine.

1. Mean maximum shade temperature; 2. mean minimum shade temperature; 3. mean shade temperature:—No record.
4. Total mean annual rainfall last 8 years = 24·43 ins.
5. ,, number of wet days per year for last 8 years = 58

Hughenden.

1. Mean maximum shade temperature for 5 years = 87·8 degs.
2. ,, minimum ,, ,, ,, ,, = 60·3 ,,
3. ,, shade ,, ,, ,, = 74·0 ,,
4. Total mean annual rainfall last 8 years = 24·35 ins.
5. ,, number of wet days per year for last 8 years = 56

Taking the temperature of the coast towns, Brisbane's mean maximum shade temperature for eight years is 77·3 degs.; that of Rockhampton, for six years, 80·2 degs.; and that of Townsville for four years is 80·9 degs. Brisbane is therefore cooler than Rockhampton in summer by 2·9 degs., and cooler than Townsville by 3·9 degs, and Rockhampton is cooler than Townsville by 0·7 degs. Comparing the minimum shade temperature, Brisbane is four degrees cooler in winter than Rockhampton and nine and a-half degs. cooler than Townsville; Brisbane being 59·4 degs., Rockhampton 63·4 degs., and Townsville 68·9 degs.; the mean shade temperature being, Brisbane, 68·4 degs., Rockhampton, 71·8 degs., and Townsville, 75·0. The difference between Brisbane and Rockhampton being 3·4 degs., and Townsville, 6·6 degs. On comparing the coast towns with their corresponding inland towns we find the following:—The mean maximum shade temperature of Brisbane is 77·3 degs. and that of Roma 77·9 degs., Roma being 0·6 degs. hotter than Brisbane. The mean minimum shade temperature is—Brisbane, 59·4 degs. and Roma 52·0 degs., Roma being 7·0 degs. colder than Brisbane. The mean shade temperature in Brisbane is 68·4 degs., Roma, 64·4 degs., Roma having a mean shade temperature 4·0 degs. cooler than Brisbane. There being no record of temperature at Barcaldine, we cannot compare it with that of Rockhampton. In comparing Townsville with Hughenden, however, we find the latter to have a mean maximum shade temperature of 6·9 degs. greater than that of the former, and a mean minimum shade temperature of 8·6 degs. less; while the mean shade temperature of Townsville is one degree greater than that of Hughenden. It will be seen that the difference between the mean maximum and mean minimum shade temperatures is much greater at Hughenden than at Townsville, being 17·5 degs. at the former place, and 12 degs. at the latter. So also the difference between the mean maximum and mean minimum shade temperatures at Roma is 25·7 degs., that of Brisbane being 17·9 degs. The difference between the mean maximum and mean minimum shade temperatures at Rockhampton is 16·8 degs. The greater difference between the mean maximum and mean minimum shade temperature at Roma than that of any of the other towns named is worthy of notice. In this respect Brisbane, Rockhampton, and Hughenden are much the same, Townsville being much less than either, and Roma 8·2 degs. greater than Hughenden.

The rainfall shows a very remarkable difference between the coastal and inland towns.

Brisbane had an average annual rainfall for the last nine years of 59·2 inches, and Roma for the last seven of 34·27 inches. The rainfall of Brisbane was spread over an average of 154 days in each year, that of Roma being spread over 67 days. This lessened rainfall at Roma, and much fewer days on which rain fell would indicate a comparatively dry atmosphere, which, taken in conjunction with the low mean shade temperature, ought to produce a healthy, invigorating climate, and one well suited to certain chest complaints. Hughenden had an average annual rainfall during the last eight years of 24·35 inches, the average number of days on which rain fell in each year being 56. The average rainfall at Hughenden was 9·92 inches less than that of Roma, and the mean shade temperature 9·1 degs. greater. The Hughenden district is therefore hotter and drier than that of Roma, its rainfall being very similar to that of Barcaldine, which for the last eight years had an annual rainfall of 24·43 inches—the average number of wet days being 58. The climate of these districts must be very similar, and although hot and dry, should not be enervating, but on the contrary an agreeable one to live in.

Townsville had a mean annual rainfall of 59·32 inches during the last eight years, and an average number of 87 wet days in each year. Taking this heavy rainfall with the mean shade temperature during that time of 75·0 degs., a warm moist climate would be expected to result. This is the case, and the effects of such are somewhat trying to Europeans and their children. The difference between the rainfall of Townsville, Rockhampton and Brisbane is not very great. Rockhampton for the last eight years had a mean annual rainfall of 50·04 inches, and an average annual number of wet days of 115.

Brisbane had a mean annual rainfall for the last nine years of 59·2 inches and an annual number of wet days of 154. Rockhampton is drier than Townsville or Brisbane, and had a mean shade temperature of 71·8 degs. for the last six years, being 3·4 degs. greater than that of Brisbane, and 3·2 degs. less than that of Townsville, which was 6·6 degs. greater than that of Brisbane. So far as one can judge by temperature and rainfall the climate of Rockhampton and district is almost, if not quite as good as that of Brisbane, and judging by my own experience I do not think that there is very much to choose between the two. Excepting for about four months of the year, the climate of Brisbane, as we all know, is a very agreeable one, and if we could get rid of the westerly winds in winter I should regard that time of the year as simply perfection. In addition to the rainfall and temperature, the direction of the wind has a marked effect on the climate, and we find in the case of the westerly winds in winter on the southern coast a cold piercing result is produced, and in summer they cause a dryness of the air and a parched disagreeable feeling. During the prevalence of north-easterly winds in summer a moist, warm, enervating condition of the atmosphere pertains, which changes to a cooler and more bracing state with a south-easterly wind, although the latter is usually accompanied by rain. The more northern parts of the coast, being within the influence of the trade winds, are subject for the greater part of the year to a sea breeze laden with moisture. These winds are, however, very grateful so long as one can remain exposed to them, but when they fall away toward evening, as they usually do, the still close nights become very trying. We have, then, the tropical climate of the northern, and the semi-tropical climate of the southern coast-line, and the temperate and semi-temperate climate of the interior.

CONSUMPTION AND CONSUMPTIVES.

Under such varying conditions of climate it is only right to suppose, that the diseases which are endemic in tropical, semi-tropical, and temperate countries, would also be found here. To a limited extent this is true, for while we have tubercular diseases, diphtheria, dysentery, typhoid fever, and malarial fevers of different type, we are free from cholera, yellow fever, and many diseases of parasitic origin.

Tubercular consumption is, I regret to say, becoming rather prevalent among our native-born people. Until comparatively recent years it was confined nearly altogether to the inhabitants of European birth, and visitors attracted here from the southern colonies during the winter months, by the reputed salubrity of the climate ; now, however, the children of our colonists are developing a tendency to the disease, and there is no doubt but that it is on the increase. With the climate such as we have in the Roma district, and further north, inland, such as at Barcaldine and Hughenden, we are in a position to deal practically, and in the main successfully, with the disease. But in order to do so, suitable provision should be made in those districts for the care of consumptives, who should be properly housed and attended to. The longer I live here the more convinced am I, that this disease cannot be as successfully combated in the coast districts as in the interior. Both at Peak Downs and Darling Downs I have seen recoveries bordering on the marvellous. But sending young people up to Roma or any other town to live at an hotel or boarding-house, cannot possibly do them any good. They require suitable food and home comforts as well as air, and they require the latter in large quantities, if it is to do them any good. They should, in fact, live almost constantly in the open air, riding about as much as possible, and sleeping out when convenient. The crowding consumptives together in our hospitals is a mistake, both to themselves and to the other patients living in the same ward. The disease is a contagious one, and should be treated as such. Consumptives should be segregated as much as possible, but not in our coast towns. We have, as I have pointed out, a climate at least equal, if not superior, to any in the world, and it is our plain duty to avail ourselves of it, and make suitable provision for the care and treatment of our unfortunate consumptives. The subject has been urged upon the Government repeatedly by Dr. Jackson, the Medical Superintendent of the Brisbane Hospital, but no Government has deemed it of sufficient importance to take any action in the matter.

DYSENTERY.

Dysentery is a disease which was formerly much more prevalent here than it is now. It is common to hot countries, and used to prevail to an alarming extent on our goldfields. The conditions of life on these were well calculated to engender this and other diseases promoted by insanitary surroundings and a contaminated water supply. However, the disease was never so intractable in its nature, nor so lasting in its effects here, as it is said to be in other parts of the world.

LEPROSY.

Leprosy is a disease which prevails in tropical and temperate climates. It is an exotic so far as Queensland is concerned, having been introduced by Asiatics and South Sea Islanders. I do not think there is much risk of its gaining ground here, but consider that the patients would have a better chance of recovery if removed to our more bracing inland districts. The experience of the Norwegian lepers who emigrated to Wisconsin and Minnesota goes to show that a free life in some inland districts would materially benefit the lepers, without causing any risk to others.

TYPHOID FEVER.

Typhoid fever is endemic all over Queensland, but is more prevalent in the temperate and semi-tropical portions than in the tropical. Although subject to considerable variations, it has of late years been steadily declining, and has now diminished to comparatively narrow proportions. A conjunction of causes—which it would be foreign to the scope of this address to enlarge upon—may in the future bring about an approach to the epidemic form which raged here in 1884 and 1885; so that, although at the present time, and for some years past, we have had a comparative immunity from the disease, this experience has only been similar to that of other countries in which the disease is endemic, and where from time to time, it has assumed epidemic proportions. However, we may be said to be particularly favoured in possessing such aids to the prevention of the disease as our sudden and copious rainfalls, which act as splendid scavengers, washing our yards and streets, and flushing our sewers, and that without endangering to any great extent our water supply in Brisbane at all events; for fortunately we are not dependent on the Brisbane River below Mount Crosby, and not even altogether on that river, but have our reservoirs at Enoggera and Gold Creek, which give us a softer and more palatable quality of water, and when properly filtered is all that can be desired in potable waters. So far as typhoid fever is concerned, therefore, this country is probably no better nor worse off than most other countries, where the rudiments of modern sanitation are carried out. I may remark *en passant* that no disease of a zymotic type is more readily controlled by efficient sanitary precautions than is typhoid fever—the principal among which is a pure water supply.

DIPHTHERIA.

With respect to diphtheria, we suffer in common with other countries of a temperate or semi-tropical climate, and so far as I know cannot claim any special advantages over other places. In fact in the southern parts of the colony, during the prevalence of westerly winds in winter, throat affections are common, and these favor the lodgment and development of the special microbe concerned in the causation of diphtheria, the Klebs-Lœffler bacillus.

MALARIAL FEVER.

The malarial fevers of this country are not now at all events of a very bad type. Formerly fevers of this character were much more prevalent and wide-spread than at present, for as the country becomes settled, these diseases gradually diminish and ultimately almost, if not entirely, disappear. No one suffers from malarial disease contracted in or about Brisbane now, although in the early days of settlement it was common enough, and so with respect to all the towns and settled districts of the southern portions of the colony. I have not seen malarial diseases of a purely southern origin for years—not since the Toowoomba to Dalby railway was being constructed, when, as the soil was being turned up, malarial fever developed of a somewhat peculiar type, inasmuch as it did not partake of the character of fever and ague so called, nor had it any distinct remissions. The patients suffered from a certain amount of feverishness it is true, but the principal symptoms were loss of appetite, anæmia, extreme exhaustion, and a dull yellowish state of the skin. The condition was rather one of chronic malarial poisoning, than that of regular fever of either the intermittent or remittent type. It resembled in many respects so-called typho-malarial fever. The disease was confined principally to the navvies engaged on the line, and was always most prevalent amongst those engaged in cuttings. When Peak Downs was first settled malarial fevers were very rife, and the diggers suffered very severely. This may also be said of all the other goldfields. In their early stages they were perfect hotbeds of malarial fever, but long since the disease has practically died out, and now few cases, comparatively speaking are met with on any of the old goldfields, or Peak Downs. Of course where the soil is broken up in anything like large areas, cases of malarial fever become frequent on these old fields. The disease is still prevalent in the northern coastal districts, the inhabitants of which suffer from time to time rather severely. It is not very fatal, and is soon recovered from on moving south, or under suitable treatment and proper regimen. In this particular disease Queensland cannot be said to be any worse off than other countries, and, so far as my experience goes, it is considerably better off than some I have lived in.

YELLOW FEVER.

That Queensland is free from yellow fever we may, I think, safely assert, but there is no doubt that at one time, and in one locality, an epidemic of a disease very closely resembling in its characters those of yellow fever, prevailed to an alarming extent, and was very fatal in its effects. I allude to an outbreak which took place in Mackay and its neighbourhood in 1869 and 1870. Arriving in Rockhampton in May, 1870, I was informed of the prevalence of this disease, but it was then on the wane, and as I was under an engagement to go on to Clermont, I refrained from visiting Mackay for the purpose of studying the nature of the disease. So far as I know, there has never been another outbreak of a similar nature at Mackay or elsewhere.

CHOLERA.

Cholera is not endemic in Queensland, and I do not think ever will become so if suitable precautions are carried out in the future as in the past. But we have had one or two invasions of the disease, and as time goes on, and the means of communication between our ports and those of eastern countries where the disease is endemic increases, we may be so unfortunate as to admit the stranger within our gates, and have some difficulty in getting rid of him. But this is a contingency which is not likely to happen if we are true to ourselves and attend to our sanitary defects. If our house is in order the stranger cannot abide in it; if it is not in order, he most certainly will effect a lodgment once he is introduced. Efficient sanitation is our only safeguard then, for we will find, as has been found everywhere else, that quarantine is not in itself a complete means of defence.

PARASITIC DISEASES.

Of parasitic diseases, those caused by the *Filaria Sanguinis Hominis*, *Anchylostomum Duodenale*, and the *Hydatid* are the most common. These diseases, however, do not exist to anything like the same extent here that they do in other countries—particularly the *Hydatid* disease, which is very much more prevalent in the southern colonies than it is in Queensland.

It will be seen from the foregoing that the climate of Queensland has, with the exception of the northern coast districts, no serious drawbacks, but is on the contrary admirably adapted to Europeans from either the north or south of Europe. The interior has a genial, bracing climate, for notwithstanding the fact of a high temperature being recorded in many places during the summer months, it must be borne in mind that the air is dry, and that in a dry atmosphere a much higher temperature can be endured without inconvenience than in the case of a moist one. A temperature of 80 degs. on the coast is unpleasantly warm on the lee side of a house, but a temperature of 90 or 95 degs. in the shade in a dry climate is by no means uncomfortable. Evaporation from the surface of the body is in the former case slow—in the latter it is rapid; consequently the temperature of the skin is reduced, and the disagreeable effects of the heat are hardly felt. In the interior, although the days may be hot and the sun scorching, the nights are comparatively cool, and one can always sleep comfortably, and in most cases a blanket is a welcome addition to the bedclothes.

The southern portions of the coastal districts, although somewhat enervating in summer by reason of the length of the hot weather more than its intensity, have five months of cool bracing weather, and in midwinter the cold is more than one cares for very often. This is more especially so in the country districts; even in the vicinity of the towns the cold becomes absolutely intense during the night, and one is tempted to long for summer again. Of course in the coastal districts of the north or tropical part, no such cool weather is experienced in winter, if indeed any season of the year can be called such—the only change being one of degree of heat. It is not so hot during the months of May, June, July and August as at other times. The northern coastal climate is no doubt trying to Europeans, but under certain conditions its effects may be much mitigated.

HABITS AND CLIMATE.

In all tropical countries that I have a knowledge of, the Europeans seek to adapt themselves to the requirements of the climate instead of vainly endeavouring to make the climate adapt itself to the requirements of the people, as is too much the case here. This warfare with nature can only be maintained at a great sacrifice of strength and comfort, and must in the end prove disastrous to those concerned in it. True, the European of adult age can stand a good deal in the way of heat and hardship, and the effect of living under such conditions may not be immediately apparent so far as the adult male population is concerned; but the women, and more especially the children, pay heavily for this mode of existence. The former prematurely age, and suffer from many physical disabilities; the latter rapidly lose the natural plumpness of childhood, are apt to grow up weedy, and without any proper muscular development, and if sent to school, in a short time may acquire some form of curvature of the spine from the want of a back to the benches on which they sit, and the awkward position they are obliged to assume when writing, owing to the height of the desk. This matter is of very serious importance, and should demand the careful consideration of the Department of Education.

SCHOOL CHILDREN.

I am informed that in some of the northern coast schools it is very difficult to induce the children to sit up properly. Suffering as they do from the enervating effects of a hot moist climate and having nothing to lean against, they soon get tired and drop into any position which affords most ease. The relative height of the seat and desk should be adjusted to the size of the children so that they may sit upright when writing, instead of leaning often arms and head on the desk. This diagram (Plate I.) illustrates the condition of things as usually found. These two boys are of different sizes, and the desk at which they are writing is too high for either of them. One however, can just manage to get his arms on the desk; the other can scarcely do so. The position which they are obliged to assume is a most trying one, and distorts the spine to a very great degree.

Further the strain on the eyesight is very severe, and must in such cases eventually lead to serious impairment of vision. So far as I am aware, no attempt is made to suit the height of the desk and seat to the child. With as much reason, and with much less chance of injury, should we make all children wear clothes of the same size, as compel children of different heights to sit at a desk of one uniform height. It is difficult to understand why this most important matter should be ignored in our State schools and others. If desks of suitable height for each child are necessary at all, and I have shown that they are, then they certainly are doubly necessary in hot moist climates, where the growing child is so limp and wanting in muscular strength and nervous energy as to be unable to sit for any length of time upright without some support to the back. Diagrams II and III illustrate two boys writing at high desks. The heads rest on the arms, and the eyes are within a few inches of the paper on which they are writing. It is plain that the position is an uncomfortable one, and very trying to the eyes; is apt, in short, to give rise to the condition of myopia which may become progressive, and lead to serious impairment of vision, if not to ultimate blindness. We certainly do not take sufficient care of our children in this respect, and I venture to assert that very few schoolmasters are aware of the dangers to which children are subjected by being allowed, or in fact made to sit in such a position when writing, as to bring the head so near the paper as to cause undue eye strain.

These diagrams (Nos. IV and V) serve to show the sort of desk and seat which should be used in our schools. The children are sitting nearly upright, the back being only slightly bent forward, the head is a proper distance away from the paper or book, and the arms are resting lightly on the desk. Each seat is supplied with a comfortable back. The light is also a very important matter from the vision point of view. It should be admitted from the left, the paper being so illuminated as to be free from any shadows. With seats and desks of a size to suit the children, as shown in this diagram, and proper attention to lighting, our school children would be saved from the risks of spinal curvature and defective eyesight to which they are now exposed. Their school life would be less irksome, they would be stronger and happier, brighter and more intelligent, and grow up into better and healthier men and women than they are likely to be under present defective conditions.

VENTILATING SCHOOL ROOMS.

The matter of ventilating our school rooms should be carefully attended to, and sufficient superficial area of floor space allotted to each child, so that no undue crowding would be possible. At least an area of 16 square feet is requisite in this country for sitting room, irrespective of that required for class formation, etc., and the ventilation should be so arranged as to cause a constant renewal of air, thereby avoiding as far as possible the necessity of breathing air vitiated by products of respiration, and emanations from the body. Ventilation without draught should be aimed at—a desideratum which is too frequently overlooked.

DRINKING WATER.

Another thing which requires more careful management than is usually given to it, is the drinking water supplied to schools. Too much care cannot be exercised with respect to it, and I fear that too little care is bestowed on it. Children are supposed to be able to eat and drink anything with impunity—a most erroneous impression. Both eating and drinking should be most carefully attended to. Excepting in the larger towns, tank water is the only available supply, and so far as I can ascertain, little or no care is taken to preserve this water from contamination by the dust which collects on the roofs, which form the gathering area for the water. This is all washed into the tanks by the first shower, and the consequence is, that a deposit of mud collects at the bottom of the tanks, containing more or less vegetable matter and probably some animal matter as well, for frogs sometimes gain access to tanks, and dying, do not improve the quality or odour of the water. Conditions are formed which favor the development and growth of bacterial organisms, that may contain among them some of the pathogenic, or disease producing nature. In any case, water impregnated with decaying vegetable matter—for in the country and smaller townships, the debris of leaves form an important portion of the matter carried in to the tanks from the roof and spouting—is apt to develop malarial organisms, or to become favourable to their development. That some system should be adopted to prevent the access of impurities from the roof to the tanks goes without sayng, and that the tanks should be frequently cleaned is self evident. No means so far as I can learn are adopted to prevent the washings from the roofs gaining access to the tanks, and I do not think that the tanks are emptied very often and cleaned. A filter is sometimes supplied, but now-a-days we are able to estimate the filters in common use at their true value, or rather want of value, and know that they are a source of danger instead of a means of safety. They should at once be abolished from all schools. The water being conserved in galvanized iron tanks which are usually not placed under cover, but are exposed to the full rays of the sun for some parts of the day, becomes very hot, and apt to cause nausea when drunk. The tanks should at least be placed under cover, and if suitable water bags were used, the water would soon become cold enough in the hottest days to be palatable and refreshing. This is a small matter, but one that would contribute very much to the comfort and health of our school children.

WATER SUPPLY.

Where a public water supply exists, the water should be delivered as pure as possible, and in order to gain this end would require in most cases to be carefully filtered before distribution. This applies particularly to the water supply of Brisbane, which is generally unusable by reason of the large quantity of suspended matters contained in it. I need not dilate on the character of this water as you are all familiar with it, and no doubt remember the kind of fluid, or I should say semi-fluid, for it was thick with impurities, dealt out during the first 10 or 12 days of this month. The subject of the supply of pure drinking water to our schools is one demanding urgent attention. The children, in addition to the physical drill so admirably carried out in most of our State schools, should be carefully trained in gymnastics. In short, everything calculated to develop the physical as well as the mental condition, should be carefully and thoughtfully applied.

EDUCATION.

Our children would thus grow up into strong, well educated men and women, a source of pride to their parents, and of gratification to their teachers. This climate appears to have a stimulating effect on the mental faculties of our youth, if we may judge by the uniform results attained at the public examinations, and subsequently at college or university by our pupils. This is to a certain extent gratifying but has its dark side. A precocious child generally means a dull adult. That is, if we stimulate the mental faculties of our children to their fullest extent, we run the risk of dulling their intellects in after life. This risk is by no means an imaginary one, and unfortunately the tendency of the present age is to get the best possible results from children by their teachers, irrespective of any consequences which may follow afterwards, when all their brain power is required to meet the competition encountered in every walk of life. Does the present system of teaching and examinations tend to strengthen the intellectual faculties and fit one for the battle of life? It may do so in some cases, but in the majority I am afraid it does not. This question is assuming serious proportions, and should be carefully investigated and dealt with by our teaching and examining bodies. It is one that I am not prepared to speak dogmatically upon. I have not had the opportunity of following the after career of many of our brilliant boys and girls, but I infer that what pertains elsewhere exists also here, and we have too many instances of the disappointing effects of forcing the mental attributes of clever children.

EXERCISE.

With respect to our young male adults, the climate offers every inducement for out-door exercises which is fully availed of by a large section of them. Consequently we have as a rule a well developed, athletic lot of young men, who would compare with those of a similar age in almost any country. In fact our Queensland youth have compared favourably with those of the mother country when brought in contact with them in athletic sports. We may conclude therefore, that so far as our male population is concerned, the climate has certainly not exercised any injurious effects, but on the contrary has furnished the opportunity of enabling them to develop a taste for out-door exercises of a healthy, invigorating kind. With respect to young women I am sorry that I cannot say the same thing. The climate does not appear to exercise the same healthy, invigorating effect on them, but on the contrary seems to have an enervating one. This probably arises in a great measure from the fact that our young girls do not indulge in out-door recreation to the extent that they should do. We do not expect them to play football, but there is no reason why they should not play cricket and lawn-tennis more generally than they do, that they should not learn to swim and row, and that they should not take more walking exercise. I know that the latter is the reverse of pleasant in hot weather, but even in cool weather they do not walk as much as they should do. Regular exercise of a non-fatiguing kind is what they most stand in need of, and I am sure that there are very few who cannot find time from their household or other duties, to have an hour's exercise of some sort every day. I by no means wish or expect that girls should become athletes, but I do wish that they were stronger and less pale than many of them are. Under the influence of any excitement, such as a ball, they can stand fatigue that would tax the endurance of the strongest of our young men, but as soon as the excitement is over, they think but little of any exercise until the next ball or party. Over-exertion of this kind, indulged in when not physically fit for it, must react very injuriously, and so we find it does. I cannot too strongly impress on our young girls the necessity of regular physical exercise. Many a headache and feeling of lassitude and weariness would be spared them if they indulged in a game of lawn-tennis every fine day, or a walk, wet or dry. Then the judicious use of clubs or light dumb-bells every day would go far to keep the system in good tone, promote the appetite, and improve the digestion. I am satisfied that the great danger we all run in this climate is from want of exercise regularly and judiciously taken. There is one amusement which is rapidly gaining ground among ladies, and which, within certain limits, must be a healthy and exhilarating one. I refer to bicycle-riding. Of course this, like horseback exercise, is not within the reach of everyone, but those who can afford to indulge in it will be amply rewarded. It is a very good substitute for walking, and has the advantage of enabling one to get over the ground with greater rapidity, so that in a comparatively short time and with a minimum amount of exertion, those residing in the towns can run out into the country and enjoy the fresh breeze, and that pleasure which comes of healthy exercise and rapid motion through the air. With the same exertion four times the distance can be accomplished on a bicycle that can be done walking. With this exercise the respiration is at first quickened, but very soon one learns to take deeper inspirations and to breathe more slowly. This leads to a more frequent and complete change of the air contained in the lungs which is not much affected by ordinary respiration, and which is termed residual air, and the lungs becoming more fully inflated, the chest walls in young peeple, and to a certain extent in older people also, become dilated, the breathing capacity being thereby increased. This leads to greater and more complete æration of the blood, with the result that the appetite is promoted, the digestion improved, the nervous system strengthened, and a healthier tone of the general system established, and not least of all to the girls, an improved complexion results. Such being the case, is it a wonder that this amusement is becoming so fashionable, or I should say so general in Europe and America. I have no doubt but that much as we are behind the fashions here, we shall soon be able to number our lady bicyclists by tens and twenties instead of by ones and twos as at present.

TEA DRINKING.

More general and regular exercise will do away with that craving for nervous stimulants which forms such a feature of our inhabitants, and which manifests itself so strongly in the tea-drinking propensities of the young and old of both sexes. That this habit is making serious inroads upon the health of many there is ample evidence, and the headaches and other nervous symptoms so common among our young nowadays, owe their origin to a great extent to the habit of tea-drinking established in early childhood. In my young days milk and water formed the beverage at meals of children up to the age of fourteen or fifteen years; now the infant of eighteen months or two years old is frequently seen sipping tea, by no means of the weakest. I have been informed by some young ladies that their usual allowance of tea per diem is a cupful in the morning before breakfast, one or two cups at breakfast, a cup at eleven o'clock, more tea at the mid-day meal, of course the afternoon tea, and again tea at the evening meal. Now tea is a strong nervous stimulant, and like all other stimulants is followed by depression corresponding in degree to its stimulating effects, so that when indulged in habitually to any extent, it establishes a craving as strong as that of the regular dram-drinker, and if this craving is not satisfied a feeling of depression, headache, and often irritability of temper result, so that the tea-drinkers, having established the habit, find life almost unendurable without a constant supply of their favourite beverage. Then again, the tea usually drunk is more often a strong decoction than a simple infusion. The old tea-drinker takes it strong and black. Tea contains a quantity of tannin, and the effects of pouring this drug into the stomach at meal-times is to retard the process of digestion, and eventually so to weaken the stomach as to induce dyspepsia with all its accompanying miseries, one of the most prominent of which is an irritable condition of the heart, giving rise to palpitation on the slightest occasion, and often without any appreciable occasion.

WHAT ARE WE TO DRINK?

But the question will be asked, if we are not to drink tea, what are we to drink? Water is said to be dangerous to health unless boiled, and boiled water is insipid, indigestible, and in many instances disagreeable to the taste and smell. That I have experienced on more than one occasion when forced to drink boiled tap water. There is no doubt but that the condition of the water supply to most, if not to all our communities, is the reverse of satisfactory, but this condition can be removed, and a pure water substituted for the present impure article by a proper method of filtration. Take the greatest city in the world as an example of what can be done in this respect. London has an excellent supply of water, nearly all of which is filtered, and it is proved over and over again in the case of every company supplying filtered water, that the ordinary filter beds in use, consisting of sand and gravel, yield a pure water free from hurtful micro-organisms. It is absurd to say that what is daily done for six millions of people residing in one city, cannot be as effectually done in Queensland for each of our communities. The present condition of our water supply then tends to engender a race of nervous dyspeptics on the one hand, and drunkards on the other, for most of those who do not care to drink tea when thirsty, fall back on ale, or soda water with a dash of something stronger, or if perchance they do drink water, they endeavour to dilute it with brandy or whisky to kill the microbes. It appears to me that our temperance societies here begin at the wrong end in their efforts to limit the evils of the drink traffic. If they put forth their energies in securing a plentiful supply of pure water first, they could then with every reason ask people to abstain from drinking intoxicants, but while the choice lies between dirty water and stimulants, many will prefer the latter.

The climate then, of Queensland, may with reason be considered as one well adapted to Europeans and their descendants, and as time goes on and the people adapt themselves and their surroundings more and more to its nature, the enervating tendency of the hot months will be much mitigated, and the race will not suffer either in physique or mental ability in the future.

In conclusion I have much pleasure in thanking the members of the Council for their unvarying kindness to me, and their able assistance in managing the affairs of the Society during the past year, and I beg also to thank the members for their uniform courtesy to me while in the chair.

On the motion of Mr. C. J. Pound, seconded by Mr. John Shirley a hearty vote of thanks was accorded to Dr. Taylor for his address. Votes of thanks were tendered to the retiring President and Officers for services rendered during the past year, after which the proceedings terminated.

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VOLUME XI, PARTS 1 and 2.

PLATE.

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ON THE MANDIBLE OF ZYGOMATURUS.

By C. W. De VIS, M.A.

[*Read before the Royal Society of Queensland, October 20th, 1894.*]

Some time ago, as friends around me may remember, it fell to my lot to question the soundness of the judgment of the English palæontologist, Sir R. Owen, in pronouncing the fossil skull named *Zygomaturus*, by Macleay, to be but the cranium belonging to his own *Nototherium* mandibles. As the reasons given on that occasion in favour of my contention were never met with counter arguments of the slightest value, I have waited in patient expectation that my view of the matter would ultimately be confirmed by the course of events. Accordingly this has brought about the anticipated, yet welcome, discovery of a veritable mandible of *Zygomaturus*, as announced by our President at our last meeting. Mr. Jack was then good enough to say in effect that the jaw in evidence was there to give me an opportunity of forming an opinion of it, but at the moment I was under the impression that the practical absence of both premolar teeth would make it a somewhat difficult matter to form any positive opinion, and naturally I did not venture to express one off-hand. When leisure permitted, a little study of the jaw brought me an agreeable surprise. I have now no hesitation in saying that it is not by any means the mandible of a *Nototherium*, and consequently that the skull claimed by Owen for that genus can no longer be refused its original rank as the representative of Macleay's genus. The fact becomes obvious to anyone placing the new arrival beside a *Nototherium* mandible of approximately the same age.

But are we at liberty to compare the two? It would appear that before we dare to take that liberty there is a question to be settled. What represents the genus *Nototherium?* Does the genus assert itself to all practical intents and purposes in the mandibles referred to it in 1877, by Owen; or does it appear in his type specimen only? It may be well to recall Owen's account of the dental wreck shown by the fossil which nevertheless served him sufficiently well for a type; he says of it* "The first tooth," the very important premolar, "is wanting, and the crowns of the rest are broken away,"—the only guide to the structure of the teeth left is that "the base of the third remains and gives an indication of a middle transverse valley which most probably separated two transverse eminences." The utter uselessness of this type at the present day, sufficient as it was fifty years ago, when differentiation from *Diprotodon* was the only thing to be established by it, led me in charity to seek the premolar characteristic of the genus among the examples of *Nototherium* fossils identified wlth the type by its propounder, barring of course the cranium in dispute.† This action was declared illegitimate.‡

Suppose the decision were confirmed by general opinion, we must then necessarily fall back on the type; also we must take the type as we find it described, abiding by the terms imposed upon us; also we must demand from its describer the same duteous observance of his own conditions as we ourselves have to maintain. The result will be disastrous.

After arriving at the conclusion that his fossil was from a marsupial of an extinct genus, Owen proceeds to compare it with *Diprotodon*. "From the jaw of *Diprotodon*," he says, "the present fossil differs in the much smaller vertical extent of the symphysis, and the convexity of the jaw at its outer and anterior part, and more essentially in the absence of the incisive tusk, and its socket. On these grounds I propose to

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* Brit. Assoc. Report, 1844, page 231.
† Proc. Roy. Soc. Queensland, Vol. V., page 3 (1888).
‡ Lydekker—Ann. Mag. Nat. Hist., Series 6, Vol. III. (1889), page 149.
Op. cit., page 232.

indicate the genus, etc." The species he names *inerme*, and he then goes on to describe a second species, *N. mitchelli*, from the hinder half of a jaw which he must necessarily have assumed to have been equally devoid of an incisive tusk during life. It follows that no jaw containing such a tooth can belong to *Nototherium*, consequently that all the fossil jaws, the type of *N. mitchelli* included, referred to it by Owen himself, or by whomsoever has followed his lead, must be withdrawn from the genus, since they either possess, or can be shown by intercomparison to have, in their perfect condition, possessed incisive tusks. The genus will thus be represented by the unique, and probably abnormal, specimen named *N. inerme.* Refuge from the catastrophe will of course be sought in the latitude allowed to authors should experience shew that the generic definitions with which they deal are inexact in detail, or too narrow in scope. A frank straightforward amendment of a genus by its orginator is unobjectionable; even a silent desertion of the "most essential" character of a genus may be condoned for the sake of preserving long established names. But then, if an author be permitted to amend and enlarge as he goes on, his amendments and additions become parts of the diagnosis of the genus, and it is clear that an opponent of any one of his determinations cannot be denied the right of appeal to characters so introduced unless it is shewn that such characters were erroneously introduced. To deny the right in the present case is to stand between the horns of a dilemma; we must either adopt a new name for all these mandibles with incisive tusks, or allow others at their discretion to take their stand upon the generic characters inherent in them. Presuming that this is the alternative which will recommend itself to most minds we will again compare a Zygomaturus fossil with a Nototherium exemplar other than the type.

The present mandible is from an individual past maturity; the ridges of the hindmost molars are worn down half way to the base, the foremost has no trace of ridge or valley to be seen in it; a further proof of age is that the hinder lobe of the last molar has in the forward travel of the whole series advanced to the level of the base of the coronoid process. On the right side of the jaw all the teeth are in place, but m^4, m^2, and the premolar have suffered damage. On the left side the last three molars are well preserved ; the foremost and the premolars have been ruined by exposure to the accidents of burial and removal. Both ascending limbs are broken away—that of the left side with a clean fracture which yields important information.

The fracture traverses the base of the coronoid process a little above its junction with the horizontal ramus, ascends to a little above the level of the angle of the post-dental platform and then passes nearly horizontally through the ascending ramus. The coronoid process rises, not gradually from a narrow, rapidly attenuating, and obliquely set base, but abruptly from a broad base retaining its thickness to a great degree as it recedes and with a longitudinal axis parallel with the line of the teeth. Opposite to the middle of the post-dental platform it has a thicknesss of 21 mm., almost twice that of the bone in *Nototherium* in which it is 12 mm. ; its outer margin is here 51 mm. distant from the angle of the platform against 44·5 in *Nototherium*. Further back, we see evidence of a similar inordinate thickening in the ascending ramus ; between the two fossæ the fracture attains a breadth of 37 mm., whereas at the same point in *Nototherium* the bone is but 15 mm. in thickness. Furthermore the posterior surface of the ascending ramus has a breadth of 55 mm., while that of *Nototherium* between the same points is only 40·5. The extraordinary strength of the posterior portion of the mandible indicated by these measure, ments, is in accord with the massiveness of the whole cranium. and was necessitated by the great volume of the masticating muscle, itself demonstrated by the outwardly bulging and ponderous zygoma. But incrassation was not the only effect which the enormous muscle had on this region of the jaw ; the thickness of that portion of it which was attached to the inner surface of the ascending limbs of the mandible forced these asunder to a proportionate extent, while the tooth-bearing portion, having to remain in correspondence with the less increased width of the upper jaw, remained less expanded ; the consequence is that the angles of divergence of the facial and articular parts of the mandible are different. The ascending ramus which in *Nototherium* is in fore and aft direction almost parallel with the horizontal, in *Zygomaturus* bends distinctly outwards behind the base of the coronoid process. The extent of this outbending will be best estimated from comparative measurements; though the *Zygomaturus* mandible is the narrower along a line joining the outer surface of the bases of the coronoid process in the ratio 195 : 203, at the back of the ascending process it is wider in the ratio 255 : 235. While the mandible contracts anteriorly, the expansion of the alveolar axes remains greater than in *Nototherium*, the space between the hinder molars being 116 mm., whereas to be in the same proportion to the length of the molar series as in the *Nototherium* it should be but 110 mm.

The teeth of this series are notably smaller than in any example of *Nototherium*, their combined length is but 144-5 mm. In the Nototherium mandible under comparison, which happens to have the shortest molar series I can find, its length is 166; in other jaws, including Owen's examples, the length goes on increasing to 186-9. Individual teeth are smaller in just proportion—the last molar being 38 x 25 against 42-5 x 31. The premolar is exactly the size of the milk tooth of Nototherium figured by Owen.*

The molars offer in their form and structure no significant peculiarity—they maintain the close family likeness seen in the molars of the allied genera Diprotodon, Nototherium, and Euowenia, which led to the confusion between the two genera in question, and still makes these teeth a most unsafe means of identification.

The incisors, on the other hand, afford differentiating characters of value—they have to a less extent the curve and the vertically extended, compressed, and rapidly tapering fang of the incisors of Euowenia, and, as in that genus, their crowns are much narrower, and more divergent at the apex than in Nototherium. A section of the fang on a level with the front of the premolar is in form an oval 38-5 x 22 mm.; the wall of bone between these voluminous fangs is reduced to a thickness of 4 mm.—the narrower and more columnar fangs of *Nototherium* leave

* Extinct Mam. Aust., Plate 40.

an interval of 15 mm. in breadth The whole tooth is abbreviated in correspondence with the shortness of the intermaxillary and its armature; the length of the diastoma being 60 mm., while that of the longer faced *Nototherium* is 98-5.

There are now two crania of *Zygomaturus* in this Museum, besides two pieces of other crania, and two editions of a cast of the type skull preserved in the Australian Museum. As a passing thought it may appear somewhat strange that of *Nototherium*, of which so many maxillary and mandibular remains are extant, the upper deck of the skull should be unknown, while the single jaw of *Zygomaturus* now brought to light should have been preceded by several cranial relics. The difficulty would hardly be worth notice were it wholly true; but as a matter of fact the *Nototherium* skull is by no means absent from our collections. We have here the greater portion of one skull, the facial and maxillary parts of another, the nasals with the intermaxillary of a third and numerous fragments of the brain case; no doubt others exist elsewhere but have escaped recognition owing to their unlikeness to corresponding parts of the *Zygomaturus* skull. I do not propose to describe the skull of *Nototherium* in this place, but will merely say that in general form it resembles that of *Diprotodon*, as indeed we might have expected from the likeness between the mandibles. The facial region is elongate, the nasals small and but little expanded, the post-nasal depression long and shallow, the brain case narrow in front with well marked parietal crests, the zygomas flat and comparatively feeble, the occipital region sloping backwards; all features in forcible contrast with those of *Zygomaturus*. The upper incisors may be known from those of *Zygomaturus* by their retaining nearly the same breadth and thickness throughout and consequently exhibiting a much greater surface of wear.

In sum, the massiveness of the articular region, its expansion at a different angle to that made by the horizontal limbs, the form of the incisors, with the shape and size of their sockets, the small size of the molars and shortness of the symphysis, are likely, one would fain think, to be convincing proofs that the mandible of *Zygomaturus* has no generic affinity with that of *Nototherium*.

The chain of proof, strong enough as it is to secure assent, will be completed when a cranium of *Nototherium* with mandible attached is unearthed, as I feel assured it will be in course of time.

Though *Zygomaturus* is thus proved to be distinct from *Nototherium* its differential characters are not strong enough to erect it into a separate family—but, associated with its three allies, Diprotodon, Nototherium, and Euowenia, it forms a natural family of the phascolomine section of the marsupials. To this we cannot consistently yield an exclusive claim to the name of Diprotodontidæ; I therefore once more suggest a name derived from the second genus in order of discovery and prevalency, and call it Nototheriidæ.

The representative of the femur of *Zygomaturus* found with the skull, confirms the conclusion that the animal belonged to the Phascolomine stirps, but gives little additional information —its distal end is the only part from which ideas of form and size can be derived—the pronounced gibberosity of the epiphysis over the inner condyle is here seen in a greater degree than in *Diprotodon*—measured across the condyles the bone is 167 mm. in breadth—its depth from the summit of the tuberosity is 133 mm.—the rest of the bone is partly mutilated, partly deformed, by some crushing force to which it has been exposed.

THE SERUM TREATMENT OF INFECTIOUS DISEASES.

By E. HIRSCHFELD, M.D.

[*Read before the Royal Society of Queensland, 20th October, 1894*].

ON THE RESIN OF ARAUCARIA BIDWILLI.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, November 17, 1894.*]

A REMEDY like the gum resins, useful as a stimulant for the mucous membranes and for external application, is the resin or rather gum resin of our Araucarias. The Araucarias belong to a tribe of the Coniferæ and have a rather smooth bark out of which a resin exudes or rather a kind of milk when the bark is wounded. The milk hardens very quickly and looks then like tallow running down from a burning tallow candle. The resin never collects under the bark in form of bubbles as it does on the stems of European pines like *Abies excelsa* and *A. pectinata.*

The resin of the Araucarias contains a high percentage of arabic gum. The resin known as Dammar, derived from *Agathis robusta* and *Dammara orientalis* has already been examined by Dulk, one of my teachers in materia medica, and has been recognised as containing arabin. Heckel in Marseille claims the priority of this innocent discovery and Maiden in Sydney does the same for the resin of *Araucaria Cunninghamii.* The latter compares it with frankincense, which he supposes to be "the produce of various species of Pinus" though it is derived from 2-3 species of Boswellia, a genus belonging to the family Amyrideæ coming near to Anacardiaceæ to which the mango-tree and the genus Rhus belongs.

In the Proceedings of our Royal Society J. H. Maiden gives an analysis of the gum resin of *Araucaria Cunninghamii* and one of *A. Bidwilli,* the "holy tree" of the Aborigines or the Bunyah-bunyah Pine (Buni means holy or awful in Turabul). Maiden obtained the resin of the latter, as he says, from the Director of the Sydney Gardens, and gives a very startling description of it, which does not inspire the reader with too much confidence. Here in Brisbane there is opportunity enough to obtain pure resin of *Araucaria Bidwilli.* It is quite white in the fresh state and only gets yellow if exposed to the weather for some days.

By boiling it in water arabic acid is dissolved, which falls out with a snowy-white colour by adding alkohol or alcohol and a few drops of hydrochloric acid. It amounts, when dry, to 23 per cent. of the air dry gum resin. The residue which is left after boiling dissolves nearly all in spirits, staying in the beaker when the alcohol evaporates. It contains a small amount of oil of turpentine, which can be separated from it by distillation. The first drops which go over have a smell like Canada balsam, the last ones seem to be different and smell more of Oleum Lauri, like the oil of frankincense.

A small residue is left undissolved in spirits and is taken up readily by strong boiling alcohol. After evaporation of this smell, plates crystallize out, melting when heated without any odour. They consist of sylvic acid, which is found too in the resin of the European pines.

UNPUBLISHED SONGS AND CORROBORREES.

By J. LAUTERER, M.D.

[*Read before the Royal Society of Queensland, 17th Nov., 1894*].

BOTANIC NOTES

By F. M. BAILEY, F.L.S.

[*Read before the Royal Society of Queensland, November 17, 1894.*]

Having recently spent with my friend, Mr. J. H. Simmonds, a few days rambling through the rich semi-tropic vegetation of Eumundi, I have in the following notes recorded the parts wanting in already published descriptions of a few species. At the same time I have taken the opportunity to include the descriptions of four new orchids which I have recently received.

Order BURSERACEÆ.

BURSERA AUSTRALASICA, *Bail.* (Carrot Wood.)

Inflorescence terminal, or in the upper axils, in pyramidal or elongated panicles; flowers in nearly sessile clusters, deep red or purplish, when fully expanded scarcely exceeding 3 lines in diameter. Calyx-lobes green 3 or 4 orbicular. Petals 3 or 4 ovate, deep red or purplish, more than twice as long as the calyx-lobes. Stamens 6, anthers yellow, filaments very short.

Order RUBIACEÆ.

MORINDA JASMINOIDES, *A. Cunn.*

The corollas of this plant are, so far as I have observed, usually white, but here we met with heads of flowers which were purple on the outside of the corollas.

Order LAURINEÆ.

CINNAMOMUM OLIVERII, *Bail.*

The Sassafras-tree of the district. Inflorescence terminal or in the upper axils, in loose elongated panicles 6 to 8 inches long; flowers in twos or threes at the ends of the branchlets, the pedicels about a line long. Flowers velvety, cream-coloured, perianth-tube slender, about 2½ lines long, the lobes equal, scarcely as long as the tube, marked by several longitudinal nerves. Stamens 9; the six outer ones about as long as the perianth-lobes, filaments flattened and hairy, the three inner ones short, with prominent glands upon the hairy filaments. Staminodia with sagittate heads and hairy filaments like the stamens. Style and ovary nearly or quite glabrous; stigma dilated. Berry partially sunk in the slightly enlarged calyx-tube from which the lobes have fallen. In the bark of several of these trees we found nodules of two or more inches diameter.

Order ELÆAGNACEÆ.

ELÆAGNUS LATIFOLIA, *Linn.*

This large rambling plant has not previously been met with so far out of the tropics.

Order ORCHIDEÆ.

SPATHOGLOTTIS, *Blume.*

S. Soutteriana, n. sp. (After Wm. Soutter, who has taken much trouble in collecting plants of this Order from all parts, and cultivating them at Bowen Park). Leaves crowning the pseudo-bulb 6 or 7, the outer one without lamina, the others increasing in length until the centre one attains a length (including the rather long petiole) of 1½ to 2 feet, width at broadest part about ¾ in., but usually less, tapering to fine points, and to the petioles, and prominently marked by numerous rib-like nerves. Scape slender; raceme about 3 in. long, bearing 8 or 9 light purple flowers. Bracts lanceolate 7 or 8 lines long, pedicels about 1 in. long. Sepals and petals about 5 lines long. Labellum ¾ the length of the other segments of the perianth, articulate to the base of the column close to the lateral lobes; these latter are oblong or slightly spathulate, and somewhat incurved, and on the disk between them at the upper end, 2 large, thick, erect, rather spreading glabrous calli; middle lobe with a rather long claw, expanding into a somewhat flabelliform blade, the claw with densely woolly margins. Column much incurved, dilated upwards—presenting, with the anther, an almost hooded appearance.

From the above brief description it will be seen that the present species approaches in many respects the only other Australian species—*S. Paulinæ*, F. v M. The present species, however, has narrower, more grass-like leaves. The flowers are also much smaller, and different calli.

Hab.: Stony Creek, Cairns-Herberton Railway line. I received a leaf and single bloom in Feb., 1893, from Mr. L. J. Nugent and more perfect specimens last October from Mr. E. Cowley, of Kamerunga, and consider it to differ from others sufficient to rank as a distinct species. The beauty of the flowers, and great length of time they continue in bloom, make species of this genus desirable plants for cultivation.

EULOPHIA, *R. Br.*

E. agrostophylla, n. sp. (Name suggested by its grass-like leaves). Rhizome of irregular form, resembling a ginger rhizome, thick, fleshy, whitish, stained here and there with purple, attaining a length of 4 in. and a breadth of 1⅓ in. Leaf-bearing stem slender, compressed, about 2 lines broad, with 2 long sheathing scales which cover the lower 4 or 5 in., and then 2 grass-like leaves on long petioles, together attaining a length of 2 feet but not over 7 lines broad at the widest part, prominently ribbed, three of these much more prominent than the others. Scape 2 feet high, slender ; the sheathing scales near the base about 1 in. long, with narrow lanceolate points, the upper ones without the sheathing base, and passing into long narrow bracts like those subtending the flowers ; the raceme or flower-bearing portion about 4 or 5 in. Bract ½ in. long, or a little shorter than the slender pedicel. Spur very prominent in the bud. Sepals narrow-lanceolate, appearing in the dry flowers to have subulate points, 4½ lines long, 3 ribbed. Petals shorter and broader than the sepals, almost apiculate, 3 ribbed with branching veinlets. Labellum long as the petals of 3 blunt lobes, the middle one broader than long, the lateral ones occupying half the length of the labellum, all prominently marked by numerous branching veins which start from 3 or 4 strong raised ribs on the disk, margins slightly undulate. Column about half as long as the sepals, the dorsal lobe bearing the anther as in *E. venosa*—rather long and ovate. Pollen-masses 2 nearly globular. Capsule oval about the size of a small gooseberry, and prominently ribbed.

Hab.: On sandy land, in shady localities of the Mackay District.—L. J. Nugent.

CLEISOSTOMA, *Blume.*

C. Nugentii, n. sp. (After the discoverer, L. J. Nugent). Stems short, covered by the prominently ribbed bases of fallen leaves, live leaves 2 or 3 distichous, linear-lanceolate 1 to 2 in. long, and from 3 to 6 lines broad, sharply keeled, the longitudinal nerves only seen in the dry or partially dry state; all much blotched with deep-red or purple on the specimens examined. Racemes spike-like, erect, often longer than the leaves. Bracts small but the lower empty one rather larger than those subtending the flower, and somewhat spreading or recurved. Flowers small, numerous, on very short pedicels. Sepals somewhat spathulate, 1 line long, incurved, greenish towards the tips, the lateral ones adnate to the basal projection of the column. Petals shorter and broader than the sepals, with thick midrib but no longitudinal veins, greenish and incurved. Labellum white, as long as the petals, the basal pouch not quite so broad but as long as the rest of the labellum, with no internal appendage; the lateral lobes very short with coloured margins, embracing the column; scale in front of the saccate end or middle lobe membranous. Column short, with broad green, ciliate wings. Anther lid purple. Pollen-masses 2 nearly spherical; candicle bipartite. Capsule not seen. In some respects this plant resembles an *Ornithochilus*, and probably upon further examination it may have to be placed in that genus.

Hab.: Black Gin's Leap, a mountain about 16 miles north of Mackay.—L. J. Nugent.

C. congesta, n. sp. Stems short, the longest seen under 2 in. long, the lower part covered by the ribbed scarious bases of fallen leaves. Leaves 2 to 5 straight, linear-oblong, obtuse-acuminate, base more or less cuneate, the longest about 1½ in. long, and about 3 lines broad, the veins in the live leaf obscure from the coriaceous nature of the leaf, but both the longitudinal ribs and cross veinlets plainly visible in the dried specimens. Peduncle usually shorter than the leaves, with 1 or 2 scarious sheathing bracts at the base, and 1-2 or none between these and those subtending the flowers. Flowers cream-coloured crowded at the apex forming a head but opening one at a time. Bracts broad, fleshy, pointed, segments of flowers all incurved, resembling those of some of our small-flowered *Dendrobiums*. Pedicels 3 lines long. Sepals broad-lanceolate about 3 lines long. Petals narrow-linear shorter than the sepals. Labellum long as the sepals, the lateral lobes long and broad, the middle lobe reduced to a truncate end to the labellum, the whole upper surface covered with a dense short white wool, the central scale broad with ciliate margins and recurved coloured point. Spur broad, obtuse, stained with yellow and red, plate at orifice transverse. Column white semiterete, scarcely one-third the length of the sepals. Pollen-masses oval, yellow. Capsule slender, $2\frac{1}{2}$ in. long.

Hab.: Cairns.—L. J. NUGENT.

Order SCITAMINEÆ.

ALPINIA CÆRULEA, VAR. *Arundelliana.*

This variety is much smaller than the common form, the margin of the leaves are wavy, and the labellum of the flower besides being small is of a rosy-red colour. The fruit only differs in its smaller size. Although difficult to describe in words, the distinction between these two forms is very evident when seen in the scrubs growing side by side as they do in this locality.

The variety is named after Mr. E, H. Arundell, a resident in the district, who has rendered much assistance towards collecting specimens of the Eumundi plants.

Order PANDANACEÆ.

FREYCINETIA GAUDICHAUDII, *R. Br.*

Specimens of this species, bearing the female inflorescence were obtained, for the first time so far south, its previously recorded southern *habitat* being Rockhampton; and no male inflorescence has so far been met with in Australia. The bracts on the specimens collected were nearly white and very deciduous, the outer ones not exceeding 2 in. in length, the innermost ones much smaller, very narrow and quite membranous.

FREYCINETIA EXCELSA, *F. v. M.*

Specimens of the male inflorescence of this species were obtained. The outer bracts are nearly as long as the leaves, which they resemble except for their broad coloured sheathing bases, which surround the base of the inflorescence. The other bracts are collected into three bundles and are, except for their green tips, of a deep red colour, and form a star of three rays several inches in diameter, bearing in its centre the spike of stamens, the filaments of which are short, and bear pale-coloured 2-celled obtuse anthers.

THE SASSAFRAS TREES OF QUEENSLAND AND THE CHEMISTRY OF CINNAMOMUM OLIVERI *(Bail).*

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, December 15, 1894.*]

There are several trees in Queensland the bark of which has a peculiar smell resembling oil of fennel. The farmers and timber-getters take the bark to the chemists, and the chemists say there is Sassafras oil contained in the bark and it would pay better to take out a license for a still, extract the oil, and sell it at a high price. The process of distillation is not difficult; according to Harris (Pharm. Journal, 1887, p. 673), most of the commercial Sassafras is manufactured in the interior counties of South Carolina from the Sassafras tree (Laurus Sassafras) which grows in dense thickets of small shrubs on worn-out lands. The root is dug and washed, then chopped short, bruised with a hatchet and put into a wooden barrel, the bottom of which is bored through with several holes. The barrel is put endwise on a wooden steambox with a sheet-iron bottom, the top of which is bored through with holes corresponding to the holes in the bottom of the cask, and with an auger-hole on the top through which water is poured.

The steam-box stands over a hole in the ground forming a kind of oven wherein the fire is made. A tin pipe is inserted in the top of the barrel and bent to go through a trough of water to serve as a worm of the still. The steam goes from the box through the roots contained in the barrel and from there through the tin pipe. Water and oil swimming in it go over. A man makes a clear profit of three dollars a day.

To ascertain whether a trade could be established by distilling the oil contained in our Sassafras trees is the object of this paper. We have three trees in Queensland which are thought to contain the oil. The first of them, *Doryphora Sassafras*, belongs to Monimiaceæ and occurs nowhere else but in N.S.W. and Queensland. In the Pharmaceutical Journal (l.c.) Prof. Flückiger puts it down erroneously as being the "Sassafras of New Caledonia." The tree grows on the Logan River; is of considerable size, but of irregular growth; glabrous, with petiolate ovate elliptical acuminate, coarse-toothed leaves 2-4 inches long; flowers 3 together on short peduncles hermaphrodite, with campanulate 6 segmented perianth tube.

The nearest relation to this tree is *Atherosperma moschata*, a Sassafras tree occurring in Victoria, New South Wales, and Tasmania, but not in Queensland. It is a large-sized tree with decussate willow-like leaves and single diœcious flowers. According to Flückiger the bark of this tree is often met with in the London market under the name of Victorian Sassafras. The oil is lighter than that of the American Sassafras and boils only at 224 (American oil at 115) Centigrades. Bosisto and the doctors in Melbourne (Pharm. Journal, 1887) believed that this oil was very poisonous, 2 drops being sufficient to cause death from paralysis of the heart. Stockman in Edinburgh (Pharm. Journal, 1892, p. 512) refuted this opinion, taking repeatedly 10 minims of the oil with no more effect than if it had been oil of Eucalypt.

The other two Queensland Sassafras trees belong to the order of the laurels (Laurineæ) which is nearly related to Monimiaceæ. The first of them, *Nesodaphne obtusifolia*, is limited to Eastern Australia and is also called *Beilschmidia obtusifolia*. It is a large and handsome tree with glabrous alternate oval oblong leaves, 4 inches long; the flowers in large and broad cymes are hermaphrodite and have 6 perianth segments, 9 stamens, 3 staminodea, and one pistil.

Now an error runs through the whole pharmaceutical literature (Pharm. Journal, 1886, p. 989) purporting that it was this *Nesodaphne obtusifolia* from which the late Dr. Joseph Bancroft obtained the bark which was sent to the Colonial and

Indian Exhibition in London, and from which the late Mr. Staiger had extracted, by the ether process, the Queensland Sassafras oil.

Up to 1892 a tree growing in the rich scrubs north of Brisbane, near Gympie, with a grey rough bark, reddish-brown internally and with a strong aromatic odour and pleasant astringent taste, was mistaken for *Nesodaphne obtusifolia*, and even a few months ago a commission, comprising Dr. J. Bancroft, Dr. Love and myself, was appointed for the purpose of introducing new Queensland remedies into the British Pharmacopœia, has sent bark and tincture of this tree to London, erroneously stating that they were derived from *Nesodaphne obtusifolia*, but being really due to the tree mentioned under the next heading. The bark of the true Nesodaphne or *Beilschmidia obtusifolia* is about ½ inch thick and is more fibrous than the bark of the following tree. In the outer layer sclerenchymatous cells with thin walls are scattered. The oil-ducts are neither as numerous nor as large as those of the following tree.

The tannic acid of Nesodaphne is identical with that of the following tree, staining green with ferric acetate, and giving the same reactions.

The second Queensland Sassafras tree belonging to the Laurel order is a new species of Cinnamomum first described by Mr. F. M. Bailey, and named by him *Cinnamomum Oliveri* or the Brisbane Sassafras. It is a handsome tree with the grey rough bark, reddish-brown internally, growing in the scrubs on the North Coast Line—the tree which was mistaken up to 1892 for *Nesodaphne obtusifolia*. The leaves of this Sassafras are not half as broad as those of Nesodaphne. They are lanceolate acuminate, 4-5 inches long, entire and shiny. The cyme is not so much divided. The flowers are polygamous, larger than those of Nesodaphne. The bark contains a layer of phylloderma on the outside, and just between the cells of this the oil ducts run along the bark the most copiously. Mr. Thiedecke, schoolmaster at Teutoburg (Landsborough) has sent me a large supply of leaves and bark from a tree growing in Mr. Sommer's paddock. The analysis of leaves and bark gives the following results :—

1. The leaves and the bark of the young branches contain ½ per cent. of true dextrorotatory camphor, being identical with

the camphor of the Camphor Laurel (*Cinnamomum camphora*). By sublimation I extracted one ounce of camphor out of 12 pounds of the foliage of *Cinnamomum Oliveri*. (I am the first scientist who has found ready-formed dextrorotatory Laurineæ-camphor in a plant other than the two species of Camphora, hitherto known as *Camphora officinarum* and *C. glandulifera* from Nepaul, and the first man who found camphor in a native plant of Australia.) It has the formula C_{10} H_6 O, and has nothing to do with the lævorotatory isomeride contained in the "fewer few" Matricaria Parthenium, or the inactive camphor from oil of sage or the bodies resembling camphor contained in the oils of Absinthe, Eucalypt, Barosma, Valeriana, etc. It has nothing to do with Borneo camphor from Dryobalanops, which is dextrorotatory too, but has a strong smell of pepper and the formula C_{10} H_{18} O, and is different from the Mgaicamphor derived from a Chinese composite, *Blumea balsamifera*.

The identity of the camphor of *Cinnamomum Oliveri* with that of Camphor Laurel was proved by me by the form of the sublimated crystals and by the polariscope. The camphor is contained in special oil-ducts in the mesophyll. It is dissolved there in the oil which will be described under the next heading. Very likely the fabrication of camphor from the foliage of the Brisbane Sassafras tree could be made payable if properly managed. A still is not wanted for it. The leaves are boiled in a large kettle, the top of which is covered by an upturned unglazed earthenware vessel filled with straw. The camphor is sublimated in the straw in the form of small pure grains.

According to the Pharm. Journal, 1892, p. 482, the manufacture of camphor in Japan is conducted as follows :—

A large metal pot is partially filled with water and placed over a slow fire. A wooden tub is fitted to the top of the pot and the camphor-yielding material is placed in this. The bottom of the tub is perforated so as to permit the steam to pass up amongst the material. From this tub a bamboo pipe leads to another tub, through which the enclosed steam, the liberated camphor and oil flow. This second tub is connected in like manner with a third. The third tub is divided into two compartments, one above the other, the dividing floor being perforated with small holes, to allow the water and oil to pass to the lower compartment. The upper compartment is supplied with a layer of straw which catches and holds the crystalline camphor deposited as it passes in the cooling process. In a similar way the camphor could be sublimated from the leaves of *Cinnamomum Oliveri.*

2. Camphorigenol C_{10} H_{18} O isomeric with borneol is the essential oil which keeps the camphor dissolved in the living plant. It goes over with the camphor and dissolves it again in hot weather. When cooled the camphor separates from it again. There is more of this essential oil contained in the Brisbane Sassafras tree than in the Camphor Laurel, and it has a peculiar odour, very likely arising from the admixture of some other essential oil which I could have obtained by fractional distillation.

By heating the oil with nitric acid I could easily turn it into camphor.

3. The decoction of the leaves, or rather a hot watery extraction, contains much Arabin precipitated by alcohol on addition of a drop of hydrochloric acid. It is turned into meta-arabin by this process and the whole of the tannin contained in the leaves gets united with it when precipitated. The meta-arabin dissolves only if boiled with solution of caustic potash.

4. A tannin, identical with the tannin of the Camphor Laurel forms a high per cent. of the decoction of the foliage of *Cinnamomum Oliveri.* As the same tannin is contained in the bark and as it has been described already by the late Mr. Staiger, it will be dealt with under the next heading.

5. The bark of *Cinnamomum Oliveri* has a strong aromatic odour and a pleasant astringent taste. It is frequently used by bushmen to improve the flavour of their tea, a little bit of bark being infused therewith. The active principles are a notable oil and a peculiar tannin. This bark has been used by many medical men as a convenient aromatic astringent in diarrhœa, and has been recommended by the Medical Society of Queensland for insertion in the British Pharmacopœia. Mr. Staiger says: "Contains 9 per cent. of tannin, which colours iron solution green,

does not precipitate solution of glue, and behaves itself similar to the tannin of the Peruvian bark."

I determined the percentage of the tannin by the Loewenthal process and found the bark to contain not more than 4·57 per cent. of tannin, stained green by ferric acetate and precipitating energetically solutions of glue (gelatin) and albumen By dry distillation it yields only catechol stained green with ferrous sulphate and brown with lime water. By boiling with diluted hydrochloric acid it yields a phlobephene (cinnamon-red) which is soluble in alcohol and which precipitates also the gelatine. It is identical with the tannin of the Camphor Laurel but has nothing to do with the tannin of the Peruvian bark as the following reactions will show :—

Cinchona (Bark).	Cinnamomum Oliveri (Bark)
Antimon-tartar ; White precipitate	No precipitate. Precipitate only on addition of sal ammoniac
Copper Sulphate ; No precipitate	Slight precipitate
on addition of Ammonia : Brown precipitate	Indian Red precipitate
Lime-water ; Clouding, soluble in excess	Light clouding, *insoluble* in excess ; (catechu soluble in excess)
Ammon. molybdate in nitric acid : White precipitate	Slight clouding, soluble in excess
Sodium Sulphide : Yellow	Slight reddening
Uran. Acetate : Slight darkening	Browned precipitate

6. The essential oil of *Cinnamomum Oliveri* was obtained by Staiger through extraction with ether, which after evaporation left the oil behind. Staiger states that the bark contains "about" 2 per cent. of oil, and Maiden says that a ton of the dry bark yields 770 ozs. of essential oil. These figures were of course got by multiplication of the experiment made on a very small scale and so the error was multiplied by hundreds. I found good bark to contain much less oil than the Sassafras bark of North America contains. From 10 pounds of bark I got (by a very exact process to be described another time) not more than one drachm of essential oil, and I am quite certain that it never will pay even the expense to distil the essential oil out of the bark for commercial purposes. The average bark contains "about" 2 pro mille of the essential oil.

The commercial Sassafras oil from North America consists of Safrol $C_{10} H_{10} O_2$ which crystallizes out under 52° F. (12° C.) and which is held in solution by the hydrocarbon Safren $C_{10} H_{16}$. Safrol is the essential part of Sassafras oil. The Sassafras oil is sold by Elliot Bros. at sixpence or eightpence an ounce and one hundredweight of Cinnamomum bark might yield 2 ounces of oil to a good still, so that a profitable trade is quite out of the question. The essential oil of *Cinnamomum Oliveri* is very likely not identical with Sassafras oil. I had a small quantity of it under ice for 24 hours, but not a trace of Safrol crystallized out of it. The smell is different, too, very likely from the presence of camphorigenol. The specific gravity is 1·072 as obtained by direct weighing and the boiling point is 112 like that in the true Sassafras oil. I have not yet quite finished my researches about this oil and reserve the final result for another occasion.

There is no doubt respecting the medicinal value of the bark, and the farmers would be wise not to touch the trees now, but wait patiently until there was a good demand. They can try to sublimate the camphor out of the leaves—perhaps it might pay well.

It will prove a capital mistake it they get in London the paper composed by Dr. Love and signed by me and are led to order perhaps Nesodaphne bark from New South Wales—the Nesodaphne bark being altogether different from the bark of *Cinnamomum Oliveri.*

The following passages in scientific books have to be altered now accordingly :—

Dr. J. Bancroft : "Contribution to Pharmacy from Queensland," p. 2, Cinnam. Oliveri instead of Nesodaphne obtusifolia

Pharmaceutical Journal 1887, p. 989, the same.

Maiden : "Useful Native Plants of Australia," p. 281, the same. Besides this the specific gravity of the oil is stated to be 0·978 instead of 1·072.

Page 328, the same; and, besides, the tannin is not identical with Cinchona tannin.

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WATER SUPPLY FOR DOMESTIC USE.

By The Hon. W. F. TAYLOR, M.D., M.L.C., M.R.C.S.,
DIP. PUBLIC HEALTH.

[*Read before the Royal Society of Queensland, December 15, 1894.*]

THE importance of making provision for an adequate supply of pure water for domestic use cannot be overrated in a country such as this, destitute as it is of natural sources to a great extent, and liable to periodical seasons of prolonged drought. That the attention of successive Governments in the various colonies has not been more directly and practically given to this matter has been a surprise to me for many years past. Had some steps been taken to remedy nature's defect in this respect in the interior of the country, the results must have been highly beneficial to the community at large, by encouraging close settlement on lands—now lying waste—improving the rainfall and dew precipitation, and rendering the climate more equable. One-fourth of the money spent on non-productive works during the last ten years would, if judiciously employed, have converted dry gullies and lagoons into lakes and sheets of permanent water. In 1884 I forwarded a report to the Queensland Government on Water Supply and Sewage Disposal (embodying the results of my investigations when last in Europe), in which the following paragraph occurs :—" A plentiful supply of pure water is of vital importance to every community, more especially in tropical and semi-tropical countries. The matter is of special interest to Queensland, for destitute as this colony is of large rivers and natural storage reservoirs, such as lakes, artificial means must be resorted to in order to supply the deficiency, and wells, tanks and dams be largely depended upon for the future water supply of the inhabitants. That nature's omission in this respect can, to a great extent, be remedied, is self-evident, and the benefits to the whole community that would accrue from a national undertaking for the purpose of storing water on a large scale throughout the country, would be soon apparent in a more equable climate with a more reliable rainfall, instead of the present condition of wet seasons followed by prolonged droughts." Action has certainly been taken in this direction, and artesian wells have been bored, and tanks and dams have been constructed by the Government since my writing the above, and a large number of private bores have also been put down; but, in my opinion, in addition to this work, efforts should have been made to fill dry lakes and lagoons. This, no doubt, could in many cases have been accomplished without much difficulty or cost, by cutting canals from adjacent watercourses, which, when in flood, would have filled the dry lakes and lagoons, thus establishing large bodies of permanent water. The Hon. James Tyson, in or about the year 1864, constructed a canal from the Lachlan River to a dry lake some 40 or 50 miles distant, and thereby secured a magnificent sheet of water, on the banks of which he built his head station. I am not aware that his example has been followed by others in this respect, but I trust that while the construction of dams and tanks, and boring for artesian water will be continued by the Government, attention will be also directed to the conservation of flood waters in the manner indicated. The Hydraulic Engineer, in his able Report for 1893, gives many interesting particulars concerning Water Supply for that year; but it is evident that that Department of the Public Service has suffered severely from the policy of retrenchment which it has been found necessary to adopt. This is a matter for deep regret considering the importance of the subject of Water Supply, and I sincerely trust that in the near future the Government will see their way not only to restore the Department to its old condition of efficiency, but to very materially increase it.

Sources of Water Supply.

From the rainfall is derived the sources of all water supply—which comprise rivers, streams, lakes, reservoirs, wells and tanks. Continual evaporation is going on from the surface of the land and sea, which descends in the form of rain, dew and mist. The evaporation from tropical seas is estimated at 100 inches per annum. About one-third of the rainfall runs off the surface of gathering areas and is naturally impounded, forming lakes, or is collected by rivulets and streams into rivers ; one-third is evaporated, and the remaining third is absorbed by the soil, and forms underground reservoirs. The amount in each case varies according to the rapidity of rainfall and the character of the surface of the ground. Dams constructed across the outlets of gathering areas in hilly districts form storage reservoirs, which are largely availed of for the purpose of providing a pure water supply to cities. One of the largest of modern times has recently been completed at Thirlmere Lake, one of the Cumberland lakes, at the foot of the Helvellyn mountain range, for the purpose of increasing the storage capacity of the lake, in order to afford an ample water supply to the city of Manchester for many years to come. Thirlmere Lake was originally 330 acres in area, and seventeen years ago a scheme was projected to raise the lake an additional height of 50 feet above its elevation from the sea level, in order to give the water a sufficient fall on its way to Manchester, and to increase the storage capacity of the lake by about 200 per cent. A huge dam 50 feet wide at its base and 18½ feet wide at the top, carrying a 16 feet roadway, protected by parapets, has been constructed. The area of the lake has been increased to 795 acres, and its storage capacity is now 8,135,000,000 gallons. The gathering area has a rainfall of 80 inches per annum—about 50,000,000 gallons per day for 150 days, even if no rain falls during that time, will be available for Manchester. At present only 10,000,000 gallons per day will be required. The water is carried over a space of nearly 100 miles from Cumberland to Manchester—the longest distance traversed by water for the supply of any city in the world. Of this distance 15 per cent. had to be tunnelled—the remainder consisting of piping on a large scale. In its long journey the water is twice carried over rivers by means of siphon bridges, at the passage of the Ribble and Lynn.

Liverpool is supplied with water from Wales, a distance of 68 miles, the waters of the Vymwy having been impounded, and an artificial reservoir 4¾ miles in length formed.

The storage of Loch Katrine, which supplies Glasgow, is 5,687,000,000 gallons. It is 34 miles from the city.

The city of Dublin is supplied from the Wicklow mountains, 26 miles distant.

Birmingham is spending millions in bringing water from the Valley of the Wye.

Our own Gold Creek and Enoggera reservoirs have both done service in their time, but a more reliable supply than could be depended upon in these cases became necessary, and the Brisbane River Scheme was formulated and carried out. When this scheme was proposed we were confidently assured that the water at the site of the proposed intake was of excellent quality and free from sediment or organic pollution. Up to the present this has not been the case; the water, in addition to being very hard, contains a large quantity of earthy and organic matter in suspension, and at times is absolutely unfit to bathe in. I am speaking from the experience which my own stand-pipe affords me, and cannot say, of my own knowledge, what condition of water is supplied to others. But this subject I intend to take up and discuss fully in the near future, unless a more satisfactory quality of water is supplied. Until now I have thought it advisable to keep silent, under the impression that as the works were got into regular order the quality of the water would approach to that which we were promised it would be when the Bill was passed through Parliament. Then, I strongly advocated the use of filter-beds, but was assured that they would be quite unnecessary. My experience of this water convinces me that some means of getting rid of the suspended matters is absolutely necessary, whether by filter-beds or subsidence tanks, and that the hardness must be reduced to render it soft enough for laundry and other uses.

London is the most notable example of a city supplied by river water. The city and county are supplied by eight water companies, five of which draw their entire supply from the River Thames, above Teddington.

The water supply from rivers has been abandoned to a great extent on account of the impurities which gain access to them from the populations residing on or near their banks, and as has been shown the great tendency nowadays is to secure for cities a water supply from sparsely inhabited districts, where the chances of pollution by raw sewage are minimised.

Where no rivers, streams, lakes or gathering grounds for the formation of artificial reservoirs are available, wells become the only source from which a water supply is obtainable. Of the rain descending upon the ground, part percolates through the soil until arrested by impermeable strata. This gives rise to what is termed underground water, and in sinking wells this is the water first met with. Large supplies of good water may be obtained in this way in localities where the impervious strata form a basin, and arrest the flow of the underground water through the porous underlying strata towards the nearest watercourse or to the sea. Water obtained from wells contains a greater or less quantity of mineral matter dissolved from the soil through which it has percolated, both from the surface and through porous strata on its way to its outlet in the sea or nearest watercourse. It is obvious, therefore, that well water is very liable to contamination from leaky sewers, cesspits or dung heaps, for although the leakage may not be direct into the well—every precaution having been taken to minimise such an occurrence—it may take place into the underground water within the area from which the well draws its supply, and thereby serve as a source of danger. The diagram now shown illustrates the manner in which this contamination may occur. Great variations in the level of this underground water are brought about by wet and dry seasons—in dry seasons the level becomes lower, to be raised again by rainfalls.

Many instances may be given of the manner in which wells have become contaminated by sewage, and the water used from them has given rise to disease. I will content myself by citing one, which is perhaps among the most recent on record.

An outbreak of typhoid fever occurred at Worthing, Sussex, in April, 1893. Dr. Thompson, Inspector of the Local Government Board, investigated the cause of the outbreak, and in doing so he had to set aside all known causes of typhoid, such as milk, sewerage, drainage, &c., other than water, but only after a careful study of their possible relationship to the disease. The water supply of Worthing is obtained from three wells, with three headings, two headings serving as connecting tunnels between the three wells. In 1885 a shaft had been commenced near a corner of the waterworks yard, but had to be abandoned on account of a large body of suspicious water met with coming from a fissure in the chalk. On March 13, 1893, a new heading was commenced, which proved to be just beneath this fissure, and on April 14, a large fissure was struck. The water derived from this new heading was, to a certain extent, allowed to mix with the general water supply, and cases of typhoid fever broke out in nine or ten days after, and within a fortnight or three weeks the main outbreak occurred.

The question arose as to how the water could have become contaminated? Dr. Thompson, in his Report to the Local Government Board, says: "With a view of testing whether the abandoned shaft of 1885 had led to the discovery of a fissure which communicated with the new heading below, he caused a ton of salt in solution to be thrown down the fissure, and had as a result, an increase of chlorine in the adjacent well of from 5·0 to 35·8 parts per 100,000 within an hour and a-half from the commencement of the experiment. It became thus evident that any sewage contamination of the surface of the ground above the fissure experimented on would permit of the entry of dangerous material to the public water service. Local contamination was abundantly shown by the existence of old disused drains leading to sewage pollution of the soil overlying the chalk in which the wells, &c., are sunk. Dr. Klein was able to demonstrate the existence of the typhoid bacillus in the water of the contaminated wells.

Wells, such as I have described, may be termed surface or shallow wells, in contradistinction to Artesian Wells, so named from the province of Artois, where they have been long in use. The term artesian is confined to wells, the water of which rises above the surface; and wells sunk into geological formations and deep beds are called deep wells. The water of artesian and deep wells is less liable to contamination than that of shallow wells. This can be easily understood when we consider the conditions under which the water is stored in the reservoirs which yield the artesian and deep well supplies. In the case of Queensland, for example, the sources of artesian water supply are supposed to have their origin in that portion of the rainfall which percolates through the aërial outcrops of the porous beds of the Lower Cretaceous formation on the western slope of the coast range. Local contamination of the rain water on or near the surface of the ground could have no appreciable effect on the great bulk of water which had percolated or filtered through the porous strata mentioned. In its passage through these permeable strata, however, it would dissolve and hold in solution more or less mineral matter; so that, as a rule, artesian water is rich in saline and other mineral constituents. Norton's Abyssinian tubes form a very valuable means of reaching water-bearing strata at a moderate depth, and have much to recommend them from a sanitary point of view.

The cause of the water in artesian wells rising above the surface, is mainly, if not entirely, due to its coming from a higher elevation than the mouth of the well.

Rain water impounded from roofs of buildings and stored in tanks, is a very common source of domestic water supply in this country. The water so obtained varies in purity according to the freedom or otherwise of the air from dust and ammoniacal and sulphurous gases, and the roofs from dust, leaves, droppings of birds, &c. Dust blown from the streets and yards, and deposited on the tops of houses may, and often does, contain organisms of a pathogenic nature. It becomes very necessary, therefore, that provision should be made to prevent the first washings from the roofs gaining access to the storage tanks. An ingenious contrivance to accomplish this object is Roberts' Percolator. The apparatus is balanced on a pivot and connected with the downfall pipe so that as soon as the pure water compartment is filled to a certain point it cants over, and the water runs clear to the storage. At my suggestion the Hon. Sir Samuel Griffith, when Premier in 1886, ordered a consignment of sanitary appliances from London, to serve as models for the use of the Local Authorities here, and, amongst the lot was one of these percolators, which no doubt is still in existence, but where, I do not know, as little or no care has since been taken of the appliances then imported, which were subsequently stowed away somewhere as so much useless lumber by those whose duty it was to look after and care for them. A resident of Toowoomba, named Irwin, invented a very simple and much cheaper appliance for this purpose, some years ago. It consisted of a small galvanised iron vessel divided into two compartments, and placed on a pivot over the inlet opening of the tank. As the water flowed it was discharged over the tank until sufficient had collected in the second chamber to tilt the vessel over the inlet. This simple, cheap, and efficient apparatus has not, as far as my observation goes, ever been brought into even moderate use in this city or suburbs. Water collected from galvanised iron roofs and stored in galvanised iron tanks—the usual practice here—has a decided metallic taste, which is disagreeable and likely to engender dyspeptic troubles in those who drink much of it. Filtration through charcoal removes this taste.

Distribution.

The distribution of water to communities is effected on two systems—the *constant* and *intermittent*. The former is by far the most satisfactory and sanitary method, as it does not require the use of storage tanks, which are objectionable on account of the difficulty in keeping them free from deposit of matters held in suspension in the water, and from dust, insects, decaying animal and vegetable matter, &c. With an intermittent supply, when the water is turned off at the main, and is still being run off at the lower levels, a partial vacuum is created in the pipes at the higher levels, and ground water and gases, if not actual sewage, may be sucked into the pipes through fissures or imperfect joints, which would be distributed to the consumers with the water when turned on again, and give rise to a fertile source of disease. The constant system is the one which is now being almost universally adopted. The water for drinking and cooking should be drawn direct from the main, and if delivered pure, as it undoubtedly ought to be, would suffer little risk of contamination at the hands of the consumers.

Quality of Water and Sources of Pollution.

Physical characters.—Good drinking water should be clear, colourless, or slightly blue, free from odour, except the ozonic odour of spring water; aërated, fresh to taste, should contain no suspended matter and deposits, and deposit no sediment on standing, and should not become offensive to smell when kept for 24 hours in a warm place.

Chemical constituents.

The chlorine in chlorides should be under	g.	1·0000	per gallon.
Total solids in solution	,,	,,	5·0000	,,
,, volatile	,,	,,	1·0000	,,
Ammonia, free or saline	,,	,,	0·0014	,,
,, albuminoid	,,	,,	0·0035	,,
Nitric acid (NO_3) in nitrates	,,	,,	0·0226	,,
Nitrous acid (NO_2) ,,	,,	,,	Nil.	
Nitrogen in nitrates ...	...	under	0·0100	,,
Total combined nitrogen, including that in the free ammonia; should be under		...	0·0112	,,
Total nitrogen, including that in the albuminoid ammonia, should be under		...	0·0163	,,
Hardness, total, should be under ...		...	6·0	,,
,, fixed, ,,	...	...	2·0	,,

An amount of chlorides much in excess of the quantity per gallon stated above, viz., one grain, would render the water suspicious; and if in addition the albuminoid ammonia exceeded to any great extent 0·0035 of a grain per gallon, sewage contamination would be suspected, and the locality carefully examined for a possibility of such. Water possessing a permanent hardness of over 10 degrees of Clark's scale, is injurious, and may in many cases gives rise to dyspepsia, diarrhœa or constipation. The permanent hardness depends on calcium sulphate and chloride, and magnesium salts; the temporary hardness is due to calcium carbonate held in solution by an excess of carbonic acid gas in the water. Boiling, by driving off the carbonic acid, precipitates the calcium carbonate; so also does lime water when added to the water, by combining with the CO_2. Time will not permit me to enter into any detail respecting the means adopted to demonstrate with accuracy the degree of hardness, temporary and permanent, of water. The test is called after the discoverer—Clark's test—and is based on the well-known curdling properties which hard water possesses over soap. An estimate sufficient for domestic purposes may easily be arrived at by noting the difficulty experienced in producing a lather with soap. Soft water rapidly produces a lather without any such feeling of resistance as is imparted to the hands when

N.B.—Solids on incineration should scarcely blacken.

rubbed together in hard water, which requires in proportion to soft water a quantity of soap to produce a lather equal to the degree of hardness of the water. A water of 10 degrees of hardness (according to Clark's scale) means that it would waste as much soap as 10 grains of chalk would if dissolved in 1 gallon of water. Every grain of chalk or degree of hardness wastes about 8 grains of soap, which is not much in itself, but in the water supply of a large city would mean a considerable tax on its inhabitants. The city of Glasgow saved, from the use of Loch Katrine water, £36,000 per annum in soap. The extra cost in soap of a hard water over a soft water supply is easily computed on the basis above mentioned. The average quantity of water required for clothes washing and personal and other washing, is 6 gallons per head daily. If the water supplied contains 10 degrees of hardness and each degree of hardness requires 8 grains of soap, the quantity required for each gallon would be 80 grains, and for the 6 gallons 480 grains. This in one year would represent 25lbs. of soap for each person. The price of this 25lbs. of soap, multiplied by the number of inhabitants of a city would represent the extra cost of a hard water over a soft water supply. Hard water is bad for cooking and making tea. Clear, well aërated soft water is then decidedly preferable to hard water for the reasons stated, but extra care is required in the case of soft water to protect it from metallic contamination, especially lead, on which it has a very salient action. Hard water rapidly forms a deposit on the inside of lead pipes, composed principally of lime salts in solution, which protects the water from any contamination by the lead. No lead piping should be used in connection with a rain water supply, and galvanised iron tanks should not be soldered on the inside. Other metals are found in water beside lead, such as iron, manganese, zinc, copper and arsenic. The two first are unimportant; copper is only met with in streams in the neighbourhood of copper mines, and arsenic is seldom found in water unless it gets there from the refuse of manufactures. The extensive use of galvanised iron tanks imparts in some cases a decided metallic taste to the water stored in them. Galvanised iron is merely iron covered with a thin coating of zinc, put on by galvanism. It is now becoming recognised that some cases of ill-health are probably owing to the use of water from these tanks containing zinc in solution—for zinc in minute doses produces a depressing effect on the system. This matter deserves more attention than is given to it here, for undoubtedly the constant use of galvanised iron tank water must have an injurious effect upon the health of some individuals. Water may be the source of various parasites which infest the human being, among the principal may be mentioned—*Hydatids*, derived from the tapeworm of the dog, through the egg being deposited in water; *Filaria Sanguinus Hominis*, from the mosquito, which develops the mature sexual worm, whose eggs again occur in water; *Anchylostomum duodenale*, a worm which infests the upper part of the small intestine, and gives rise to fatal anœmia; *Bothriocephalus latus*, or tapeworm, and varieties of the *Distoma*.

The characteristic organisms of typhoid fever and cholera have been found in water, it being generally recognised that outbreaks of these diseases have occurred in which the proof of their origin from drinking water is irrefutable. I have already given an instance of a recent occurrence, where an outbreak of typhoid fever was clearly traced to water contaminated by the specific bacillus of the disease, and many other cases could be recorded of a similar kind were it necessary to bring them forward in support of this fact. Plenty of evidence is also forthcoming to prove that cholera is spread by drinking water, although some men of eminence have denied that it is so. The bacillus of tubercle, the bacillus of anthrax, the bacillus of tetanus, the bacillus of scarlet fever and of diphtheria, and the streptococcus of erysipelas, have all been found in water; but there is little or no evidence that the diseases produced by these organisms have been more than only occasionally propagated by drinking water. Diarrhœa and dysentery may be caused by the use of polluted water, and malarial fever has been proved to have been produced by the same cause.

Purification.

It has been seen that water may be contaminated from various sources; means, therefore, should be adopted to purify it before its distribution to the consumer. Among the various methods in use for that purpose filter-beds afford the best means of purifying water on a large scale. These are usually composed of sand and gravel—about 2 feet of the former to 3 feet of the latter. The greater portion of the London water supply is filtered—the New River Company having 20 filter-beds with an area of $16\frac{1}{2}$ acres, the filtering medium being—sand 2ft. 3in., gravel 3ft. to 5ft. 3in.

The East London Waterworks have 31 filter-beds, with an area of $29\frac{3}{4}$ acres, the filtering medium being—sand 2 feet, hoggin 6 inches, coarse gravel 1ft., equal to 3ft. 6in.

The Southwark and Vauxhall Waterworks use a filtering material of sand 3ft., hoggin 1ft., fine gravel 9in., coarse gravel 9in., equal to 5ft. 6in. in all.

The West Middlesex and Grand Junction Waterworks use a filtering medium of sand and gravel 5ft. 6in. deep; the Lambeth Waterworks, one of 7 feet; and the Chelsea Waterworks filter-beds 8 feet deep. The filtered water is conveyed to covered tanks, from which it is drawn off by mains to be distributed.

The filter-beds require cleaning about once in six weeks or oftener, according to the condition of the water, and may need renewing every six months.

The effectual filtration of water depends on—(1) a sufficient area of properly constructed filter-beds, cleaned and fresh sanded from time to time as required; (2) the rate of filtration being controlled and regulated; (3) and the water, if at all turbid, being first received into subsidence tanks, in order that the suspended matters may be deposited before the water is run on to the filter-beds, thereby maintaining their efficiency for a maximum period by preventing unnecessary fouling. After a filter-bed has been in use for a short time, a film of gelatinous material forms on the surface of the sand. When this film becomes thick enough to interfere with the usual rate of filtration it is skimmed off, and the filter-bed allowed a certain period of rest.

This gelatinous film forms a very important function in relation to bacterial organisms, as it effectually intercepts by far the greater number contained in the water passed through the filter. The bacteria become attached to and entangled in the colloidal mass, and are consequently prevented from passing down into the deeper beds of sand and gravel. Professor Ray Lankester describes this filtration as like the dialyses through a fine jelly, which is capable of intercepting the very smallest bacteria, if there is no rupture or loss of continuity in the material. This gelatinous material which forms on the top layer of sand, consists, no doubt, very largely of intercepted organic matter and saprophytic bacteria. It becomes sufficiently well formed in two or three days after removing the top layer of sand, to become effective in arresting bacteria. For the first two or three days, therefore, after removing the sand, the filter-bed is not effectual in intercepting bacteria. There is no evidence of filter-beds becoming reduced in efficiency by prolonged use, even for a period of 68 days. It would seem that the organisms tend to grow deeper and deeper into the beds, and might possibly in time grow quite through the filter and re-appear in the filtered water—but owing to the thickness of the filtering medium this must necessarily occupy a long time. The reason why the top layers of sand should be skimmed and removed periodically is to prevent the filter-beds being overtaxed, because filtration becomes slow in old beds owing to the thickness of the gelatinous coating and clogging of the top layers. This gelatinous colloidal mass of bacteria with which the filter-bed becomes covered has the power of arresting 97·5 per cent. or more of the bacteria in the filtering water.

The process of filtration is chemical as well as mechanical and bacteriological. The late Colonel Sir Francis Bolton, in his instructive work on the London Water Supply, says :—" It is well known that all solid bodies attract about them an atmospheric film, and therefore as a bed of sand and gravel is an agglomeration of minute stones, each with its coating of compressed air (or in other words, compressed oxygen and nitrogen), the water filtering through its interstices has to pass a concentrated body of oxygen capable of decomposing it and forming other compounds ; consequently, if we take the case of a decayed leaf for example, we can see that it could be resolved to some extent into carbon, nitrogen, and hydrogen, which re-combining with the oxygen, form carbonic acid gas, ammonia and water. As the result of this chemical process the polluting vegetable matter will have actually vanished, and though the filter-bed has really abstracted it from the water the bed itself will show no trace of it."

Efficiency of filtration will depend very much on the rate the water passes through the filter. The pressure of water should not be great, the depth being not more than 2 feet. From 70 to 75 gallons is the usual quantity which should pass through in 24 hours for each square foot.

By means of subsidence tanks the water may be freed to a large extent of suspended matters and bacterial organisms, the latter becoming entangled in the suspended matters sink to the bottom with them, and probably undergo changes there somewhat similar to those undergone in a filter-bed—75 per cent. of bacteria may be got rid of in this way.

Various other means are adopted for the filtration of water besides sand and gravel, such as fine animal charcoal, carferal, which is a black granular matter having some resemblance to granular animal charcoal. It consists of charcoal and iron in small quantities with a basis of clay—but these are only employed on a small scale or for domestic filters. The following are the essentials of a good filter, given by Dr. Parkes :—

"1. That every part of the filter shall be easily got at for the purpose of cleansing or renewing the medium.

"2. That the medium shall have a sufficiently purifying power, and shall be present in sufficient quantity.

"3. That the medium yield nothing to the water that may favour the growth of bacterial organisms.

"4. That the purifying power be reasonably lasting.

"5. That there shall be nothing in the construction of the filter itself that shall be capable of undergoing putrefaction, or of yielding metallic or other impurities to the water.

"6. That the filtering material shall not be able to clog, and the delivery of the water shall be reasonably rapid."

The Chamberland-Pasteur Filter is one of the most recent, and owes its filtering power to finely divided porcelain. It is attached to a stand-pipe or tap, and efficiently filters the water, provided that the current be not too strong. It is easily cleaned, and has proved its efficacy by reducing disease among the French soldiers in Cochin China by 50 per cent. At all events, after the introduction of the Chamberlain filter, the health of the army very notably improved.

Different means may be resorted to in order to purify water without filtration.

(1.) *Exposure to the air in divided currents* removes hydrogen sulphide, offensive organic vapours, and possibly dissolved organic matter.

(2.) *Boiling and agitation.*—This plan gets rid of calcium carbonate, iron in part, hydrogen sulphide, and lessens organic matter. It also destroys parasites and bacterial organisms, and is on the whole the safest plan to adopt on a small scale with suspicious water. After boiling and before drinking it should be well aërated, as boiling, by driving off CO_2 and air, renders the water insipid and indigestible.

(3.) Alum is often employed to purify water from suspicious matters.

(4.) Addition of limewater lessens the hardness of water as already mentioned, and rapidly throws down the suspended matters, as well as bacterial organisms, which become entangled in the sediment.

(5.) Sodium carbonate with boiling throws down lime and possibly lead if present.

(6.) Addition of potassium or sodium permanganate removes the smell of hydrogen sulphide, and also carries down suspended organic matter.

(7.) *Perchloride of Iron* is a powerful oxidizing agent, and throws down finely suspended organic matters.

(8.) Spathose and spongy iron are powerful filtering materials.

Tests for the Purity of Water.

It is often a matter of extreme difficulty to state positively from either chemical or bacteriological examination of water, whether it is free from organic impurity, or pathogenic micro-organisms. Either test applied alone is insufficient, and the application of both does not always solve the question. Valuable evidence on this point was given before the Royal Commission on Metropolitan Water Supply recently, by Sir G. Buchanan, M.D., F.R.S., late Chief Medical Officer to the Local Government Board, to the effect that neither chemical nor bacteriological tests were to be relied on as to the purity of water; that we did not know how small an amount of morbific material, if it gained access to the water, might set up disease; and that the way to gain information as to purity and safety was, to search out the conditions surrounding watercourses and water services.

Evidence of a similar nature was given before the Commission, and the conclusion which forces itself upon one is, that the interpretation of water analyses must be arrived at gradually, and that the safest way to secure immunity from waterborne disease is to prevent the contamination of the water supply as far as possible. This is in many cases more easily accomplished and should be aimed at rather than purifying the water after contamination.

CONSTITUENTS OF RESIN OF AILANTHUS IMBERBIFLORA, VAR. MACARTNEYI.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, February 16, 1895.*]

[The matter contained in this paper is included in a Bulletin shortly to be issued by the Department of Agriculture.]

A NEW METHOD OF ASSAYING TANNATES.

By Dr. JOSEPH LAUTERER.

[*Read before the Royal Society of Queensland, February 16, 1895.*]

A GREAT number of methods have been described for determining tannin and assaying tannin-yielding materials. All of them are tedious and require some hours, and at the end do not give satisfactory results. For the chemist or the tanner, who wants to buy some material, a quick method of ascertaining the actual amount of tannates for which he has to pay, would be invaluable. For the scientific investigator of the imperfectly-known constituents of a flora, who has to go through a large number of plants, and who is often travelling, the published methods are nearly or altogether unavailable. I therefore put before the public to-day a colorimetric process of assay, which is very delicate and gives satisfactory results in less than five minutes if everything is prepared.

I.—PRELIMINARY ARRANGEMENTS.

(1) In a six-ounce bottle two drops of liq. ferri perchloride fort. of the British Pharmacopœia are dropped and diluted with 3 ounces of distilled water, 1 drachm of Mistura Acaciæ (mucilage of arabic gum) is added, the whole well shaken and the six-ounce bottle is then filled with distilled water.

(2) A 1 per mille and a 1 per cent. solution of the best Berlin tannic acid (Schering's) in distilled water is then prepared and filled in well-made patent drop bottles.

(3) A number (50-60) of 1-drachm Nessler bottles (perfectly clean) are kept ready.

One drop of the ·001 solution of tannic acid is then put in the first Nessler bottle and the bottle filled with the solution of perchloride of iron mentioned under (1). This Nessler bottle is labelled "1 per mille."

The second Nessler bottle, labelled "2 per mille," gets two drops of the ·001 tannin solution and is filled with the iron chloride solution like the first. In this way each following Nessler bottle gets one drop more of the ·001 solution of tannic acid. So many drops, so many per mille, of tannin are put in the bottle. Ten drops of ·001 is equal to one drop of the 1 per cent. solution. So we put in the tenth bottle one drop of the 1 per cent. solution of tannin, fill it with the iron solution and label it "10 per mille." In the fifteenth bottle, to be labelled "15 per mille," we put one drop of the 1 per cent. tannin solution and five drops of the ·001 solution; in the twentieth bottle two drops of the 1 per cent. solution ; and in the fifty-fifth bottle, to be labelled "55 per mille," five drops of the 1 per cent. and five drops of the 1 per mille tannin solution, etc.

The tannin, on addition of the iron, forms a black ink, darker or lighter according to the lower or higher percentage of tannin brought into contact with the ferric-chloride. The colour of this ink is not altered for many months, as the mucilage of arabin keeps the small particles of ferric-tannate suspended in the liquid and the small amount of benzoic acid prevents the growth of fungi.

A very good colorimetric scala, available for a long time, is obtained in this way.

II.—Process of Assaying.

Now, to find out the percentage of tannin contained in a body to be examined, we take 10 grammes of the material, put it in 90 grammes of boiling water (or 5 to 45) and keep it boiling for half an hour, adding constantly as much water as is lost by evaporation. Of this decoction or solution we put a part in a patent drop bottle and let one drop out of it fall in an empty Nessler bottle, filling it up with ferric-chloride solution. At once the ferric-tannate is formed, being kept in suspension by the arabic gum. By comparing the colour of this test-bottle with the colour of the scala-bottles the percentage of the solution is easily ascertained. The material then contains ten times this amount, having been boiled with 9 parts of water.

As the gallic acid gives the same reaction as the tannin, the percentage of it has to be determined for a correct assay ; but no notice need be taken of it as it is generally present in very small quantities.

If it is suspected in any material, 10 grammes of this must be boiled with 50 grammes of water and 40 grammes of a strong gelatine solution must be added. The precipitated tannate of gelatine is filtered off and the liquid has to be tested in the Nessler bottle for the unaltered gallic acid.

The percentage of this, subtracted from the first result, gives the amount of tannin contained in the material to be assayed. Mango seeds, for instance, contain much more gallic acid than tannin. As it is seldom necessary to go through this process, my colorimetric method of determining tannin is the quickest and cleanest hitherto devised.

BUNYA BUNYA NUTS.

By Dr. JOSEPH LAUTERER.

[*Read before the Royal Society of Queensland, February 16, 1895.*]

There are two species of the Order Coniferæ in Europe which yield edible fruits, namely *Pinus pinea*, from Greece and Italy, and *Pinus cembra*, from Tyrol and Switzerland. The nuts of *Pinus pinea* are winged, those of *Pinus cembra* are triquetrus and have no wing. Both contain 40 or more per cent. of a fatty oil like that of the almonds.

Our Bunya Bunya Pine (*Araucaria Bidwilli*) yields nuts three times as large as those of the European pines. The cone of *Araucaria Bidwilli* is larger than a man's head and weighs up to fifteen pounds. It is very interesting for botanical morphology, as an examination of its scales solves at once a question left unanswered by my old friend and teacher in botany, Professor Sachs, in Wurzburg. From the cones of *Araucaria brasiliensis* he inferred that the scales of the Araucaria cones are destitute of a placenta in opposition to the scales of the genus Pinus. Now the scales of *Araucaria Bidwilli* are distinctly shown to be composed of two parts, a proper bract and a placenta which is grown to the bract and which includes the nut.

Unlike the nuts of *Pinus pinea* and *Pinus cembra* the Bunya-nuts contain absolutely no fatty oil. The whole endosperma is filled with amylum (starch) which resembles closely the starch grains contained in the fruits of the Chestnut tree (*Castanea vesca*). Under the microscope the grains are seen to be packed closely together so much as to be pressed in a polygonal form. No sugar is contained in the Bunya nuts ; whereas the Chestnuts contain a large quantity of it. The endosperma includes the atropous embryo which has only two cotyledons and which shows the anomalous power to develop chlorophyll and to get green in the absolute dark when the seed is germinating.

NATIVE ASTRINGENT MEDICINES AND TANNING MATERIALS OF QUEENSLAND.

By Dr. JOSEPH LAUTERER.

[*Read before the Royal Society of Queensland, March 9, 1895.*]

THE SUPPOSED DESCENT OF THE AUSTRALIANS.

By Dr. JOSEPH LAUTERER.

[*Read before the Royal Society of Queensland, March 9, 1895.*]

PERMO-CARBONIFEROUS FOSSILS FROM BANANA.

By FREDERICK BENNETT.

[*Read before the Royal Society of Queensland, April 20, 1895.*]

[Abstract.]

Some time ago Mr. Herbert Mackay presented to Mr. De Vis a collection of fossils from Banana Creek, on the strength of which, and a collection by Daintree from Cracow Creek, it was inferred that a belt of the Middle Bowen formation occurred on the right bank of the Dawson. Mr. Bennett gave the results of a journey undertaken with the object of re-discovering (with the help of notes from Mr. Mackay) the locality from which the fossils were derived, and tracing the line of demarcation between the Bowen and the Gympie formations. Mr. Bennett succeeded in the former part of his quest, and obtained a number of additional fossils, and also discovered other fossiliferous localities in the neighbourhood. From Mr. Mackay's locality—namely, the limestone on Big Sandy Creek (the head of Banana Creek) Mr. Bennett obtained *Zaphrentis*, *Spirifera*, and *Productus*; and from quartzite blocks on Banana Creek and its tributaries north of the limestone, *Aviculopecten*, *Fenestella*, *Protoretepora*, *Stenopora*, and *Zaphrentis*. The assemblage of fossils (inclusive of Mr. Mackay's) indicated that the whole belonged to the Gympie rather than the Bowen formation. No formation of undoubted Middle Bowen age was observed.

In the discussion which followed, Mr. Jack said the inference on which the presence of the Bowen formation was based was justifiable from the evidence formerly to hand, but Mr. Bennett had rendered an important service in extending our knowledge of the fossil fauna with the result of making it very doubtful whether there was any Middle Bowen formation on the Upper Dawson. It was singular that Mr. Mackay's collection should have been deficient in the characteristic Gympie fossils brought to light by Mr. Bennett. The suggestion that the Banana Creek (or Big Sandy Creek) limestone, from which Mr. Mackay's fossils came, was identical with that of Kooingal from which the late Mr. James Smith made a notable collection of undoubted Gympie fossils was a strong point in support of Mr. Bennett's position. The Cracow Creek fossils still remain to be disposed of, but it must be confessed that their evidence is not, by itself, very strong, since *Chonetes Cracowensis* is common to Banana Creek, the Star formation, and the Rockhampton division of the Gympie formation, and *Platyschisma rotunda* has only been noted from Cracow Creek and the Gympie beds of Rockhampton district. On the whole, pending the mapping of the district, the Bowen formation had better be erased from the geological map of the Upper Dawson, and the area added to the Gympie formation.

Mr. W. H. Rands, Assistant Government Geologist, also spoke on the subject. He thought that Mr. Mackay's specimens must have got mixed.

THE DOMESTIC WATER FILTER.

By the Hon. W. F. TAYLOR, M.D., M.L.C., M.R.C.S.
DIP. PUBLIC HEALTH.

[*Read before the Royal Society of Queensland, April 20, 1895.*]

THE filter being an article of pretty general use in this community, it is a matter of importance to ascertain to what extent the various filters sold are reliable as a means of purifying the water which passes through them. The source of the water supply is the rain which falls either on the roofs of buildings, and is collected and stored in tanks, or on the catchment areas of our reservoirs, and those of the Upper Brisbane river and its tributaries, well water being used in very few instances, if any. In the case of the tank water, it is obvious that unless some special means are provided for excluding the first washings from the roofs, it must be contaminated with the dust and leaves which have collected on them since the previous rainfall, and consequently the tank in which the water is stored becomes the receptacle for decaying organic matter, and the storage and propagation of bacterial organisms. However, as all suspended matters fall to the bottom, and the tap being inserted some inches above it, the water drawn from the tank is as a rule clear and palatable, if we except the metallic taste usually present in all water gathered from galvanised iron roofs and stored in galvanised iron tanks, and is consequently, in the majority of cases, drunk without being filtered. But many householders, under the impression that although the water may be clear, it must, from the manner in which it has been collected, contain impurities not visible to the naked eye, and therefore ought to be filtered before being drunk, or boiled and filtered. A filter is therefore purchased which is supposed to be capable of rendering the water passed through it absolutely pure, and the householder is satisfied that he and his family are protected from the risk of disease so long as they drink filtered water. How much reliance may be placed on the filter to purify the water will be seen further on when I refer to the results of "An inquiry into the relative efficiency of water filters in the prevention of infective diseases," conducted by Drs. Sims Woodhead and Cartwright Wood, and published in the November and December, 1894, numbers of *The British Medical Journal.* In the case of the Public Water Supply, or what is usually denominated "tap water," the necessity for the use of filters is much more apparent than in that of the private supply or the water collected from the roofs of buildings, for the former always contains a large quantity of suspended matters which are only too visible to the naked eye, and which boiling will not precipitate, and has a strong peaty taste when drawn from Enoggera or Gold Creek, and either a mineral or muddy flavour, as the river is low or in flood when obtained from the Mount Crosby Works. The tap water, containing as it does such an excess of suspended matters, will in a very short time clog and destroy any filtering medium, unless renewed very frequently. Now, in most of the filters in use here the medium is charcoal, either in the form of blocks or granular, and with the filter, when purchased, only a second block, or an extra change of charcoal is given, so that when these are rendered useless it is very difficult if not impossible to obtain a fresh supply of charcoal or blocks. One is then recommended to boil the charcoal and dry it in the sun. Well, this might be of some use in destroying bacterial organisms provided the boiling were continued sufficiently long to destroy the spores, and provided the charcoal had not been clogged by having muddy water passed through it, in which case the boiling would not free the granules of charcoal from the earthy and organic matters which adhered to them, but would in all probability tend to fix them more firmly to the atoms of charcoal; and in the case of blocks, boiling would not free the clogged pores, but would render them impervious. I have had some experience in this respect recently which I will briefly relate. The house in which I resided prior to removing to my present residence, had a corrugated iron roof from which the water was collected in a large galvanised iron tank. The water in this tank was always quite clear and free from any but a slight metallic taste, which was perceptible only when the tank was about half full. I contented myself with filtering this water through a Cheavin's filter, the filtering medium being granular charcoal. The water was always bright, sparkling, free from unpleasant taste or smell and palatable, and the filter was easily kept clear of all visible impurities. No member of my family ever suffered in any way from drinking this water, and I regarded it as a great boon, more especially when compared to the quality of the water obtained from the tap. The tap water was only used for the bath, and was frequently so offensive by reason of its odour, colour and consistency, as to be unfit to bathe in. On one occasion it was so bad that I tied a piece of flannel over the tap, and after allowing the water to run through it for a few minutes found it coated with a thick deposit, principally composed of vegetable matter. It was such a curiosity that I took it down to a meeting of the Central Board of Health in the afternoon, and showed it to the members. On removing into my present residence, over three years ago, I found that owing to the roof of the house being covered with ironbark shingles, which were spongy from age and ingrained with dust, the water collected in the tank was not usable, consequently I was forced to use tap water only. My old filters soon became clogged and foul, so I bought a new one which did service for a time, but soon gave out. I tried drying and heating the charcoal, but the water which passed through it afterwards was so offensive that it could not be used—the heating having set up decomposition in the organic matter adhering to the granules of charcoal. I obtained another change, or rather used one which had been lying by for some time, for I could not obtain any charcoal or charges at the various shops here, and proceeded to boil and dry it so that I might have it as pure as possible before using. The water passed through it was so disagreeable that I boiled it again. However, repeated boilings had the effect of making it worse, and the reason became plain at last: the charcoal was boiled in tap water and became contaminated with the impurities contained in it. In despair I have had to give up the use of filters, and now am obliged to drink tap water that has been boiled. The boiling may destroy any organisms that are in it, but certainly does not improve the taste or smell of the water, nor cause any appreciable precipitation of the suspended matter ; on the contrary, the peaty taste of the Enoggera and Gold Creek waters is intensified and they are rendered more acrid. Some weeks ago the Mount Crosby water was turned on, and for some time it was very muddy, but gradually cleared and became bright, and after boiling was quite palatable, but when it had arrived at this stage, and I was congratulating myself that my troubles respecting drinking water were at an end, for a time at all events, the next morning, to my chagrin, on turning the bath-tap muddy water issued from it and has continued to do so, with a slightly varying degree of intensity since. It is highly desirable to obtain drinking water as free from suspended impurities as possible, even if it cannot be freed from dissolved matter and bacterial organisms, and for that reason the use of the ordinary filter is not to be despised altogether. And possibly in the case of a fresh charge of pure charcoal or other medium employed, careful boiling of the water before filtering may preserve the filter from bacterial contamination for a time. But in order to do that, the filtered water should be drawn off and used as soon after filtration as possible, otherwise it may become inoculated with some pathogenic organism from the air, and serve as a means of conveying the organism to the filtering material; whereas in the case of charcoal filters, it will find suitable conditions for its development, and then become a source of infection to all the water which may be passed through the filter. The experiments above referred to, conducted by Dr. Sims Woodhead and Dr. Cartwright Wood show how different filtering media may serve as breeding grounds for disease-producing organisms. I will not weary you by detailing these experiments at length, but will merely state the results.

In these experiments the filter was first carefully sterilised, and repeated charges of tap water passed through it. The number of organisms per cubic centimetre originally present in the tap water was first determined, and the filtrate examined from time to time. Samples of the first water passed were poor in organisms, owing to the greater number being arrested in the upper layers of the filtering medium, but the numbers kept on increasing, owing to the organisms which were retained in the filtering medium having undergone multiplication, and some of those arrested from previous charges, being washed down. On the fourth day of testing the filters, the results were in the case of every filter tried, an enormous increase of micro-organisms.

It is clear, from these experiments, that the ordinary filter not only does not intercept micro-organisms, but after a short time of use, adds very materially to their number in the filtrate. If they will not arrest micro-organisms, it is hardly to be supposed that they will arrest disease germs, and in fact it was proved that they do not arrest them. Not one of these filters was able to arrest the passage of the Staphylococcus pyogenes aureus, yeasts, the cholera or typhoid bacillus ; so that as a protection against water-borne disease they are valueless. It is true that a sterilised filter will, for the first day or two, arrest the greater portion if not all the micro-organisms present in the tap water passed through it, so that to be of any use even in this respect, it should be freshly charged with a sterilised charge of filtering material every second day—a proceeding which would be both costly and troublesome.

Three filters, however, were found by Drs. Woodhead and Wood, capable of resisting the passage of disease germs. These are the Chamberland Pasteur Filter, the Berkefeld Filter, and the Aëri-Filtre-Mallié Porcelaine D'Amiante. The first consists of a filtering machine composed of a specially prepared form of porcelain formed by a mixture of kaolin and other clays, the exact details of which remain a trade secret. These filters are supplied in two forms—as table filters, and tap or pressure filters—the latter being the form most commonly used, for on account of the density of the porcelain forming the candles or filtering medium, filtration is very slow unless under considerable pressure. The table filter when composed of only one candle, requires such a long time to filter sufficient water for ordinary use, that it is found necessary to group together two or more candles to render it of much value. The only sample of this form of filter that I have yet seen is the one I hold in my hand, and which comes from the Stock Institute here—Mr. Pound having kindly lent it to me for this evening. It is a hollow cylinder, closed at one extremity and having a nipple-shaped open tube composed of glazed porcelain at the other extremity. The unfiltered water surrounds the outer surface of the unglazed porcelain, and passing through this issues as filtered water from the glazed nipple. This candle is composed of such dense porcelain, that enormous pressure is required to force water through it. The candles used for table filters are not so dense, and consequently permit the water to flow through by gravitation and capillary attraction. After a time these candles become coated on their outer surface with a film of a slimy nature which impedes the passage of water. This, however, is readily brushed off, and the candle may be boiled to render it absolutely sterile. This form of filter is extensively used in laboratories, and is found to work very well, not only in sterilising water but also the various cultures used for bacteriological purposes. The Pasteur filter, as this is called in France, has been in use in that country since 1886, and has been shown practically and scientifically—according to the statement of the vendor—to absolutely arrest all germs of disease in water, and to prevent typhoid fever, cholera, malaria, dysentery, and all other diseases communicated by water. Drs. Woodhead and Wood state that the "true criterion of an efficient filter is, whether it permits or not of the passage of test organisms, such as cholera and typhoid bacilli which do not readily multiply (if at all) in water, with the filtrate." Water containing in suspension the Staphylococcus pyogenes aureus to the number of 3,000 to 4,000 per c.c. was passed through this filter and the filtrate gave a negative result on the first, second, third and fourth days. Suspensions containing from 5,000 to 6,000 cholera bacilli to the c.c. and those containing 8,000 to 10,000 typhoid bacilli to the c.c. were also passed through the filter, and gave negative results on the first, second, third and fourth days. Tap water containing 35 to 40 micro-organisms per c.c., when passed through these filters was free from the presence of any organism on the first, second, third and fourth days.

The Berkefeld Filtering Company.—The filtering medium of their filters consists of silicious earth formed into a hollow cylinder, the candles being very similar to the Chamberland Pasteur ones. This filter can be used as a table as well as a pressure filter.

The manufacturers claim that the Berkefield Filter possesses the following advantages :—

1. It will filter large and small quantities, according to pressure and number of cylinders.

2. The filtered liquid is absolutely free from solid particles and from germs.

3. The filter can easily be cleansed, as all impurities remain on the surface owing to the density of the material. One cylinder will last for years.

4. Each cylinder can be thoroughly sterilised by being placed in warm water, and boiled for an hour.

Test organisms were completely arrested by this filter, but on the third day, in the case of tap water containing 35 io 40 organisms suspended in one c.c. the filtrate contained 60 per c.c. and on the fourth day 200 to 300. However, inasmuch as this filter completely arrests test organisms the conclusion is that it affords a sufficient safeguard against the passage of disease germs.

Aëri-Filtre-Mallié Porcelaine D'Amianté.—The filtering medium used in the manufacture of these filters consists of some specially prepared unglazed porcelain, the pores of which are very fine. This filter is impervious to test organisms, such as Staphylococcus pyogenes aureus, yeasts, cholera bacillus and typhoid bacillus, and completely arrests the organisms found in tap water. It, therefore, affords a complete safeguard against the communication of water-borne disease, but it has the drawback of filtering very slowly except under high pressure, and is consequently not very suitable as a table filter.

I have been at some little trouble to induce our importers to send for a supply of the Chamberland-Pasteur filters, and I am glad to say that one firm has sent an order for some samples, I have ordered through this firm a tap filter, and hope in the future to be independent to a great extent on the degree of impurity of the tap water supplied to me. These filters are not expensive. The tap filter I have ordered will not cost much more than three pounds. I would have liked to-night to have said something about the means of preventing the pollution of tank water, and what means should, in my opinion, be adopted in order to insure a public supply of good wholesome water—but consider that the subject of Domestic Water Filters is probably sufficient for one night, and hope in the future to take up the question and deal with it fully. I may, however, be permitted to draw your attention to this drawing of a self-cleansing tank, which is the invention of John Tyler, of Yaamba, near Rockhampton. (The author exhibited and explained the drawing.)

In conclusion, I would urge all those who are obliged to use tap water, to obtain one of the pressure filters I have mentioned. It appears to be hopeless to expect that Brisbane will ever be supplied with water fit to use direct from the tap, at all events in our time, consequently we should as far as possible protect ourselves and those belonging to us, by only employing water for drinking purposes in the purity of which we can safely rely.

CHEMISTRY OF BRIGALOW GUM.

By Dr. JOSEPH LAUTERER.

[*Read before the Royal Society of Queensland, April 20, 1895.*]

[The matter contained in this paper is included in a Bulletin shortly to be issued by the Department of Agriculture.]

THE CONGLOMERATE ROCKS OF WILD RIVER.

By R. C. RINGROSE
(Communicated by W. H. Rands, F.G.S.)

[*Read before the Royal Society of Queensland, May 18, 1895.*]

DISTILLING COGNAC FROM SUGAR AND GRAPE JUICE.

By Dr. JOSEPH LAUTERER.

[*Read before the Royal Society of Queensland, May 18, 1895.*]

If the views contained herein were practically carried out, great benefit to Queensland would result. I have made experiments which established the undoubted fact that Queensland could be made the great emporium of the whole world for the export of really good cognac, and then for the production of all kinds of wine, brandy, and liqueur. As I have been intimately acquainted with wine-making all my life, and have visited all the wine-producing countries in Europe, every confidence can be placed in my suggestions. A first-class wine can be produced here, as the climate and the soil of Australia are thoroughly adapted to the different varieties of the vine. Southern Queensland has a climate to be compared with that of Madeira and Teneriffe, where wine of the finest quality is produced. Really good wine of course is made from fermented grape juice only; white, when separated from the skins at once; red, when allowed to stand on the crushed grapes for some days. It then contains from 10 to 17 per cent. of alcohol and more or less extract, which gives the agreeable taste to the wine. If there is much extract the wine is called heavy; if little, it is called a light wine. A heavy wine with much alcohol is fiery; a light wine containing much alcohol is called spirituous or generous. Fiery wine can only be produced by fermentation of pure grape juice; a generous or spirituous wine can be obtained from grape juice mixed with a watery solution of cane sugar. A great deal of the wine produced at present in Queensland belongs to the second category, only there is too much sugar added, which gives it an unpleasant taste. Four gallons of a light spirituous wine yield one gallon of cognac by distillation. It is a very great mistake to think that good cognac can only be distilled from a highly palatable, dear, and heavy wine. The best French cognac is really fabricated from "petit vin" obtained from grape juice and an addition of a watery solution of beetroot (sweet turnip) sugar. The wine must of course be healthy and of a good flavour, but it can be sour and very poor of extract. If there is much sugar in the wine it will cause the production of caramel in the still, and the cognac will smell of rum. Use the cheap cane sugar in addition to some grape juice for the production of a healthy, light, and spirituous wine; distil cognac from this and export it—in other words, turn the cheap cane sugar into dear cognac. Let me give some figures derived from experiments. One ton of sugar at £8 12s., with two tons of grapes at £16 8s., gives 1584 gallons, or twenty-seven hogsheads of good wine, containing 10 per cent. of alcohol. The gallon of this wine costs the producer 3½d.; four gallons are 14d., and these four gallons yield one gallon of good cognac, which will bring at least 5s. in Europe, so that the £25 costs will bring a return of nearly £100. Distilling, shipping, duty, &c., will, of course, reduce the profit, but still there is life in the idea, as 5s. is a very low price for one gallon of cognac, and very likely more could be obtained if the prices for sugar and grapes unavoidably rise. The following points must be borne in mind:—1. A sugar solution does not ferment well without the addition of grape juice. 2. The sour grape juice yields, by fermentation, the sour esters of the wine, which go over into the cognac by distillation, imparting to it the proper flavour. 3. Yeast, produced by the fermentation of a really good and pure wine, if added to a watery sugar solution, mixed with grape juice, produces a wine coming near in good qualities to the wine from which it originally was derived. This fact was found out only lately in France, and also in South Germany, as can be read in the "Pharmaceutical Journal" of 1889. 4. The fermentation of the wine must not be hurried on by heat, as a quickly-fermented wine is destitute of a good flavour as well as the cognac derived from it. 5. By drying the grapes and boiling them in water, the production of wine can go on the whole year round, just as it is the case with the renowned Hungarian wines. The trade is very much simplified by this method, and a heavy expenditure on casks, &c., is saved by it. To arrive at the conclusion, the following advice is given :— 1. Plant new vines next month (June) from good cuttings, avoiding the Isabel. 2. Do not neglect your sugarcane. 3. Learn the art of distilling.

ON SOME ABANDONED GOLDFIELDS OF THE OLD WORLD.

By F. H. DODGSON
(Communicated by R. L. Jack, F.G.S.)

[*Read before the Royal Society of Queensland, June 8, 1895.*]

It is quite certain that large quantities of gold were won by the nations of antiquity. Enormous quantities were brought to Jerusalem in the reign of Solomon, a thousand years before Christ, and abundant evidence can be adduced of its common use among the ancient Persians, Greeks, Romans, and inhabitants of Asia Minor. None of the fields whence these large supplies were drawn are now being worked, though it is probable that they would all prove remunerative if they were reopened and attacked with modern appliances. The sources of Solomon's supplies are, and probably will always remain, doubtful. The Romans derived some of their gold from diggings in Italy, as may be learned from Virgil (Georgics, book 2, line 166), and some I believe from Spain, but I cannot give any reference except to Macaulay's Lay of Virginia. So far as I am aware we are in possession of no information as to the locality of the Persian auriferous country eastward of the Halys River. It is quite different however with the sources of the gold-supply of the ancient Greeks and inhabitants of Asia Minor. Herodotus has preserved for us an exact account of the position of at least five ancient goldfields, and it is quite possible that if any one will prospect him more thoroughly than I have been able to do, he will discover more.

I need hardly point out that these long abandoned fields would be in a sense virgin to the modern miner. The miner of antiquity had no blasting materials nor steam pumps, and was unacquainted with the use of mercury for amalgamation. Judging therefore from Australian analogy, he must perforce have left behind him many deposits which would yield a rich harvest to his modern and better equipped representative. Indeed the ancient man must have been shut up to alluvial in fairly dry ground and "dolly" reefs.

Having said so much by way of preface, I will now go on to specify the localities referred to above as having been described by Herodotus. The first on the list is the island of Siphnos in the Ægean, one of the group known as the Cyclades. Speaking of this island as it was about B.C. 525, the Father of History says "The affairs of the Siphnians were then in a most prosperous condition, as the island, owing to the gold and silver mines that were being worked there, was the wealthiest of the whole group. The annual yield of gold was tithed in favour of the god at Delphi, and such was the value of this tenth that the wealth of the Siphnian treasury at the Delphic temple rivalled the wealth of the treasuries of the most opulent states. Siphnos, as may be learned from the map, is a small island, and therefore not difficult to prospect" (Herod. III, 57). The next locality is another island, Thasos, at the north end of the Ægean, on the continuation of Mount Pangæus, the range that separates Thrace from Macedonia. With the Thasos goldfield may be associated the goldfield of Scapté Hylé on the mainland and opposite to it. Herodotus tells us (vi, 46, 47) that the Thasians with the proceeds of these mines not only defrayed the entire cost of the administration of the state, but also built themselves a fleet and surrounded their city with a wall of unusual strength (τεῖχος ἰσχυρότερον). Their total returns from these two fields were from two to occasionally as much as three hundred talents a year—an enormous sum for so small a community. The wealthiest mines on the island were to the south and east, opposite the Isle of Samothrace. Herodotus says that Mount Pangæus, above referred to, is also auriferous. He does not, however, give many particulars in regard to this range. He simply says that it contains gold and silver mines, the most valuable being in the territories of the Pierians, Odomantians, and Satrians. I have also seen it stated—but do not know on what authority—that Philip of Macedon, father of Alexander the Great, derived from these mines and those on Thasos and at Scapté Hylé the treasure that enabled him to carry out his projects. So much for Greece, Turkey in Europe, and the islands. The next locality to be mentioned, and the last, is in Asia Minor, and is in all probability the goldfield whence the proverbial Crœsus derived no small portion of his wealth. Crœsus was King of Lydia, his capital being Sardis on the Pactolus, an affluent of the Hermus ; the sands of the Hermus are auriferous, according to Virgil (Georgics II, 137) ; Herodotus mentions that the Pactolus is auriferous (Herod. I, 93 ; v. 101). He says nothing further as to the sources whence Crœsus derived his gold, but from the account he gives of the offerings which Crœsus made to Apollo at Delphi, it is quite evident that the yield from his mine must have been very large. Putting the above together it would seem probable that there is an important goldfield about the heads of the Pactolus on the northern slopes of Mount Imolus.

The French have made a very great success by reopening the silver mines at Lauricem, near Athens. The archæological discoveries of Dr. Schliemann are due to his knowledge of the ancient authors, and the intelligent care with which he followed the indications they afforded him ; and there is every reason to believe that discoveries of far greater importance from a commercial and industrial point of view would follow the application of modern mining appliances to the abandoned goldfields of antiquity.

CHEMISTRY OF SOME UNDESCRIBED GUMS.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, June 8, 1895.*]

[The matter contained in this paper is included in a Bulletin shortly to be issued by the Department of Agriculture.]

INSPECTION OF MEAT.

By EUGEN HIRSCHFELD, M.D.
(Honorary Bacteriologist to the Brisbane Hospital).

[*Read before the Royal Society of Queensland, June 8, 1895.*]

The export of meat is based on the fact that at a small prime cost we are able to supply the consumer on the other side of the world with meat of good quality and undoubted wholesomeness. Both these conditions are fulfilled only when the meat is the flesh of healthy cattle. In contradistinction to the live cattle trade, the consumer of frozen meat has to trust mainly to the seller, because it is more difficult for him to find the traces of disease in the meat which manifest themselves clearly enough in the viscera immediately after the animal has been killed. This being so, the consumer naturally expects that the same care, over which he has perfect control in his own country, shall have been exercised in the country whence the imported meat comes.

The centres of population in Europe are some of the markets we are looking forward to for the disposal of our surplus meat, and here we find that legislation has been insisted upon for all known infectious diseases of cattle and sheep with a view to prevent their spread to human beings. Their legislation has been based on the bacteriological discoveries of the last fifteen years and it presses somewhat hardly on the home producer of meat. Is it at all likely that these countries will forego the labour, care, and sense of safety such inspection confers, and relax it for the benefit of a foreign country from which there is absolutely no kind of guarantee or indeed statement as to the healthfulness of the meat sent over for sale ?

The real question is not whether we shall have inspection, but whether inspection—in common with European countries—shall be placed on the firm and reliable basis of Bacteriology.

Taking the laws in force in Great Britain, Germany, France, and America as a guide, I venture to make the following suggestions :—

(1) The Minister to appoint a competent inspector for every freezing and exporting meat works in the colony, who shall carefully inspect all live cattle, the meat of which is intended to be exported to foreign countries, with the view to ascertain if such cattle are free from disease.

(2) That such examination be made according to the rules and regulations to be prescribed by the Minister.

(3) That prior to appointment, every inspector shall undergo a course of six weeks' pathological and bacteriological instruction.

(4) That all animals meant for exportation be registered at the works they are slaughtered at, and that such registration shows the station or farm they are fattened on ; the sex, age, colour and breed ; every animal to be provided with a metal tag bearing a number corresponding to the entry book, to allow identification of the cattle with the carcass at the landing-place.

(5) That the inspector shall clearly state the condition in which animals are found, giving clearance only to such cattle as are free from disease. In cases of diseased cattle, the inspector to report them immediately to the chief inspector and to state the disqualification. No clearance to be given to any vessel

carrying meat to foreign countries unless the shipper of the meat has a certificate from the inspector, certifying that the carcasses are sound and healthy.

(6) That the annual report of the chief inspector to the Minister shall state the diseases, if any, found to be prevalent amongst the cattle meant for exportation, the stations or farms they were fattened on, the incidence of disease as regards sex, age, colour, and breed, and the organs affected, and by these means acquainting the owners of the cattle of the special conditions, healthful or otherwise, which affect their cattle.

Rules and Regulations.

1. *Tuberculosis.*—Every animal found to be affected with tuberculosis shall be seized, and the meat of such animals shall be excluded whatever the extent of the tuberculous lesions found in such animals may be.

(1*a*) That the inspector carefully note the location of the disease in the different organs of the animals, the sex, age, colour, and breed; the station or farm they were fattened on; and shall report to the chief inspector who, thereupon, shall furnish the Minister with information and prevent further loss by advising the owners of the cattle of the disease and what cattle are liable to it.

(1*b*) That in order to detect tuberculosis the inspector shall carefully examine the condition of the lymphatic glands of the chest, abdomen, lungs, liver and generative organs, and in cases where there is reason to suspect the disease, to remove all doubt by staining cover glass preparations as taught in the bacteriological course. Live cattle to be examined with tuberculine.

2. *Actinomycosis.*—The same regulations as for tuberculosis.

(2*a*) The same as in (1*a*).

(2*b*) That in cases where there is reason to suspect actinomycosis the inspector shall carefully note the condition of the tongue, lower jaw, and parotid gland, and in doubtful cases to use microscopical examination.

3. *Glanders and Fascy.*—Fortunately not present in the colony, so need not be referred to.

4. *Foot and Mouth Disease.*—Unknown in the colony.

5. *Anthrax.*—Immediate seizure of any animal suffering from anthrax, isolation and killing apart from other animals.

No portion of the animal to be used for any purpose whatever, and the entire carcass to be destroyed by fire.

6. *Symptomatic Anthrax.*—The same as in anthrax.

7. *Pleuro pneumonia.*—No animal suffering from pleuro pneumonia shall be used for export, *and every case of pleuro pneumonia arriving at the meat freezing works shall be isolated immediately.*

8. *Cattle Plague or Rinderpest.*—Unknown in the colony.

9. Any other disease not specified above to be reported to the chief inspector, who shall order an inquiry to be made immediately.

The suggestions made above may at first sight appear to be cumbrous, expensive and not easy to work. If such objections are advanced, I answer that the difficulty in carrying these ideas out will be smaller than hitherto the inspector will have conditions to deal with clearly defined, allowing him to arrive quickly at a decision. As regards the system being cumbrous, I admit that it would be more convenient to export the meat without inspection, but I must take leave to point out that the proposals I have made are to a great extent identical with the legislation passed by the United States of America, which had been insisted upon by other countries before they opened their markets to American meat and that such legislation has been instrumental in opening the markets foreign to America. On the other hand the advantages are obvious and great, for we are able to guarantee in every case the healthfulness of our cattle and sheep and meet all reasonable requirements. Should any injurious rumour arise and be maliciously circulated, we shall be in a position to trace every carcass back to the station or farm it was fattened on and furnish a report; and such a mode of procedure will, I believe, favourably impress foreign countries that we are using the precautions that skill, science, and good-feeling suggest to prevent any but the most wholesome and healthy meat being taken to their markets, and in this respect placing it on an equality with their own.

COLOURATION OF INSECTS.

By THOMAS P. LUCAS, M.R.C.S.E.,

L.M. AND L.R.C.P.E., L.S.A., ETC.

[*Read before the Royal Society of Queensland, July 7, 1895.*]

Colour in insects is believed to be produced by the sunlight. Various pigments appear to absorb certain rays of light, but to be unable to absorb other rays. The absorption of certain rays is said to mean the disappearance of ethereal vibrations at a certain speed. White is supposed to be caused by irregular reflection of the vibrations, and thus a greater distribution of light. This irregular reflection is believed to be produced by thin plates.

Again, heat and cold appear to affect the colours. Black and dark browns readily absorb heat and readily part with it; white more slowly and with difficulty absorbs heat, but slowly parts with it. As witness, black and white clothes. Hence the Arctic insects are largely or altogether dark coloured, to snatch, as it were, every sun's ray possible for their short existence. Northern birds, on the contrary, become white, so as to keep the heat of the body in as slow a radiation as possible.

Dr. Standfuss, of Zurich, experimented on a large number of chrysalides of the Painted Lady and Tortoiseshell butterflies. He found that by submitting these pupæ to a refrigerator atmosphere for 23 days, and then to normal temperature for another 12 days, that the emerging butterflies had the black colouration very largely extended and deepened, and that the red colour was faded and speckled over with black scales. In a word, under the conditions of cold, the butterfly, in being dressed in black, was being prepared for a cold climate existence.

He likewise found that the opposite conditions obtained where the pupæ were submitted to heat. He submitted 42 for 6 hours to a temperature of 104deg. F.; then for 12 hours to a natural temperature of 72deg. F.; then for 6 hours to a higher temperature of 104deg. F.; then for 12 hours to a natural temperature of 72deg. F. Twenty-eight butterflies emerged. The red was deepened, spread out in wider area, and scattered in scales over the thinned-out black marks and pattern. In a word, these were thus prepared for a tropical or sub-tropical sunshine existence.

The surroundings of the pupa often affect the colour. Most chrysalises are chocolate, brown, or black, or tinted with violet. These mostly bury in the ground, beneath a stone, the bark of a tree, &c., or in a cocoon. But some butterflies, and even moth pupæ, hang suspended on their food plant or otherwise, and secure more or less the warmth of the sun's rays. Those against rails, dark stems, &c., are generally brown. Those among green herbage are green or light brown, and often gilded with gold. Poulton found that caterpillars turning, with a background of white paper, gilded paper, or in a strong light, were oftener green or light brown, and were more gilded than those which turned against a background of black or in the dark, which latter were generally dark brown.

The green chlorophyll in the food of the caterpillar gives colour, and probably pigment foundation for light to play upon. Greens, yellows and browns may be thus accounted for. Gold is stated to have been in sufficient quantity to answer to analysis, and many scales appear like silver. Probably iron yields colour in its high dilutions. But it is almost safe to argue that in the same manner in which the elements give colouration to the plant and flower in their organic appropriation, so these same elements in the plant, eaten by the caterpillar, are laid up to give colouration, if needed, to the larva, and, when further needed, to the imago.

Many caterpillars are dimorphous; others are polymorphous. This is caused by the distribution of the green colouration and brown pigment. Many noctuid moth caterpillars, which feed at night, are brown; others, which hide in herbaceous leaves, are green. The hawk moth caterpillars are often polymorphous. The common convolvulus, which feeds on sweet potato, convolvulus, &c., appears in some half-dozen habiliments. The dorsal streak, naturally green, often becomes more or less darkened by distributed dark pigment as the larva grows. The same may be said of the lateral lines and of the oblique connective lines between the body segments. The extent of darkening pigment, and its manner of distribution on a field of green, determines the pattern. Thus some are quite green, others quite or almost black, and many patterns are intermediate. The colouration is protective. To ascribe to the creature the power of natural selection is a fable. The greens instinctively shelter in the leaves; the dark varieties cling to the stems or lay close to the ground. Collect a number and keep in a box with leaves only. The browns do not turn green, but all feed. They are automatous creatures and cannot turn themselves green or brown any more than the new-born babe could determine in natural selection whether it would be boy or girl. It is more rational and practicable to argue from analogy, that as in all creatures the sexes bear a nearly equal relation, or only differ in such proportion to meet the exigencies of death, accident, &c., of the species, so the caterpillars of a species which feeds on tree or bush shall be produced for the safety of the species as a whole in such ratio of morphism as the occasion and habits demand. Thus in any batch of caterpillars, a proportion can find secretive shelter under and on the leaves, while another proportion must seek for safety on the brown or dark stems, &c. Each caterpillar did not prepare itself for its duty post of safety, but all were prepared in individual colouration to intuitively distribute themselves as their Creator and Ruler determined. The Darwinism which relegates all such pre-natal determinations to the power of the creature itself in natural selection is, as a writer to the *Banking Record* lately tersely put it, nothing but polytheism. Such surmissals are unphilosophical and unscientific.

The colouration of the butterfly is doubtless protective and nuptial. The richness of colouration as the creature flies may well dazzle the creature's enemies. As the pea-hen, sombre and quiet, admires the display, dignity and majesty of her consequential gaudy-coloured lord, so the sombre lady butterfly is evidently equally dazzled with the brilliancy of her more favoured consort. The polymorphism of the female image is difficult of explanation. The Diadema Bolinda has been named some twenty-four times in consequence of the variableness of the females. Such variation is doubtless influenced by the damp or dryness more than by the temperature. It may also be that these females are thus enabled to frequent a larger number of species of trees or shrubs or flowers in the search of food, &c.; but whatever the cause, it had been foreseen, and each pupa automatously prepared for its position and duties.

Poulton tells us that he is convinced that the caterpillar is influenced in its nerve economy by its surroundings to definite instinctive actions. True; but surely no one in their senses would say that the caterpillar looked wisely into the future and itself provided against a state of being of which it had never had any experience. Light and shade, food, heat and cold all influence the individual in its automatous helplessness, but what laws determine its sex and its colouration type in all its stages is even beyond man's ken. Is the caterpillar wiser than man?

In the variations, and in the near assimilations of species, and even in the mimicries of nature, every species, male and female, knows its own mate. And in polymorphisms the variations go on from season to season in the play of the species, never changing to a new creature, unrecognizing and unrecognizable by its fellows. Antheræa Janetta is a silkworm moth in point. The multiple variation gives power of increased measure of concealment. No type keeps distinct, each may develop from a single batch of eggs.

I have only touched the barest outline of the subject. Little has as yet been done. Brisbane is most rich in numbers. I suppose there are nearly 400 species of Pyrales to be taken near the town—more than twice the number found in Great Britain and two-thirds the number found in all Europe. Scores of species remain to be discovered and described. The study is most healthy; it entails no hard work. The lady artist may revel here and do permanent helpful service. Again I urge the various members, but especially the ladies, to add to the pleasure and happiness of life by taking up this most charming, bewitching, and elevating study.

STRATIGRAPHICAL NOTES ON THE GEORGINA BASIN. WITH REFERENCE TO THE QUESTION OF ARTESIAN WATER.

By ROBERT L. JACK, F.G.S., F.R.G.S.

(Government Geologist of Queensland).

[*Read before the Royal Society of Queensland, July 7th, 1895.*]

A NUMBER of unsuccessful bores having been put down in the north-western portion of the colony, I think it my duty to do what is in my power to disseminate the latest information on a matter so nearly affecting both the public and private purses. The following are such particulars as I have been able to obtain regarding these bores:—

CHATSWORTH No. 1. (Head of Colar Creek). Drillings, quartzite with granitoid rock at bottom. Depth, 3,227 feet.

CHATSWORTH No. 2. Drillings, limestone, shale and quartz. Depth, 900 feet.

MARION DOWNS. (Georgina River, between mouths of Burke and Hamilton Rivers). Drillings from 730, 825, 1,510, and 1,560 feet; all limestone.

GLENORMISTON. (Between Mulligan and Georgina Rivers). Limestone at surface. Drillings from 520 and 1,100 feet, limestone and shale; deeper drillings (depth not stated), (1) dark, hard shale, (2) compact grey limestone with shale adhering, (3) dark grey sandy limestone, (4) hard quartzose rock. Drillings from 1,900 feet, granite.

Tooleybuck (Junction of Hamilton and Warburton Rivers); also called Toolibune and Tooleybuck:—

No. 1.—Depth, 917 feet.—Bore stopped in granite after passing through blue shales.

No. 3.—Depth, 817 feet.—Bore stopped in granite after passing through blue shales.

No. 4.—Depth, 456 feet.—Bore stopped in granite.

No. 6.—Depth, 860 feet.

Carandotta (Junction of Georgina River and Moonah Creek). Over 1,006 feet. Unsuccessful; no information as to strata.

The nearest bores in which overflowing water has been struck are those on Warenda run, extending, I believe, from the head station on the Hamilton to Pollygammon Creek; two (Nos. 2 and 5) of the Tooleybuck bores; and one at Llanrheidol, six miles up Saville Creek. The Warenda bores are in the vicinity of mud springs, the deepest (on Pollygammon Creek) being 77 feet. No. 2 Tooleybuck bore is 531 feet deep and "bottomed" on granite after striking an overflowing supply of 33,000 gallons per day. No. 5 Tooleybuck bore is 441 feet deep and gives 20,000 gallons per day; I have no information regarding the strata.

Regarding the structure of the Macdonnell Ranges in South Australia we have some important information from the Government Geologist, Mr. H. Y. L. Brown,* the pith of which, for the present purpose, is contained in a note by Mr. Brown to Mr. Etheridge's Appendix (pages 12 and 13 of the 1891 Report). Mr. Brown distinguishes three rock systems: (1) crystalline, metamorphic, gneissic and granitic Archæan rocks; (2) lying unconformably on (1), quartzite, quartzite-conglomerate, dolomitic limestone, limestone, sandstone, and slate, striking east and west, "lithologically similar and doubtless of the same [Cambrian] age" as the fossiliferous Flinders Range; and (3) red and pale sandstone, quartzite and shale with thin bands of limestone, lying unconformably on (2) and also striking east and west. These yield Lower Silurian fossils.

* Reports on Coal-bearing Areas in neighbourhood of Leigh's Creek, etc. Adelaide: By Authority: 1891, and Further Geological Examination of Leigh's Creek and Hergott Districts, etc. Adelaide: By Authority: 1892. Each report contains a Palæontological Appendix by Mr. Robert Etheridge, junr.

This threefold division is called in question by Dr. Chewings,* and also, as I learn from private letters, by Professor Tate. For the present purpose, however, it is enough to note the presence of metamorphic and palæozoic rocks in the district referred to.

Mr. W. O. Hodgkinson,† in the year 1876, showed that the Cairns Range, on the Queensland and South Australian border, was composed of "micaceous sandstones, porphyry, quartzose rocks and limestone," and accordingly in my first Geological Map of Queensland (1886) I coloured a small area between lat. 22 S. and the Tropic of Capricorn as "slates, schists, gneisses, etc." This classification was adopted in the Geological Map of Australia, published by the Victorian Government in 1887, and the portion of South Australia included in the Cairns Range was designated "Crystalline or Metamorphic." The same map shows, to the west of the Cairns Range, firstly, an area of Cretaceous rocks, and, secondly, an area of "Tertiary or Cainozoic" rocks extending to the eastern margin of the Macdonnell Ranges.

Professor Ralph Tate has recently informed me (in a letter, dated 18th December, 1894), that a *Euomphalus* of the same species as one found in the Upper Finke basin has recently been found in the Cairns Range. We have, therefore, definite information that palæozoic rocks (probably Lower Silurian) reach the borders of Queensland from the west.

It has been known since the issue of Daintree's Geological Map of Queensland in 1872, that the head of the Cloncurry River was in palæozoic or metamorphic rocks. Mr. Daintree understood this to be an isolated area; but on the Transcontinental Expedition (1881), I ascertained that these rocks crossed the Nicholson and Gregory Rivers, and they probably reach the Gulf of Carpentaria, near the Western boundary of Queensland. There is reason to believe that these rocks form a portion of the Selwyn Range, dividing the Cloncurry from the Burke River. No further information being available at the time, I drew the boundary line between the metamorphic rocks and the Lower Cretaceous so as to include in the former the heads of Wills' Creek and the Burke and Hamilton Rivers, in the Geological Map of 1886; and from what could be gathered from Mr.

* Trans. Roy. Soc., South Australia, Vol. xviii (1894), p. 197.

† North-west Explorations. Brisbane: By Authority: 1877.

Hodgkinson's traverse I mapped a portion of the watershed between the Burke River and Cotton-Bush Creek as an inlier of the metamorphic rocks.

The earlier explorers traversed the country with a view, almost entirely, to its cattle-carrying capacity, and from the frequent references to "rolling downs" and "Mitchell grass" up the Georgina River, I considered that I was justified in regarding this portion of the colony as being of the same character and origin as the "rolling downs" of the Western interior. The unsuccessful bores already mentioned, however, almost conclusively prove that metamorphic rocks are continuous from the Cairns Range to the Cloncurry area, and either come up to or very near the surface.

I have searched in vain the broken records of Burke and Wills' Expedition, in 1860-61 ; and the report of the *Queenslander* Expedition of 1879, for any indication of the geological structure of this district.

From all the information available up to this date I should regard the district north of a line, about to be indicated, as unfavourable country for the search for artesian water. The line extends from the boundary of the colony, by the Tropic of Capricorn, to the Georgina River, and thence north-eastward (perhaps not in a straight line) to the head of the Warburton River. The country north of this line, including the Cloncurry area, may be either Archæan, Cambrian, or Silurian, or one or other or all of these ; but for the present purpose the establishment of an approximate north-western limit for the water-bearing Cretaceous rocks is the essential point.

Mr. Daintree, in 1872, in his paper on the "Geology of Queensland"* recorded that a *Tellina* (a fossil so far as we know not found in rocks older than Cretaceous) was "found in a bed of horizontal limestone at the head of the Gregory, on the Barkly Tableland, and forwarded to me by Rev. W. B. Clarke of Sydney." While accompanying the Transcontinental Railway Expedition in 1881,† I observed, behind the Police Barracks, on Carl Creek, "a hard yellowish limestone, horizontally

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* Quart. Jour. Geol. Soc., Vol. xxviii, p. 278.

† Report on the Geological Features of part of the District to be traversed by the proposed Transcontinental Railway. Brisbane: By Authority: 1885.

bedded, unconformably overlying the nearly vertical sandstones, etc., which form the staple of the formation prevalent in the district, and which rises on the right bank of the O'Shanassy to a greater elevation than the limestone." The summit of the limestone formed a plateau which, I was informed, extended as far as Rocklands, under the name of "Barkly's Tableland." I believed the limestone to be the same as that described by Daintree, from which the *Tellina* was obtained, and on this account Barkly's Tableland was mapped as Cretaceous, whilst the extension of the Cretaceous area to the south-east appeared to agree with the "rolling downs" character described by the explorers. It is needless to say that limestone of any age is likely enough to furnish open, rolling and well-grassed "downs" country. It is quite possible that the Carl Creek Limestone may after all prove to be Lower Silurian; although in that case there remains the difficulty that the occurrence of the *Tellina* at Rocklands has to be explained away.

ANATOMICAL AND CHEMICAL RESEARCHES ON THE PARASITIC PHANEROGAMS OF QUEENSLAND.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, July 7, 1895.*]

Only few phanerogams depend for their existence on other phanerogamic plants. They fix their roots in the living tissue of the host and receive the assimilated sap of it into their own tissue. Some of these parasites are altogether destitute of chlorophyll, like the species of Cuscuta and of the half-parasitic genus Monotropa ; some contain only a small amount of true or modified chlorophyll like some species of Orobanche and Viscum ; and others have a splendid green foliage and large showy flowers like the Queensland species of Loranthus.

Now the question arises, whether the parasitic phanerogams alter chemically the juice of the plant they live on or if they just use the prepared material for building up their cellular and vascular tissues. A fine specimen of *Loranthus pendulus* growing on an ironbark had to give me the answer to this question. The root of the parasite was deeply inserted into the wood of the tree. The whole of the parasite was taken away and infusions of the different parts were examined for colour reactions, and a very wide gap between the chemical constituents of the parasite and that of the host showed itself at once. Infusions of all parts of *Eucalyptus siderophloia* are stained delicately blue by ferric acetate ; whereas those of the parasite (*Loranthus pendulus*) are stained grass-green by ferric salts (which colour is turned into purple by ammonia). Limewater gives a pink precipitate with infusions of ironbark ; whereas infusions of its parasite make a brown precipitate. Caustic potash, ammonia, sodium, sulphide and potass-cyanide establish a very marked difference between the saps of both plants : the Loranthus of *Eucalyptus siderophloia* gets pink by these reagents; that of the parasite attains a golden yellow colouration by them. Ammon. molybdate in nitric acid gives a dark brown precipitate with infusions of the ironbark, and a blood-red colouration with those of the parasite. Copper acetate gives a dark brown precipitate with ironbark; whereas infusions of Loranthus get greenish-yellow by it.

These reactions show plainly that the parasitic plants maintain vigorously their own life economy and that they do not only use the ready formed sap of the host for the construction of their body.

The other species of Loranthus and those of Viscum give similar reactions.

The species of the Dodder (like *Cuscuta australis*, R. Br.) also differ chemically very much from the leguminous plants on which they generally grow. These parasites are (nearly) destitute of chlorophyll. Their tissue consists for the most part of a juicy parenchyma with only a few scalariform vessels. There is plenty of starch in the cells which must be derived from the host, as the starch can only be produced by chlorophyll.

Infusions of the parasite are stained green with ferric salts and they contain more tannic acid than those of the Lucerne (*Medicago sativa*), on which the dodder grows. Besides this, there is a yellow colouring matter present which is turned golden by caustic potash and by sulphuric acid, and which is bleached by nitric and hydrochloric acid. No such dye is contained in infusions of the host of the parasite.

The species of the Climbing Laurel (*Cassytha*) are very common parasites in the Australian bush. They grow mostly on young eucalypts and destroy them by taking the light away. Infusions from *Cassytha melantha* gave the following colour reactions:—Ferric acetate, green; caustic potash, golden yellow; ferro-cyanide of potassium in ammonia, brown; copper acetate, yellow. These reactions are altogether different from those of the common trees on which the parasite lives.

Both genera, Cuscuta and Cassytha, are fastened to the plants by means of so-called haustoria. These I found to consist of flattened parts of the surface of the parasite on the concave side of the coils, emitting a kind of roots which penetrate into the bark or into the epidermis and into the inner tissues of the host.

THE DISCOVERY OF CHICKEN CHOLERA IN QUEENSLAND.

PART I.

By C. J. POUND, F.R.M.S.,
DIRECTOR OF THE STOCK INSTITUTE.

[*Read before the Royal Society of Queensland, August 10, 1895.*]

THE subject I wish to draw your attention to this evening is one of special interest, namely, the existence in Brisbane of an historical disease technically spoken of as *Septicæmia Hemorrhagica*, but more commonly known in European countries as chicken cholera. I say historical, because it was this disease that M. Pasteur proposed to introduce into Australia for the purpose of exterminating the rabbits in order to claim the reward of £25,000 offered by the Government of New South Wales.

Some two months ago I received information that a number of fowls and ducks were dying from apparently some form of poisoning at a place in this city. I requested that some of the dead birds should be forwarded to the laboratory for examination. Next day a muscovy duck was received which had just died. Post-mortem examination showed that the intestines were in a state of hemorrhagic inflammation and infiltration; the blood-vessels on the outer muscular coat of the small intestine had the appearance of being injected; on the mucous membrane several small ulcers were seen, while the contents of the intestines were streaked with blood; numerous hemorrhagic patches were found in both lungs. The outer surface of the heart was covered with several hemorrhagic patches, due to extravasation of blood. The pericardium, or membrane covering the heart, contained an excessive amount of serous fluid; the spleen was enlarged and dark in colour. The most pronounced feature, however, was the enormous enlargement of the liver, which was very dark in colour and extremely friable. These appearances coincide exactly with those found in chicken cholera.

Cover-glass preparations of blood from the liver, stained with Löffler's alkaline methylene blue and examined under the microscope with an oil immersion lens, were found to contain a few bacteria morphologically identical with Pasteur's microbes of chicken cholera. Inoculations were made with the blood of the liver on a series of sterilised tubes of 15% nutrient gelatine, 2% of glycerine agar and peptonised beef broth. These cultivations were placed in the incubator at a temperature of 38° C. for development; in 24 hours a characteristic growth appeared in each tube. The cultures were also examined microscopically, with positive results. Several inoculations were made on sterilised potatoes, which yielded typical cultures in four days.

Experiments on Rabbits, etc.

Experiment 1.—A mere trace of the blood from the spleen of the duck was injected into the subcutaneous tissue of a rabbit and a mouse; both died in about 14 hours, with all the symptoms peculiar to this disease. On microscopical examination of the blood from various internal organs of both these animals, the same bacteria were discovered; cultures also yielded positive results.

Experiment 2.—Blood from rabbit 1 was injected into a rabbit, a guinea-pig and a pigeon. In this experiment all the animals died within 24 hours, of acute septicæmia. Microscopical examination and cultivations on various nutrient media gave positive results.

Experiment 3.—A rabbit fed with a little of the blood from rabbit 1 died in 20 hours, with the same characteristic symptoms. Microscopical examination and cultivations also gave positive results.

Experiment 4.—Four rabbits were fed with a broth culture of the bacteria from the blood of rabbit 3; all died within 24 hours, with symptoms characteristic of infection from chicken cholera. Microscopical examination and cultivations again gave positive results.

In addition to the above experiments a number of other rabbits and fowls were experimented on, both by feeding and inoculation, the results of which were highly satisfactory in demonstrating the nature of the disease. All the animals used in the foregoing experiments were well nourished and healthy, having previously been kept under observation for several months.

Etiology of Chicken Cholera.

Pathogenesis.—Pathogenic for chickens, pigeons, pheasants, sparrows, and other small birds ; also for rabbits and mice. Subcutaneous injection of a minute quantity of a virulent culture usually kills chickens within 48 hours. Some time before death the fowl falls into a somnolent condition, and, with drooping wings and ruffled feathers, remains standing in one place until it dies. Infection may also occur from the ingestion of food moistened with a culture of the bacillus or soiled with the discharges from the bowels of other infected fowls. At the autopsy the mucous membrane of the small intestine is found to be inflamed and studded with small hemorrhagic foci, as are also the serous membranes; the spleen is notably enlarged. The bacilli are found in great numbers in the blood, in the various organs, and in the contents of the intestine. In rabbits, death commonly occurs in from 16 to 20 hours, and is often preceded by convulsions. The temperature is elevated at first, but shortly before death it is reduced below the normal. The post-mortem appearances are :—Swelling of the spleen and lymphatic glands ; ecchymoses or diffuse hemorrhagic infiltrations of the mucous membranes of the digestive and respiratory passages, and in the muscles; and at the point of inoculation a slight amount of inflammatory œdema. The bacilli are found in considerable numbers in the blood within the vessels, or in that which has escaped into the tissues by the rupture of small veins. They are not, however, so numerous as in some of the other forms of septicæmia—for instance, anthrax, mouse septicæmia—when an examination is made immediately after death ; later the number may be greatly increased as a result of post-mortem multiplication within the vessels. The rabbit is so extremely susceptible to infection by this bacillus that inoculation in the cornea by a slight superficial wound usually gives rise to general infection and death. This animal may also be infected by the ingestion of food contaminated with a culture of the bacillus. Both in fowls and in rabbits the disease may, under certain circumstances, run a more protracted course ; for instance, when they are inoculated with a small quantity of an attenuated culture.

It has been repeatedly proved that horses, cattle, sheep, goats, pigs and dogs are naturally immune.

Morphology.

The microbe of chicken cholera is one of the smallest germs known, rarely exceeding the $\frac{1}{15000}$ of an inch in length and the $\frac{1}{30000}$ of an inch in diameter ; in fact, it not only requires the use of specially prepared stains and the highest class lenses for its detection, but a certain amount of skill and perseverance in order to understand its morphological characters.

In cover-glass specimens of blood from an animal dead of septicæmia hemorrhagica, stained with an alkaline solution of methylene blue, the organisms appear when suitably illuminated under an oil immersion lens, as extremely minute slightly oval-shaped cells, the poles or extremities staining very deeply while the central portion remains almost clear.

They are mostly uniform in size, but more rarely some are seen to be very much longer, taking the stain in a more irregular manner.

Biological Characters.

The chicken cholera organism is non-motile, does not form spores, grows in various culture media at the room temperature, but more rapidly at 100° Fahr., or just above blood heat. It is an aërobic bacterium—that is to say, oxygen is required for its development.

Upon gelatin plates after three days incubation at 70° Fahr., the colonies appear as extremely minute granular spherical white dots, with a more or less irregular outline, and by transmitted light have a yellowish colour ; later the central portion of the colonies is of a yellowish-brown colour and is surrounded by a transparent peripheral zone.

In streak cultures upon the surface of sterilised tubes of nutrient agar agar, gelatin or blood serum, the growth is limited to the immediate vicinity of the line of inoculation, and consists of finely granular semi-transparent colonies, which form a thin greyish-white layer, with irregular somewhat thickened margins. Upon potato no development occurs, as a rule, at the room temperature, but in the incubator a thin yellowish, waxy layer is developed in the course of a few days. Development in *bouillon* (beef broth) is rapid and causes a uniform turbidity of the fluid.

In concluding this paper I may state that as far as I am aware there are no records to be found anywhere of any person having previously discovered the existence of chicken cholera in these colonies. I, therefore, claim priority in scientifically proving the existence of this most interesting and historical disease in Australasia. Further, I have every reason to believe that, from my own practical observations and the vast amount of information I have received from reliable sources, it has existed not only in Brisbane but in other parts of this and the neighbouring colonies for a number of years.

When we consider the extraordinary numbers of different breeds of poultry which have been annually imported into Australia from various European countries where chicken cholera has been known to exist from time immemorial, and also the numbers of live fowls (for table use) carried on passenger boats to Australia from different English, American, and continental ports, it appears more than ridiculous to suppose that a bacterial disease like chicken cholera should have been excluded from our shores up to the present time.

CAFFEIN-YIELDING PLANTS.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, September 7, 1895.*]

At the last annual meeting of the Acclimatisation Society His Excellency the Governor, Sir H. W. Norman, said he could not see a reason why we ought not to grow our own tea and coffee in Queensland. As there are plenty of coffee trees and also of tea shrubs growing here in Brisbane, I undertook a series of investigations concerning the chemical constituents of the different parts of these plants and of the quality of the Queensland product. In spite of the abundant literature on the subject, I was able to find out some new points worthy of interest, never mentioned before.

As Mr. Bernays, in his excellent "Cultural Industries for Queensland," has pointed out, the coffee tree grows best at an elevation of about 2500 feet above sea level. Brazil furnishes now the half of the coffee used in the whole world. The young trees want shade or they will not grow. In the third year each plant will give a first crop, about one shilling's worth, and the value of the crop will increase for the next two or three years. The berries do not get ripe at once, and the gathering is extended over four to six weeks. 100 parts of ripe coffee berries, gathered in Brisbane, I found to consist of 36 parts of pulp and 64 parts of beans included in the parchment. In these 100 parts I found 57 parts of water, 13 parts of dry pulp, 10 parts of parchment, and 20 parts of beans. Fresh ripe beans contain 0·4 per cent. of caffein. The quantity of cured beans (before roasting) will just amount to the fifth part of the weight of the fresh ripe berries. The pulp (13 per cent. of the dry berry) is always thrown away, though I found it to contain at least 0·5 per cent. of caffein in the dry state. So, in 1 kilogramme of ripe berries the 130 grammes of pulp contain between 0·6 and 0·7 grammes (10 grains) of pure caffein. When roasted properly the pulp yields a coffee good enough for home consumption. The parchment is used in Europe for mixing with roasted and ground coffee beans. It contains, as is also stated in the books, 0·25 per cent. of caffein, the 110 grammes of parchment in 1 kilo of ripe berries contain 4 grains of pure caffein.

The cured Brisbane coffee beans contain 1·5 per cent. of caffein, so that the 200 grammes of beans in the kilogramme of ripe berries contain 3 grammes of pure caffein. One gramme is contained in the pulp and the parchment, so that 1lb. of ripe coffee berries contains 30 grammes of caffein.

Of the cured Brisbane coffee beans 3312 go to a pound. They contain 7 grammes, or 105 grains, of caffein.

The coffee beans have to be roasted before they are used. They lose much weight through this, so that 4600 roasted Brisbane beans go to a pound. In spite of this, one pound of roasted beans contains only 8 grammes (120 grains) of caffein, as much of it is sublimated at a temperature of 380° C. If the beans are put in a covered tin box immediately after the roasting, the sublimated caffein can be seen on the beans after cooling in the form of white silky needles, which have been mistaken for mould sometimes.

The caffein is a heart poison, accelerating first and then retarding the action of the heart. A cat died in half an hour after it was forced to swallow 7 grains of caffein.

Besides the action on the heart the caffein is a stimulant for the nervous system, and is said to favour assimilation and to facilitate the breaking up of nitrogenous substances in the body. The maximum single dose of caffein allowed in the German Pharmacopœia is 2 decigrammes (3 grains); whereas, the highest dose for a day is put down as 6 decigrammes (equal to 10 grains). No restrictions are given in the British Pharmacopœia.

One cup of good coffee prepared from 10 grammes (150 grains) of roasted beans, contains just between 2 and 3 grains of caffein, so that only one cupful would be allowed at a time under ordinary circumstances.

The coffee plant contains in all parts a special tannin, called coffee tannic acid (3-5 per cent. in the unroasted beans). It is sharply distinguished from all other tannins by not coagulating the gelatine and not precipitating tartar emetic, even on addition of sal ammoniac. It stains ferric salts grass-green.

The most prominent reaction of infusions from all parts of the coffee plant not yet mentioned in the books is the golden yellow colouration, with alkalies and cyanide of potassium. Adulterated coffee can easily be found out on application of this test, as only brown tints are found with chicory and other substances. Acetate of copper is greenish with coffee tannic acid, and yellow on addition of ammonium carbonate. Lime water makes a greenish, lead acetate a greenish-yellow, ammonium molybdate in nitric acid a reddish-yellow precipitate. Ferro-cyanide of potassium in ammonia gives a greenish-brown reaction.

By the roasting process a part of this coffee tannic acid is changed into caffeol, and if the roasting is too strong, into catechol and phenol (carbolic acid), both of which I detected in the smoke of the roasting beans and in the fried beans themselves. The caffeol is an oily liquid to which the agreeable smell of the roasted coffee is due. It is said to be antagonistic in its action to the caffein, which explains the difference of the physiological effects of tea and coffee. The leaves of the coffee plant contain 63 per cent. of water. The dry leaves contain at least as much caffein as the dry beans. An analysis of the fresh leaves gave—water 63, coffee tannic acid 2·0, caffein 0·6, extract 10·0, insoluble matter 24·4. The leaves of the coffee tree have been roasted and used like coffee beans during the last twenty years with satisfactory results.

The Queensland coffee is at least equal to the Brazilian product sold in Europe, if not superior to it. In open bush land, with a deep soil, cultivation of the coffee tree would not be a failure, as the native trees would supply the shade so necessary for the young plants.

The Tea, *Camellia thea*, still grows wild in Assam. It wants a hot and damp, and therefore an unhealthy climate, as Mr. Bernays points out, and our dry country is not very suitable for tea-growing. Nevertheless there are good shrubs to be found in

Brisbane gardens. I found 65 per cent. of water in the fresh tea-leaves. The dried leaves contain a much higher amount of caffein than the dry coffee beans. From 100 grammes of dried tea leaves, grown in Brisbane, I obtained 3·8 grammes of pure caffein. The fresh leaves contained—water 65, tannic acid 3·5, caffein 1·3, other matter 30·0. For a good cup of tea about a drachm, or between 4 and 5 grammes of Chinese tea is wanted, and the cup contains then just 3 grains of caffein, like the coffee made from 2½ drachms of coffee beans. More than three cups of such strong tea during the day might produce bad effects on the heart and on the nervous system.

Besides the caffein there were small quantities of another alkaloid (isomeric with theobromine), found by Kossel in the tea-leaves. (*Theophyllin.*)

For the production of tea, fresh leaves of about six months' growth are wanted, and therefore pruning is a prominent feature in tea manufacturing. Fresh dried leaves have scarcely any aroma. It must be developed by fermentation, and this involves one of the drawbacks in the production. The leaves are first withered for some hours in the open air, to take their stiffness away and to prepare them for rolling. When they are soft enough, they are rolled together by the hands of the workers, a process not always connected with too much cleanliness. As the moisture in the rolls cannot get away, fermentation sets in, by which the aroma is produced; whereas the caffein does not undergo any change. After some hours the rolls are broken up and dried quickly and the tea is ready for packing.

Dry tea leaves contain 10 per cent. of a special tannin. According to Allen, it is thought by some authorities to be identical with gallotannic acid, and by others to consist of quercitannic acid. My researches show that it comes near to both, but that it cannot be identified with any of them. From gallotannic acid it differs by yielding a red phlobaphene if boiled with dilute hydrochloric acid, and by the brown precipitate with lead salts. From quercitannic acid it is separated in giving only pyrogallol by dry distillation. Its reactions are as follows:—Ferric salts, blue (purple with ammonia); alkalies and cyanide of potassium, pink; copper acetate, brown; lead salts, brown precipitate; ammon. molybdate in nitric acid, brown; limewater gives a white precipitate, turning blue; ferrocyanide of potassium in ammonia, Indian red. The tea tannin coagulates albumen of the egg and gelatine, and gives precipitates with alkaloids and with tartar emetic on addition of sal ammoniac.

There are many adulterations made in Europe by mixing the genuine tea with leaves of other plants. The Sloe (*Prunus spinosa*, L.) takes the first place. There is much tannic acid contained in the sloe leaves, but they are easily recognised, being much thinner than tea-leaves, and the same holds good for adulterations with the leaves of strawberries, roses, and blackberries. Besides this, the leaves of the sloe give a green reaction with ferric salts, and a golden yellow one with caustic potash.

The tea prepared from unfermented tea-leaves possesses just the same good qualities as that from fermented leaves, but it is nearly destitute of flavour. On a farm with deep soil and a good drainage, enough tea shrubs could be kept in any part of Queensland to supply the whole family with tea for a year, and, as the fermentation could be dispensed with, it would not give any trouble.

The Paraguay Tea, or Maté (*Ilex paraguayensis*), is a near relation to the European Christmas Holly. It is a small evergreen tree with shiny glabrous crenate oval leaves. It grows all over South America, and its leaves, mostly gathered from the wild plant, are just dried and roasted a little, without having undergone any fermentation, and after having been reduced to powder, are used like Chinese tea. As they contain less caffein a larger quantity of them is wanted for a good cup of tea. The Maté Tree grows remarkably well in the Brisbane Gardens. For my investigations I got a good supply through the kindness of the Curator, Mr. MacMahon. The fresh leaves contain 63 per cent. of water, 5·5 per cent. of tannic acid, and 0·4 per cent. of caffein, besides 30 per cent. of other substances. From the dry leaves I obtained 1·1 per cent. of caffein, so that nearly half an ounce of Paraguay tea is wanted to make a good cup of tea, equal to one prepared from one drachm of good China tea.

In Clamor Marquart's "Pharmaceutical Chemistry," the tannin of Paraguay tea is stated erroneously to be identical with coffee tannic acid. Allen puts it down as identical with tea tannin. The tannin is present in the dry leaves at 1·5 per cent., and it differs from tea tannin by some essential reactions. The blue colouration produced by ferric salt is turned intensely purple by ammonia, the brown precipitate by copper acetate turns violet on addition of ammonium carbonate, whereas tea tannin gets green. Tartar emetic gives a slight precipitate, lead salts give a white precipitate (tea tannin, brown), lime water gives a white precipitate turning green (tea tannin turns blue). Boiling with dilute hydrochloric acid yields a phlobaphene, and dry distillation gives pyrogallol.

The use of Paraguay tea is, in my opinion, to be preferred by people of a nervous temperament, with a weak digestion and a tendency to looseness, as it is weaker in caffein and richer in tannin than Chinese tea.

As the Maté Tree is getting on so well here, acclimatisation ought to be encouraged as much as possible.

The Kola nuts, or the seeds of *Sterculia acuminata*, a native of Guinea, in Africa, contain more caffein than the coffee beans (2 per cent.), so that I entertained the hope to find some caffein in the nuts of our Australian Sterculias. This hope has not been realised, as I was not able to detect any caffein in the nuts of *Sterculia trichosiphon* and *S. quadrifida*. The chemical constituents of the African nuts seem to differ widely from those of our seeds. The amylum grains of these are much smaller and there is much more fat and much less tannin present in our Sterculia seeds. The tannin of Kola nuts strikes green, that of our Sterculias gets blue by ferric salts.

Still, some other species might contain caffein.

The easiest way for detecting it is by sublimation. If a few drops of hydrochloric acid and a particle of potassium chlorate are added to the sublimated alkaloid, it gets purple (after drying) on addition of a little ammonia.

As there are caffein-yielding plants in Asia, Africa, and America, it is to be anticipated that we will yet succeed in finding a similar plant in the Australian flora.

FURTHER NOTES ON CRATER LAKES AT BAN BAN

By N. W. BROUN

(Communicated by Hon. A. Norton, M.L.C.)

[*Read before the Royal Society of Queensland, October 5, 1895.*]

[Specimens were exhibited of—(1) red, or terra-cotta lava, and (2) black lava, both very porous. Mr. Broun pointed out that he had observed river gravel, two or three feet in thickness, lying between two beds of lava.—R. L. J.]

A FISH-POISON OF THE ABORIGINES

By J. SHIRLEY, B.Sc.

District Inspector of Schools.

[*Read before the Royal Society of Queensland, October 5, 1895.*]

It has long been known to Australian ethnologists that the principles of certain plants are employed by aboriginals in poisoning or stupefying fish with a view to their easy capture for food; but little has been done to identify the plants employed, so that the chemist may make known to us the name and qualities of the alkaloid or other substance which the plant contains. Having to visit Mudgeraba, a settlement to the south of Nerang, on a creek of the same name, and distant about four miles from the sea coast, I made enquiries as to the use by the blacks of any plant substance in the capture of fish. That such means were employed was well known to the settlers, many of whom have been born and reared in the triangle lying between the Albert River, the Macpherson Range, and the sea. A plant locally known as the *tape vine* was named as furnishing the substance. By the aborigines it is termed *Nyannum*, and with their help the plant was found in the scrubs adjoining the old saw-mill at Mudgeraba, and identified as *Stephania hernandiæfolia*, belonging to the order Menispermaceæ. In a paper communicated to the Linnean Society of New South Wales, by Dr. T. L. Bancroft, in November, 1889, it was pointed out that an extract from the root of this plant is extremely poisonous to frogs, and that the poison causes loss of co-ordination of muscular movement in the creature. He also states that the action of the poison is similar to that of *Picrotoxin*, and that like that substance, it is an alkaloid. In a paper to the Royal Society of South Australia, in 1894, Dr. Rennie showed that *Picrotoxin*, as well as a second poisonous alkaloid, could be found in an extract from this plant. It is strange that the use of this poison should have been discovered and applied to other cold-blooded creatures by the natives of this country, whom writers, especially those who know least about the subject, delight to picture as the lowest of the human race. The part employed by them is the stem, which is cut in lengths of about 2ft., and frayed out by beating, just in the same manner as that by which the native cloth of the South Sea Islanders is made. The structure of the stem is abnormal in menisperms, the medullary rays being in excess, and possibly this aids in the fraying out of the plant. A well-known waterhole or rock-pool, noted as a good haunt for fish, is selected; and the bruised stem is scattered about in the water of the pool. The alkaloid is extracted from the bruised plant by the water, and its action upon the fish is said to be very rapid. Probably it also causes "a loss of co-ordination of muscular movement," as stated by Dr. Bancroft; but, whatever the way in which it acts, the fish float on the surface of the water, and soon find their way into the dilly-bags of the operators. It is asserted by the farmers living in the neighbourhood that the fish recover after a time, if left in the poisoned water, but of that I have no proof to offer. *Stephania* is a genus of an order from which is obtained the so-called *Cocculus indicus*, a drug well known to be employed in various countries in fortifying beer, and making it more intoxicant. Bentley states that it has been extensively used for a long period as a poison in taking fish and game. Further inquiry will probably prove that other plants of this order, as *Cocculus Moorei*, are also used by our aborigines in like manner. The only list of Australian fish poisons I have yet met with is by Mr. J. H. Maiden, in the July number of the *Agricultural Gazette* of New South Wales, for 1894; but no mention is made of any menispermaceous plant.

THE POISONOUS PRINCIPLE OF MACROZAMIA SPIRALIS.

By JOSEPH LAUTERER, M.D.,

[*Read before the Royal Society of Queensland, November 16, 1895.*]

[The matter contained in this paper is included in a Bulletin shortly to be issued by the Stock Department.]

ON ABORIGINAL CAVE-DRAWINGS ON THE PALMER GOLDFIELD.

(PLATE I).

By ROBERT L. JACK, F.G.S., F.R.G.S.,
GOVERNMENT GEOLOGIST.

[*Read before the Royal Society of Queensland, December 14, 1895.*]

THE figures about to be described are not introduced to your notice on account of their artistic merits, which would hardly procure for them a place in the National Gallery. They are, in fact, not much above the level of the dawn of art displayed on school slates. As examples of the art of a race in a stage of intellectual infancy, and which race will certainly die before attaining manhood, they possess, however, a certain interest for ethnologists.

All the drawings, except two, are from two localities within the limits of the Palmer goldfield, viz., Chinky Creek, a tributary of the Mossman, and Mun Gin Creek, an affluent of Cradle Creek, which is itself a tributary of the Palmer River. They occur in caves or on cliffs forming the escarpments of horizontal beds of the Desert Sandstone or Upper Cretaceous formation, which here lies unconformably on the upturned edges of Palæozoic schists. Geologically the drawings are, therefore, of more recent date than the upheaval and extensive subaërial denudation of the newest Cretaceous rocks; but there is internal evidence that they are probably not more than twenty-five years old. The drawings are reproduced (Plate I) on a uniform scale of one-twenty-fifth.

I am somewhat at a loss for a single word by which to name the drawings. A fresco was originally understood to be a drawing on wet plaster, destined to dry with the plaster. Later the word was applied to drawings on dry plaster. More recently any drawing on a wall was called a fresco. It would not be a great liberty to apply the word to a drawing on a natural wall or escarpment of rock.

Again, silhouettes, which were in fashion in the first half of the century, were drawings in solid black on white. The drawings about to be exhibited are solid masses of red or white on a buff back-ground. They would be silhouettes according to the strict definition, if they had been black.

No. 1 is in the "Dripping Cave," formed in the basal bed of the Desert Sandstone on one of the heads of Chinky Creek. From the roof of this cave a continual shower falls about 30 feet, and forms a small pool of refreshing water, even in the driest season. The drawing, in red ochre, is on a ledge of rock which dips at 60 degrees (from the horizon), and represents a much distended mammal. I was at a loss to name it, and called in the assistance of Peter, an intelligent native trooper, who, without a moment's hesitation, pronounced it a "porcupine" (*Echidna*). It has a sharp snout and four short legs, each of which terminates in four digits—at least the right legs do—while the extremities of the left legs have suffered from weathering. The sharp snout is suggestive of the *echidna*, but not the inflated cheeks. If it is an *echidna*, why did the artist omit even to hint at the spines, which are the most salient features of the animal?

No. 2 undoubtedly represents the same animal, although it differs from No. 1 in having four digits on the right legs and three on the left. This figure, and Nos. 3 and 4, are in caves in a bed of sandstone about 100 feet above the "Dripping Cave." No. 2 is drawn in red ochre on the roof of a cave which slopes at 20 degrees, and is about five feet above the level of the floor.

No. 3 is a lizard or crocodile (?), 4½ feet in length, drawn in red ochre, outlined with white clay, adjacent to No. 2, on the roof of the cave, which has the same angle. It is dabbed over with round spots of white clay, the neck being marked with a band of white clay, and a similar mark running along the middle of the head. There are four claws on each leg. Two of the legs are transfixed by or hung on two jagged spears, or, it may be, one broad spear. In the latter case this is the only outline drawing in the whole series.

No. 4 is on the roof of the cave, which dips at 30 degrees, and is five feet above the level of the floor. It is drawn in red ochre. It represents a woman (with four fingers on each hand) carrying, I believe, a baby on her neck. The pigment of the burden has scaled away in places, or it has been laid on confusedly to represent the apparent motion of a lively infant. Two small arms project above the mother's head and terminate in formidable clenched fists.

Nos. 5 to 14 are from caves or cliffs protected by overhanging rocks, on Mun Gin Creek, about 100 feet above the base of the Desert Sandstone.

No. 5 is the only one of a large series of piscatorial subjects which the weather had left in sufficiently good preservation to be made out. It is done in red ochre on a vertical surface. One white line runs across the base, and another along the middle of the head, and two round white dots on the head may be eyes. It may be mentioned that white lines, such as ornament Nos. 3 and 5, form a notable feature of many of the aboriginal human and animal drawings given by Mr. R. H. Mathews, in his paper on "The Aboriginal Rock Pictures of Australia," in the *Proceedings of the Royal Geographical Society of Queensland*, vol. x., p. 46. Mr. Mathews does not explain their meaning, nor can I. In the case of Mr. Mathews' drawings, I was tempted to regard the lines as "directions for carving," as the only parallel I can recall is in Mrs. Beaton's cookery-book, where animals are mapped out so as to show the different "joints" and "cuts."

No. 6 is a very remarkable group. It is in red ochre on an upright wall of sandstone, beneath an overhanging ledge. The male figure is 30 inches long. The drawing appears to me to depict the domestic economy of the grazier class of the intruding whites. A cow leads the way. It is in the emaciated condition which I recognise too well as characteristic of the cattle running on the Palmer goldfield, which is not, if the truth must be told, a first-class pastoral district. The animal is followed by a woman and man carrying a log. The woman supports the heavy end, of course. The aboriginal critic would have condemned the picture as untrue to nature had it been otherwise. The man is assisted with the little end by a child which brings up the rear. It may be remarked that the woman's foremost leg is singularly effective and spirited. It seems as if the artist had for a moment laid aside the conventionalities which evidently trammel aboriginal art, and succeeded, to some extent, in imitating nature. The woman's head is missing, probably through weathering, but the man's is a thing of beauty and in perfect preservation. It is adorned with ten locks, one of which stands upright, while the rest stand out all round the head but curve slightly upward at the extremities.

No. 7 is in red ochre, on a vertical wall under a ledge, and is 20 inches in length. It represents a man with exceptionally long arms, and three fingers on each hand. One leg is unusually good, showing a distinct thigh and calf. The remarkable feature of the painting is a four-pronged rod, resembling a lightning conductor, as long as the man's body, running straight up from the top of the head. It may be some festal style of hair-dressing formerly practised by the aborigines, or it may be a Chinaman's pigtail standing on end.

No. 8 is a group or procession of animals, occurring on a vertical surface beneath a ledge. The peculiarity of the position is, that unless the artist stood ten feet high he must have clung with one hand to a ledge two feet below his "canvas" while painting with the other, or stood on a platform, or been supported by his assistants. The foremost and smallest of the animals is in white clay, outlined with red ochre. The four others are all in red. The first (white) animal may be a pig. The second, third and fifth are unquestionably marsupials. The third has long hind and short forelegs. The fourth seems to me not a marsupial at all—witness the bison-like wither and the hoofed feet. The projections from the head of this animal I take to be horns, while those of the others are probably ears. My friend Peter, I may mention, calls the whole group "possum," but I cannot agree with him. The enigmatical fourth animal, if to be classed among cattle, is certainly not one of the Palmer breed. It is just possible that the artist may have seen and painted from memory one of the "buffaloes" descended from the herd imported in 1824, to Melville Island, by Captain Gordon Bremer.

No. 9 is a group of two figures. The larger figure is in white clay and the smaller in red ochre. The artist must have knelt while painting part of these pictures on the roof above his head. The head of the female figure is on a part of the roof of the cave which is only 10 degrees from the horizontal. The body is on a surface dipping at 40 degrees, and the legs on a surface dipping at 60 degrees. The smaller figure is painted on a horizontal roof as far as the waist (or where the waist should be), and the legs dip at 10 degrees. The meaning of the group is not clear, but it appears as if the woman supported on her arm a child nearly as large as herself. The woman's hands and feet are more than usually absurd, not so much from the fact that there are four fingers on each hand and three toes on each foot as from their general unshapeliness. The child has four fingers on the left hand, and, for a wonder, the correct number on the right.

No. 10 consists of two human figures, painted in red ochre, outlined with white clay. They appear to form part of a "corrobboree" group. One figure has two eyes, represented by dabs of white clay; possibly similar features adorned the other, but have peeled off. The legs and feet are remarkably clumsy. The hair is carefully arranged in seven "horrid" locks. Four fingers are the general rule, but one hand happens to have five. The figures are notable examples of that style of art sometimes disrespectfully described as "wooden." I imagine that the artist meant the series to be continued as far as the available surface would permit, but that the art critics persuaded him that as the figures were exactly alike, two would suffice for a sample of the whole.

No. 11 is painted in red, outlined with white, on a wall dipping at 75 degrees, at a height of only two feet from the floor of a cave. It is a human figure of the same class as the two in No. 10, and has two white eyes, and the same arrangement of the hair in "horrid" locks, but the locks appear to have been simply put in at discretion, instead of being carefully counted as in the two larger figures. It was possibly a first study for the projected group. There are four fingers on the left hand and three on the right. The feet are shapeless.

No. 12 is painted in red, on an upright wall. The human figure is one of a rather numerous series, with upturned legs. What distinguishes this figure from the rest is that the head is covered with an unmistakeable hat—a circumstance which may be accepted as proof that the drawing was made subsequent to the European occupation of the district. As for the upturned legs, possibly the artist had seen the performance of some professional contortionist in Cooktown or Maytown.

No. 13 is painted in red, on a vertical wall. Peter called it a "native cat," founding his view evidently on the white spots with which the lower half of the body, and the head, ears and legs are liberally decorated. It is an undoubted marsupial, but appears to be too heavily built for a native cat. I have my doubts regarding Peter's ability as an art critic, though I have a high regard for him as an active and intelligent member of the Mounted Constabulary.

No. 14 is also painted in red, alongside of No. 13. The figure is imperfect, having been encroached on by the growth of a lichen, which has left a mere undecipherable trace of a prostrate figure beneath. It is a female figure depicted in the act of falling to the ground. A more than usually earnest attempt has been made to depict the human contour. From the shape of the head and the " coming-down " of the hair, we may venture to guess that the subject was a white woman.

Some pictures of shields occur in the Mun Gin caves, but as a rule they are so badly drawn and so imperfectly preserved that they seemed unworthy of reproduction. Their general type may be described as that of a boomerang straightened out, and with a line drawn along the middle.

The two last drawings of the series (Nos. 14 and 15) are taken from a number of figures drawn on the underside of what may be called a " loggan-stone," at the head of a branch of Marshall's Creek, a tributary of the Mossman. The stone, about the size of a Pullman palace car, is all that remains of a thick bed of Desert Sandstone, and rests by a narrow point on the underlying bed of sandstone. The under surface of the stone (3ft. above the floor) has been selected for decoration with drawings, which, however, are mostly a good deal weathered. The two birds are evidently the same. Their general contour is suggestive of the "native companion," while their wingless condition points, on the other hand, to the emu or cassowary. The spots agree with neither. The tail of No. 15 is like that of a plucked fowl; the corresponding part of No. 16 is blurred by a portion of a superimposed human figure. The extreme attenuation of both birds rather inclines me to think that the models were "drawn" as well as plucked.

As an apology for the badness of the paintings, it may be said that the artist must, in most cases, have drawn from memory. In no case could he have had the model in front of him, as he painted not on a canvas but on a wall or roof.

From their state of preservation, or, in other words, from the extent to which they have suffered from weathering, I am inclined to think that all the paintings are about the same age. I am not sufficiently learned in "*technique*" to detect any such mannerism running through the paintings—with the exception of a certain "woodenness" which appears to be common to all aboriginal Australian art—as would enable me to declare with certainty that they are all the work of a single artist, although I think it very likely.

The peculiar positions of the drawings may be accounted for in two ways: first, the inherent laziness of the Australian aboriginal, whose favourite attitude is, not leaning on posts, but lying on his back; and second, the desire for immortality which fills the heart of every artist, however humble. With the latter end in view a position has always been chosen where the drawing would at least be protected from rain. In superimposing white clay on red ochre, or *vice versa*, the simple native displayed an ignorance of the chemistry of pigments which is not without a parallel, even among Royal Academicians. Hence the pictures can hardly be expected to outlive a single generation.

When first I lighted on the animal paintings, I thought for a time that I might be privileged to discover paintings of some of the extinct marsupials by contemporary artists, and so provide direct evidence not only of the co-existence of man and the extinct fauna, but also of the forms of the latter. Some of the subjects, although decidedly marsupial, were so grotesquely unlike the present fauna that the hope seemed reasonable, but I was compelled to fall back on the comparatively prosaic explanation of imperfect drawing. The hope was finally dashed to the ground by the discovery of the Palmer cow, and still more by that of the man in the hat, which proved that the drawings did not date further back than the settlement of the district by white man, viz., 1873. It is to be remarked that the hat is the only instance in which the artist has taken any notice of clothing, even on subjects presumably European or Chinese.

Before dismissing the subject, allusion may be made to the hazy ideas of the black artist regarding numbers. The number of fingers on the human hand is only correctly given in two cases, and even varies in the same individual. This vagueness, I think, is characteristic of the aboriginal mind. Not that the aboriginal is absolutely incapable of correctly appreciating numbers when he gives his mind to it. Probably the locks of hair on the two figures in No. 10 are correctly delineated, as they are drawn with great care, and the number (seven) is the same in both. Possibly the number of locks in this instance was of ceremonial importance.

I may mention finally that in a certain class of delineation I have found at least one native (of the Townsville district) singularly expert. The native referred to has many times, for my information, drawn route maps on the sand with a stick, in a manner which would be no discredit to a Fellow of the Royal Geographical Society, showing the river system of the district, where crossing a river was practicable, where a detour would have to be made to avoid a mountain or other obstacle, and so forth. Drawings of this class would be unlikely to be perpetuated by natives on caves or rocks,

L. C. Green, Del. H. W. Fox, Lith.

Aboriginal Cave-Drawings.

$\frac{1}{25}$ Nat size.

A PARASITIC SCOURGE OF WARM CLIMATES.

By A. JEFFERIS TURNER, M.D.

[*Read before the Royal Society of Queensland, December 14, 1895.*]

In the interests of preventive medicine it is desirable that the public should become acquainted with a serious but easily preventable parasitic disease which is widely distributed in all hot countries, but has only been recognised within the last few years as existing in Queensland.

The parasite which causes this disease is a minute worm, known to science under the rather cumbrous name of *Anchylostoma duodenale.* There has been, unfortunately, some confusion as to its generic name, and it is also known as *Sclerostoma* or *Dochmius.* All these names refer to the same species of worm. Its habitat is the upper part of the small intestine of the human being, and it lives by sucking the blood of its host in much the same manner as a leech. When present in large numbers—and it sometimes occurs by hundreds or thousands in one individual—it gradually reduces the sufferer to a condition of extreme or fatal bloodlessness.

The *Anchylostoma* was discovered by Dubini, in Milan, in 1838, but it was not till 1854 that Griesinger demonstrated its importance as a cause of disease in Egypt. He found that a condition of anæmia, or bloodlessness, which was very prevalent in Egypt, and was indeed known as "Egyptian chlorosis," was due to this worm. In 1866, Wucherer discovered the same parasite as a cause of a similar disease in Brazil. Since then the parasite has been discovered in many parts of the world. It is known in Southern Europe, Northern, Eastern and Western Africa, also in India, Assam, Ceylon, the Malay Peninsula, Cochin-China, Tonquin, Japan, Java and Borneo; and in the new world in Brazil, Colombia, Venezuela, Guiana, Peru, Bolivia, the West Indies, and the southern United States. In short, it is probably present in all tropical and sub-tropical countries. In

Europe, at least, it spreads far beyond the tropics, for it is found endemic as far north as Dortmund, in Westphalia, a town in nearly the same latitude as London. Roughly speaking, its northern limit in Europe coincides with that of the cultivation of the vine. I would draw attention to this as indicating that there is nothing in climatic conditions to prevent it from spreading into, if it is not already present in, the southern Australian colonies.

The first record of the occurrence of *Anchylostoma* in Australia was made in 1889, by Dr. Hogg, who found it post-mortem in an inmate of the asylum at Goodna. This remained an isolated observation until March, 1892, when the parasite was re-discovered by Dr. J. Lockhart Gibson and myself, during life in two children from Cairns, admitted into the Children's Hospital for anæmia. These cases are recorded fully in the Transactions of the Intercolonial Medical Congress, held in Sydney during the same year. Since that time many cases have been recorded by ourselves and other observers, from Cairns, Townsville, Mackay, Maryborough, and from various stations on the North Coast line between Brisbane and Gympie, and lately also from the Tweed River, just across the border of New South Wales. So far as is known at present this is its southern limit, but as the disease is one that may easily pass unrecognised, it is quite possible that it may extend further. There is no doubt that this pest has spread thoughout the coastal districts of the colony. From the interior no cases have, so far, been reported. In the south of the colony it appears to affect particularly the country districts, for I know of no case originating in Brisbane, though it prevails both to the north and south of this city. Whether it is really indigenous to the colony, or has been introduced, is beyond the reach of direct proof. I hold the latter opinion. When we come to consider the life-history of the parasite, we shall see that it is easily capable of being introduced from infected countries, and of being spread from one locality to another in the same way; and it is probably so spreading at the present time.

The adult *Anchylostoma* is a minute slender worm, from a quarter to half an inch in length. When fresh it is frequently of a pinkish colour, from ingested blood. I do not propose to describe its anatomy in detail on the present occasion. One point must, however, be mentioned as of special importance, and that is, that it possesses a mouth furnished with horny teeth. With these it clings to the mucous membrane of the human intestine, sucking the blood of its host into a thick muscular-walled pharynx. The quantity of blood extracted by one worm is insignificant, but that taken by hundreds or thousands of worms during the course of months and years becomes very considerable. Under normal conditions the worm never leaves its habitat in the bowel, but once there remains established for many years at least. The female worms discharge an enormous number of minute eggs. These pass from the body of the host by millions; and can be detected by microscopical examination; thus making the recognition of the presence of the parasite an easy matter.

The symptoms manifested by infected individuals are those of gradually progressive anæmia, or want of blood, varying in degree according to the number of parasites present. There is gradually increasing pallor of the face and lips, with gradually increasing weakness, and, in some cases, abdominal pain and digestive disturbance. Usually, except in extreme cases, the patient remains well nourished. This condition of pallor and weakness may last for years without increasing. In other cases the anæmia may progress so far as to be directly fatal; or, more commonly, the already weakened patient is carried off by some intercurrent ailment. In children, who so far have been the most frequent sufferers noted in Queensland, there is one symptom sometimes but not always present, which cannot fail to attract attention. This is a morbid propensity for eating earth, or indeed any kind of dirt. Earth-eating may occur in children who are quite free from *anchylostoma*, but it is of special importance, as we shall see, as exposing them to the risk of continually increasing infection, if they happen to reside in an infested district.

What now is the life-history of this parasite, and how does it come to attack human beings? Our knowledge of its life-history is not yet quite complete, but this much may be taken as fairly certain: Firstly, that the worm does not multiply in the intestine, but that every individual found there has been taken through the mouth from without. Secondly, that the eggs, which are discharged in such myriads, have been observed to develop in damp earth into minute larval worms; and these, when swallowed, have been observed to develop in the intestine into mature worms. From damp earth to muddy water is not a far step; and in these two we may look for our source of danger. In Europe it has been observed that those most frequently affected are those who are continually handling earth, more particularly brick-makers, those engaged in mining and tunnelling, and agriculturists. In one family which I know of, I was inclined to attribute the infection to drinking the water of a stagnant waterhole situated not far from the house. It is obvious that infected individuals, by distributing the eggs, will carry the parasite from one locality to another.

The rules for the prevention of this serious malady may be formulated under three heads:—

(1.) *Cleanliness in eating*—To eat with unwashen hands is dangerous, particularly to all who work on the soil in country districts. Children addicted to earth-eating must be broken off the habit at any cost; nothing but constant watchfulness will do this. In an infested district the habit, if unchecked, will almost certainly lead to early death.

(2.) *Carefulness as to drinking-water.*—Water in iron tanks above ground is not likely to become infected. Underground tanks and waterholes may harbour the parasite. If the water supply is doubtful, any simple form of filtration would probably render the water harmless as regards *anchylostoma.* Boiling the water is a certain preventive.

(3.) *The treatment of affected individuals.*—The parasite can be effectually expelled by suitable medical treatment. Every individual harbouring the parasite is a source of danger to others, and should be cured for their sake as well as his own.

COMPARATIVE GRAMMAR AND VOCABULARY OF THE YÖGUM AND YAGGARA LANGUAGES.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, December 14, 1895.*]

TABLE SHOWING RAINFALL AT BULIMBA, NEAR BRISBANE, DURING 1895.

By Mrs. CHARLES COXEN, M.R.M.S.

[*Presented at the Annual Meeting of the Society, January 25, 1896.*]

Month, 1895.	Total rainfall in each month.	Aggregate rainfall from 1st Jan. to end of each month.	Heaviest rainfall in 24 hours.	Number of days on which not less than ·01 of rain fell.	Aggregate number of such days from 1st January up to the end of each month.
January.. ..	25·51	25·51	5·00	21	21
February ..	5·15	30·66	1·72	13	34
March	1·20	31·86	·34	14	48
April	3·39	35·25	1·98	7	55
May	1·33	36·58	·44	7	62
June	*Nil*	36·58	*Nil*	*Nil*	62
July	·53	37·11	·32	5	67
August	·63	37·74	·32	3	70
September ..	2·30	40·04	1·23	3	73
October	2·08	42·12	1·15	6	79
November ..	5·49	47·61	2·45	11	90
December ..	10·32	57·93	2·80	15	105

NOTE.—This is the first year since I began to keep the record (January, 1883) that I have no rain to report for the month of June.—E. F. C.

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CONTENTS OF VOLUME XII.

VOCABULARIES OF THE GOWRBURRA AND KOOLABURRA TRIBES.

By JOHN SHIRLEY, B.Sc.
(District Inspector of Schools).

[*Read before the Royal Society of Queensland, February 8, 1896,*]

INTRODUCTION.

In the mountainous country between Taromeo and Kilkivan stations, there live two tribes of native blacks, evidently the remains of once powerful races, and having much in common in their languages, both being branches of the Wakar tongue, thus possibly pointing to a common ancestry. The Gowrburra occupy the tableland, forming part of the Burnett basin, between Nanango and Kilkivan, drained by Barambah Creek and its tributaries. The Koolaburra roam over the mountainous tracts between Taromeo and Nanango, which form the watersheds between the Brisbane and Burnett to the north, and the Brisbane and Condamine to the west.

From the names of the tribes it seems likely that the laughing jackass (Dacelo gigas), and the native bear (Phascolarctus cinereus), give them their tribal appellations, and these animals are probably their *totems* or tribal marks. A study of the aboriginal drawings, in the districts named above, might supply some interesting information as to the use of these and other animals as hieroglyphics. It would be well also to ascertain whether the animal, which gives a tribe its name, is eaten by members of that tribe, as the creature selected as *totem* is, in many parts of the world, tabooed to the tribe it is supposed to represent.

To the south of the Gowrburra and Koolaburra, another cognate tribe resides, whose hunting grounds extend from Esk and Cressbrook to Crow's Nest, over country watered by Cressbrook Creek, and other tributaries of the Brisbane River, joining it on its right bank. A commencement was made with a vocabulary of this third language, but it was pointed out by Dr. Lauterer, that a list of words in this Wackar tongue already existed in "The Australian Race," vol. III, p. 210, by E. M. Curr. No name was given to this tribe by Messrs. W. Landsborough and M. Curr who supplied the vocabulary, nor is the locality specified, but a comparison of my list with that of Curr's work proved their similarity.

The vocabularies presented to this Society are therefore restricted to the two tribes living in the southern extremity of the Burnett basin, or on the Burnett watershed. Many points of resemblance can be noted running through the three languages, and there are twenty words (†) in the Gowrburra list evidently derived from the same roots as the words of similar meaning in Curr's work, but only one word—*Bee*, the hand—is exactly similar. Comparing the Koolaburra words with Landsborough's list, twenty-eight words (†) are clearly drawn from the same root; and seven others (‡), *i.e.*, *Tambor*, mouth; *Moo*, stomach; *Goonang*, faeces; *Koondo*, bark; *Ban*, grass; *Mera*, thunder; and *Koondo*, canoe, are identical. On the other hand, there are many points of divergence, especially in the names of weapons, of family relationship, and even in the numerals. From the Lower Burnett vocabulary given in Curr III, p. 8-13, these differ wholly in the numerals, names of weapons, family relationships, names of sun, moon, &c.

Every care has been taken in preparing these lists, and it was mentally laid down as an axiom that no word can stand which relies on the statement of a single black. It would have given any onlooker some hours of intense enjoyment, who could have heard me taking my first lesson in Gowrburra from a party of that tribe of all ages, gathered round the veranda of the old Burnett Inn.

Many of the Koolaburra words were collected by the late Walter Scott, Esq., of Taromeo Station, who spoke the language fluently, and whose list was kindly placed at my disposal by Mr. Paulovitch of Nanango.

I have to thank Mr. T. G. Kerby of Nanango, for assisting me on various occasions by obtaining intelligent and reliable blackfellows as informants.

PRONUNCIATIONS.

a has the same sound as in *father*
i as in *sin*
ee as in *seen*
oo as in *food*
g is always hard, and approaches *k* in harshness.
g before *k* is very short
c is represented by *k* or *s*
q is represented by *kw*
dj is intended to represent the French *j* sound; as uttered by some blacks it approaches *th* and *sh* in English.
— in the middle of a word marks a distinct separation of syllables.

GOWRBURRA—BARAMBAH TRIBE.

I.—PARTS OF THE BODY.

English.	Gowrburra.	English.	Gowrburra.
Hand	‡ Bee	Face & forehead	M'war
Finger or nail	Gáyn	Eyebrow	Debinjin
Thumb	Geerah	Eye	† M'-air
Wrist	Bimbeen	Nose	† Mee
Arm	Gínning	Lip, mouth	Dambour
Elbow	Gulloommóor	Teeth	Daéng
Shoulder	Wallee	Tongue	Djunoom
Shoulder-blade	Warróo	Chin	† Yekah
Nape of neck	Wandah	Neck	Boúgour
Ear	† Beenang	Collar-bone	Boondárr
Breast	Dundárr	Thighbone	Gánim
Breast (of a woman)	Námoung	Loins	Garrom
Navel	Djwendjwen	Backbone	Búrroom
Belly	Moo	Urine	Gówoor
Testicles	Booroo	Stomach	Goonong
Penis	Dugkar	Liver	Gunnang
Buttocks	Munde	Heart	Doo
Foot	† Djinang	Kidney	Deeórr
Ankle	Wooloo	Diaphragm	Gúnnbee
Lower leg	Boojon	Ribs	Gunggeer
Calf	Mungam	Head	† Mŏw
Knee	Bun	Brain	Njar
Thigh	† Djúngar	Hair	Gun' gara

II.—NAMES OF PERSONS—(Not being proper nouns).

English.	Gowrburra.	English.	Gowrburra.
Blackfellow	Djan	Son-in-law	Gweyyum
Black gin	Boowórren	(My) child	Náremunnáh
White man	† Mie	Father	Bawoo
White woman	Wymáry	Mother	† Muwing
Black baby boy	Gábboo	Sister	† Djajee
Black girl	Yeramgan	Brother	Djajah

III.—NAMES OF ANIMALS.

English.	Gowrburra.	English.	Gowrburra.
Kangaroo	Gooróman	Black snake	Mullár
Wallaby	Wyar	Brown snake	Yellam
Opossum	† Djowán	Death adder	Minnoom
Native Bear	Gool-la or Kool-la	Iguana	Djoonbenu
Dingo	Boogeen	Carpet snake	Booee
Black duck	† Njaim		

IV.—NAMES OF TREES.

English.	Gowrburra.	English.	Gowrburra.
Apple tree (native)	Nyuggoor	Bunya	Bahnyee
Hoop pine	† Goonnem	Silky oak	Gánbeer
Blue gum	Maubúrrie		

V.—NAMES OF CELESTIAL OBJECTS AND PHENOMENA.

English.	Gowrburra.	English.	Gowrburra.
Sun	† M'weem	Thunder	† Mirray
Moon	Gagarra	Sky	Moonar
Star	Googie	Rain	Gooróy
Lightning	† Marra	Cloud	Bell

VI.—WEAPONS, Etc.

English.	Gowrburra.	English.	Gowrburra.
Spear	Billar	Fishing net	Dammer
Waddy	Mo-or	Opossum rug	Giddes
Boomerang	Barrón	Gunyah	Barroo
Shield	Goomurrie		

VII.—GEOGRAPHICAL TERMS.

English.	Gowrburra.	English.	Gowrburra
Mountain	Gooéngee Bóyair	Creek	Girrárr
Ridge	Bóyair	Waterhole	Goong
Plain	Ween	Swamp	Yiddíng

VIII.—NUMBERS.

English.	Gowrburra.	English.	Gowrburra.
One	† Garroo	Three	Gooróm dah
Two	† Bayu	Plenty	Yourón

IX.—PHRASES.

English.	Gowrburra.
Go away	Yanna
I am going	Yanandie
I have gone	Goyango yanandie
Light a fire	Guyoom marrá
Give me a light	Nárrigúyum
What is it?	Minyanda?
Draw water	Ninyear gungo
Come here	Yearbá
I am coming	Nyabear

X.—ADVERBS.

English.	Gowrburra.
Yes	Yoh
No	Wackar

KOOLABURRA—TAROMEO TRIBE.

I.—PARTS OF THE BODY.

English.	Koolaburra.	English.	Koolaburra.
Head	† Mow	Breasts	Dundar
Hair	Kum	Arm	Gining
Eye	† Ma	Hand	Na
Face	Kwunor	Finger	Na
Ear	† Pinang	Nail	Kellon
Nose	† Me	Leg	Booyu
Mouth	‡ Tambor	Thigh	† Djungar
Lip	Tambor	Calf	Yula
Teeth	† Diang	Foot	† Djinang
Chin	† Ega	Toe	Djinang
Cheek	Wanka	Tail	Djun
Forehead	Kwunar	Skin	Pel
Beard	Ega	Blood	Dur
Tongue	Djunum	Faeces	‡ Goonang
Stomach	‡ Moo	Urine	Gour

II.—NAMES OF PERSONS—(Common nouns).

English.	Koolaburra.	English.	Koolaburra.
The blacks	Moron † djun	Girl	Kinkin
A blackfellow	Moron † djun	Baby	Nuny
A black gin	Kin † booberan	Father	†Pabo
One black	Kabun moron	Mother	Gnulhan
Two blacks	Boyu moron	Husband	Mawm
Three blacks	Koromto moron	Wife	Mawmeun
Four blacks	Boyu boyu moron	Elder brother	Djutha
White man	Day	Younger brother	Djerang
Old man	Koorlorkna	Elder sister	†Djathia
Woman	†Booberan	Younger sister	Kundon
Old woman	Worankan	Children	Nunemmuen
Boy	Perang		

III.—NAMES OF ANIMALS.

English.	Koolaburra.	English.	Koolaburra.
Porcupine ant-eater	Kar	Wood duck	Munaro
		Scrub turkey	Wowan
Native bear	Koola	Pelican	Djunkar
Native dog	Watha, Nunda, Boging	Laughing Jackass	Goggaga
		White cockatoo	Kiar
Kangaroo	Koroman	Black cockatoo	Wyalla
Opossum	† Djuan	Swan	Wanam nurra
Emu	Knewi	Fly	† Deong
Iguana	Djoomben	Mosquito	Moongee
Eagle hawk	Kwial	Worm	Djeam
Crow	† Waw	Snake	Yuran
Black duck	Knami		

IV.—NAMES OF TREES AND THEIR PRODUCTS.

English.	Koolaburra.	Botanical Name.
Tree	Tado	——
Wood	Tado	——
Bark	‡ Koondo	——
Grass	‡ Bun	(Any succulent kind).
Wild rosella	Yárra	Hibiscus heterophyllus, *Vent.*
Kurrajong	Déwrie	Sterculia diversifolia, *G. Don.*
Native orange	Doója	Citrus australis, *Planch.*
Red ash	Dunánya	Alphitonia excelsa, *Reissek*
——	Moorjung	Cupania pseudorhus, *A. Rich.*
Cork tree	Goomúrrie	Erythrina vespertilio, *Benth*
Green wattle	Gnjumgahn	Acacia decurrens, *Willd.*
Hickory wattle	Boorgun	Acacia aulacocarpa, *A. Cunn.*
Mezoneurum	Bówar	Mezoneurum brachycarpum, *Bent*
Falcate-leaved wattle	Búrra	Acacia falcata, *Willd.*
White bloodwood	Gou-únya	Eucalyptus trachyphloia, *F. v. M.*
Bloodwood	Goodén	,, corymbosa, *Sm.*
Gum-topped box	Woórgun	,, hemiphloia, *F. v. M.*
Blue gum	Moonburrie	,, tereticornis, *Sm.*
Narrow-leaved iron-bark	Bie	,, crebra, *F. v. M.*
Silver - leaved iron-bark	Gaygár	,, melanophloia *F. v. M.*
Moreton Bay ash	Woonára	,, tesselaris, *F. v. M.*
Apple-tree	Nankoor	Angophora intermedia, *D.C.*
Scrub ironwood	Burran	Myrtus Hillii, *Benth.*
——	Gooréng	Solanum aviculare, *Forst.*
Mistletoe	Binyára	Loranthus sp.
Cypress cherry	Denjúmgah	Exocarpus cupressiformis, *Labil.*
Large stinging-tree	Burrie	Laportea gigas, *Wedd.*
Peach-leaved poison-bush	Dínjin	Trema aspera, *Blume*
Native fig	Djaka-óor	Ficus platypoda, *A. Cunn.*
Oak	Goúrnah	Casuarina torulosa, *Ait.*
Hoop pine	† Gooném	Araucaria Cunninghamii, *Ait.*
Grass-tree	Dackowar	Xanthorrhæa arborea, *R. Br.*
Blady grass	Barile	Imperata arundinacea, *Cyr.*

V.—NATURAL OBJECTS AND PHENOMENA.

English.	Koolaburra.	English.	Koolaburra.
Sun	Ghigan	Wind	† Boran
Moon	Koolaua	Mist	Tom
Star	Googie	Thunder	‡ Mera
Cloud	Bail	Lightning	† Mura
Sky	Gnoor or Knoor	Darkness	Kneun
Rain	Kwang	Morning	Kitty & Knoorang
Rainbow	Kewar or Gewar	Day	Djigonda
Light	Kuewom or Kitty	Night	Naugh
Shadow	Wangie or Woninge		

VI.—WEAPONS, FURNITURE, Etc.

English.	Koolaburra.	English.	Koolaburra.
Wood spear	Djua & Kwa (gua)	Club	Djabur
Shield	Koormu	Food	Djuer
Tomahawk	† Mouim	Canoe	‡ Koondo
Stone knife	Koomkam, Thungar	House	Koondo
		Camp	Moron
Boomerang	Buran		

VII.—GEOGRAPHICAL TERMS.

English.	Koolaburra.	English.	Koolaburra.
Hill	Piare	Country	Dja, Djuan
Creek	Grira	Ground	† Dja

IX.—ADJECTIVES.

English.	Koolaburra.	English.	Koolaburra.
Alive	Meal	Full	Munangy
Dead	Bongy	Quick	Perama
Big	Dandy	Slow	Djella djella
Small	Djunk djunk	Blind	Ma koun
Long	Kwungay	Deaf	Pinang koun
Short	Djumka djumka	Strong	Tarin
Good	†Kulang	Weak	Djungar or duranga
Bad	†Yang	Heavy	Tarin
Hungry	Duroy	Light (not heavy)	Kurra
Thirsty	Koonge	Wrong	Yang
Red	Kooyer	Straight	Djunim
White	†Djieling	Crooked	Warung
Black	Knomun knomun	Mine	Knaamah

X.—VERBS.

English.	Koolaburra.	English.	Koolaburra.
Eat	Tha	Strike	Boombe
Sleep	Boyanda	Fight	Poomjou
Sit	Kniona	Kill	Boombir
Go	Yango	Fall	Yera
Come	† Yeaba	See	Mea
Tell	Ya	Hear	Paengi
Speak quickly	Porama ya	Know	Warka
Run	Djia	Swell	Dandy
Bring	Parey	Sing	Yahganbar
Carry	Knerdure	Weep	Doongir
Make	Yugar	(Am) tired	Kying boongy
Break	Knuna		

XI.—ADVERBS.

English.	Koolaburra.	English.	Koolaburra.
Afraid	Bungangy	Yesterday	† Moonir
Yes	‡ Yoh	To-day	Tooroo
No	† Wackar	To-morrow.	Munimunoo

XII.—MISCELLANEOUS NOUNS.

English.	Koolaburra.	English.	Koolaburra.
Heat	Kamumba	Smoke	‡ Djum
Cold	Knear	Hole	Nula
Fire	† Kooum	Lump	Wanka
Water	† Koong	Path	Dumpa
Demon	Taran	Footmark	Ghinang
Ghost	Taran	Smell	Moor
Stone	Tie		

XIII.—NUMBERS.

English.	Koolaburra.	English.	Koolaburra.
One	Kabun	Three	Koromto
Two	Boyu	Four	Boyu boyu

THE RESINS OF CALOPHYLLUM INOPHYLLUM, *LINN.* AND CANARIUM MUELLERI, *BAIL.*, AND THE METARABIN-GUM OF BAUHINIA HOOKERI, *F.V.M.*

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, February 8, 1896.*]

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THE

ABORIGINAL LANGUAGES OF EASTERN AUSTRALIA COMPARED.

A PHILOLOGICAL ESSAY.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, March 6, 1896.*]

THE aboriginal languages of Eastern Australia all belong to the same family. They are more or at least as much related to each other as the languages of the Arian or Indo-Germanic family. The words are derived from roots which are common to all of them. All our aboriginal languages are very rich in words and forms. There are more words in their languages for one concrete subject than in any of the Indo-Germanic languages.

In the same manner as the Sanskrit must be considered the leading and best preserved language of the Arian family, or as the Finnish is the purest of the Altai languages, so the languages of Northern Queensland are purer than those of Southern Queensland and of New South Wales. There are about twenty different languages in Eastern Australia, each of them split up into a large number of dialects, and it is a most interesting fact that one word, the word for *foot*, *t'sitne* is the same in all these dialects. No other word besides that runs through all the aboriginal dialects of Eastern Australia. Now there is one word which is characteristic in showing a division between the aboriginal languages of Queensland and those of New South Wales, the word for camp or house. From the 20th degree North, down to the borders of New South Wales, the word for camp or house, is ngpi, humpi, or yamba. From here through a large part of New South Wales, house or camp is given by wullai, wurrai, or wuttai, as l, r, and t can be used as substitutes for each other.

In the Wirrai languages west of the Great Dividing Range of New South Wales ngurumba is used for camp and house.

It ought to be supposed that words for father and mother would be the same in all the East Australian dialects, but this is not the case. In nearly all the Indo-Germanic languages the word for father is derived from a root *pa*, which coincides with the root *pa*, "to protect." The word for mother is derived from a root *ma*, which coincides with the root *ma*, "to produce." Now it is a strange fact that similar words for father and mother occur in different parts of the globe. Whereas in the most of the aboriginal dialects of Queensland the word father is given by "bing," or "beong," or "buna" (Dawson River); still there exist synonyms for it, like "boba" in the Wakar language on the Upper Brisbane, "buba" in the Yaggara of the Lower Brisbane, "babun" or "bobin" in the Karbi, on the Burnett.

In the Wirrai dialect on the Murrumbidgee, the general rule is reversed. Father is called "mamma," mother, "papa." As all these words cannot be derived from Sanskrit roots meaning "to protect" and "to produce," it is evident that *pa* and *ma* are only to be considered as the first efforts of the infantile human race, to use the organs of speech in connection with the nearest and most beloved objects of childhood.

As already mentioned, the languages of all Eastern Australia belong to one and the same rootstock. With a very few exceptions the negative is derived from the same word, still preserved in the northern languages, namely, "Kara" or "Kura," which means "No." The exceptions refer to languages belonglng to another rootstock, put between "Kura" languages by migrating tribes from the west, like the Koi language west of Tenterfield and Glen Innes, where the foot is called "winnier," and like the Beall language around Sydney, which died out long ago, and where the foot was called "manoe." Pure Kura or Kara is spoken by the Goa tribe, and the other tribes in the district of Gregory North, on the sources of the Diamantina River, in the southern and eastern parts of the Mitchell district, and also in the whole district of South Kennedy, on the waters of the Burdekin, and in the northern part and western half of the Leichhardt district, on the tributaries of the Dawson River. Between the Goa tribe (Gregory North), and the waters of the Burdekin, the Nowa language of the Tateburra tribe is interserted between the Kura languages. Foot is "dina," father "murina," but strange elements from the west seem to have been interpolated. The northern part of the eastern half of the Leichhardt district is occupied by tribes speaking Kanggu. These dialects have the same roots in the vocabularies, and indeed, the negative Kanggu is to be derived from Kara, emphasized by apposition of nggu.

On the whole globe the nations have never been satisfied with a single negative, as a comparison with our Aryan languages can show. "Ne" was the original negative of these, as is still preserved in the Slavonian "nie." The Latins already put another word, "un," to the simple negative, and said "non," that is, not one. The Gothic and Anglo-Saxon negative was "ni," their daughter languages put "echt," something, behind it, changing the word to the German "nicht," the Dutch "niet," and the English "not," all of which mean, not anything.

The Scandinavian language went even a step further, and omitted the negative *ni* altogether, transforming the word "nikke," to "ikke," which literally would mean, something, instead of nothing. The French language was not satisfied with the emphasized Latin "non," it wanted an additional word. "Not" was expressd by "ne passum," not a pace. The true negative can now be omitted in isolated use, and the word "pas," meaning literally a pace, advanced to the dignity of a negative. In a similar way our East Australian aboriginals have not been satisfied by the simple negative "Kar," or "Kara." They added other syllables before or after it, and the negative "Kanggu," in the languages of the north-western part of the Leichhardt district, is the first instance of this.

In the Port Curtis district, north of Rockhampton, the negative is "yamma," and "tamma." The vocabularies contain the same roots as the Kara languages. *Y* and *t* are of the same value as *k* in all the languages (Grimm's laws), and the *m* is very often changed with *r* in the languages of Eastern Australia. So both forms of negatives are just an unessential variation of

"Kara." It is of very great interest that more than 300 miles south-west from Rockhampton, that is to say on the head waters of the Paroo and Warrego rivers, near Charleville, the negative "yamma" is again found with tribes using mostly words of the Curda language.

South of Rockhampton, the Byellee tribe speaks the Wonda language, which is one of the Wakkar dialects to be mentioned directly.

In the Leichhardt district, south of the 24th degree, the Wakkar languages begin; following up the head waters of the Dawson River, crossing the Main Range to the sources of the Burnett River, and from there following the mountains and occupying the whole tract between Moreton Bay, the Brisbane River, and the railway line from Brisbane to Dalby.

The Yaggara language near Brisbane is indeed a Wakkar dialect, including the Gowar dialect on Moreton Island and the Dsandai on Moreton and Stradbroke islands, as both these dialects know the negative "yaggara," besides the negatives "gowar" and "dsandai."

In the Wide Bay district south of the Wando dialects, and in the eastern part of Moreton district down to the Brisbane River, another language is spoken, the Karabi, or as it is misspelled, the Kabi, or even Gabbie, between Gympie and Brisbane. Father is given by "beya" or "babbun," or "babbin." In this dialect, the ear (a word characteristic of many East Australian languages, is represented by "pidna" or "binnung."

Karbi or Karabi is the negative *Kara* emphasized by the apposition "bi."

South of the Karbi dialects, the Yuggum language begins, following the coast tract east of the Dividing Range, from the Albert River down to Grafton, and is split up into many dialects. The negative "wakar" is an abbreviation of "wakara," that is to say "wa-kara," indeed not. "Wa" and "ya" means indeed. "Ya," "yau," and "yo," are used in the different languages of Eastern Australia for the affirmative "indeed" or "yes," and it is a strange coincidence with the Teutonic affirmative, say with the Gothic "ya," as it is found in Ulfila's Bible, and with the German, Dutch, and Scandinavian "ya" (ja) used as an affirmative up to the present time. The English yes is composed of two words, of "ya" or "yea," indeed, and of the copula "is," meaning, indeed it is. "Ya" cannot be derived from any root, it is merely an exclamation of surprise or consent common to all mankind. "Wa" and "ya" are of the same value, therefore the negative "wakara," or "wakar," used on a tract covering 300 miles in length, is altered to "yakara" or "yaggara" on the Lower Brisbane, and around the city (Brisbane).

"Marmong" or "mammong" means father in these dialects. The camp is given by "himbing," characteristic of Queensland, and by its synonyms, "weabra," and "murra," reminding one of the word "wurra," or "wutta," characteristic of New South Wales. Some nearer relations seem to exist between the Yuggum language and the dialects of the Yamma in the Port Curtis district.

The word "yukum" has to be derived from "ya," indeed, and "kum," a mutilated form of "kara," not, as in our aboriginal languages the *m* very often takes the place of *r*. West of the Dividing Range between the border and Grafton, the Yukum languages run into the dialects of the Wakar, and the negative receives the form of Yakka. To this category belong the languages on the head waters of the MacIntyre west of Warwick and Stanthorpe, the Pikumpal language on the Dumaresq, and MacIntyre and Prealagh languages on the sources of the latter.

West of the Yakka dialects of the Darling Downs district, the Wolleroi or Yeralleroi language is used, extending into the south-eastern part of the Maranoa district on the Culgoa and Ballon rivers. Camp or house is given by "wullai" or "wollai" in all dialects of this language. Father means "yabbo" or "benno" and "busine," the male form of the Yaggara word, "busang," used for mother, in the Moreton district. The negative "woll" is an altered form of "wo-kar" or "wo-kal;" "wo" is indeed, and the "ll" stands for "kara." On the Bokhara River the word is transformed into "wulla," and further south it takes the form of "wail."

The Wirri language has only a dialectic relation to the Woll language. "Wirri" stands for "wikri," "wi" is the emphatic, "kri" is the real negative. The Wirri dialects which include Ridley's Wiraduri, are the most widely spread dialects of Eastern Australia. They are and have been spoken with very little difference south of the Namoi and Barwon rivers, as far as Bourke, then in the plains and along the rivers Castlereagh, Macquarie, and Bogan, and over all the immense tracts of land westward to the line from Bathurst to Albury. In the Forbes district, "widdi," in the Bathurst district, "wirrai," is the negative. East of the Great Dividing Range we find dialects of the same language in the Camden district, near Kiama and Wollongong; on Botany Bay the negative was "mirra," whereas the Sydney blacks with whom Governor Phillip met, spoke one of the Woll dialects, where the negative was "beall." Between Sydney and the Hunter River, the negative is "worri," on the Hunter River it has changed into "yalla," which is the same word as "yaggara" in a mutilated form.

On the Manning and Hastings rivers, the negative is "kuriat," and "korang," the vocabularies belong to the Kura languages; "beung" is father, "murrai" is camp.

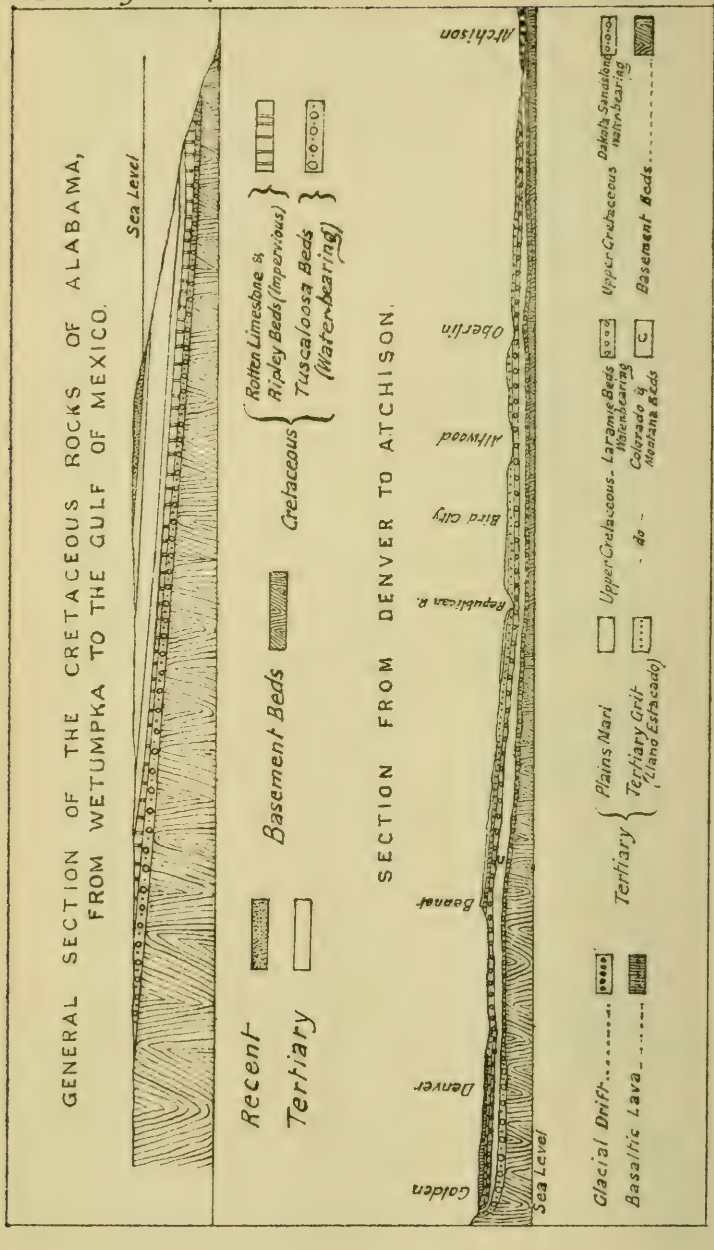
On the Macleay, the negative "kara" is emphasized by "kimbo," "karakimbo," or "kokimbo."

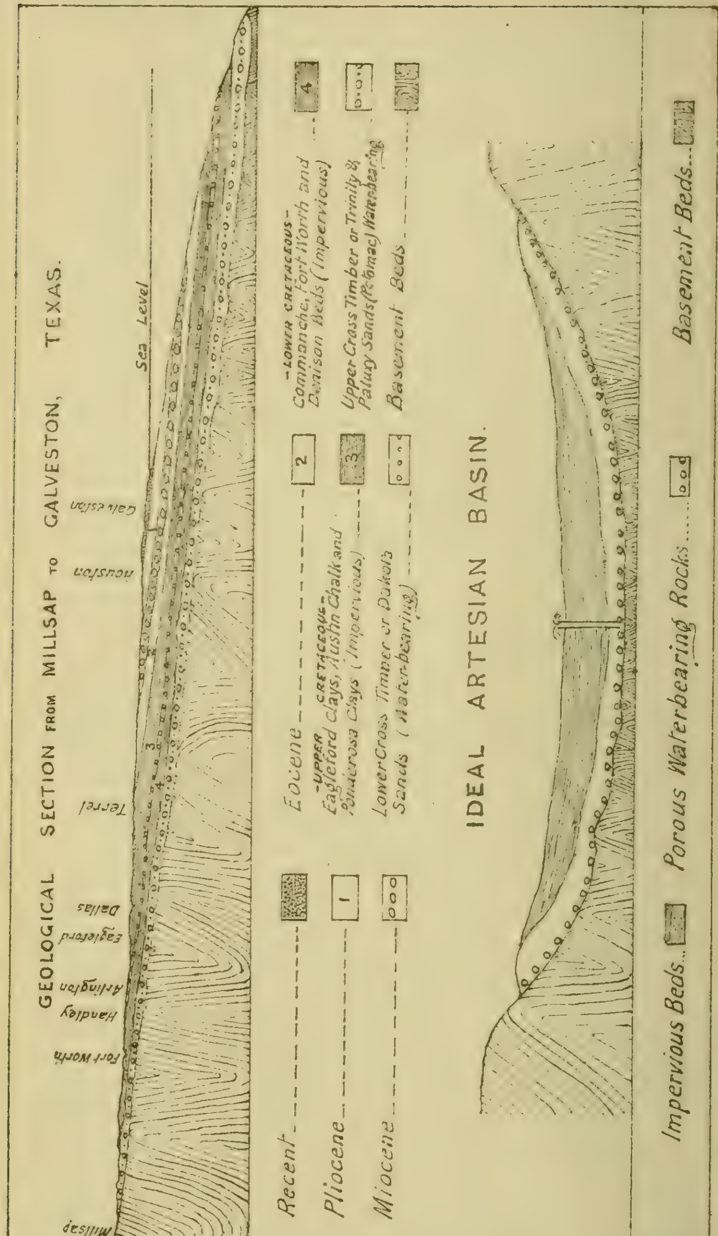
The Koi language, west of Glen Innes, has already been referred to, and it only remains to notice the Urda or Kurda, and the Kamil.

The Kamil (Kamilaroi), is spoken in the tract of land enclosed on the east by the Dividing Range, on the south by the Namoi, and on the west by the Barwon. In the Karmil or Kamil language the negative "kara" is emphasized by the apposition "mil." "Buba" is father, "binna" is ear, "malli," is camp. Very many words familiar to the Brisbane student of aboriginal languages occur in the Kamil. "Marumba" (good in Yaggara), means sweet in the Karmil.

The Kurda language is spoken in the southern part of the Mitchell district, and in the Warrego and Maranoa districts (in Queensland). There exist some dialects, and one dialect of the Yamma is interpolated between them. "Kurda" is the negative "kara," emphasized by the apposition of *da*. Instead of "kurda," we find "hurda" or "urda," and "arda" as negatives in the different dialects. The vocabularies differ much from those of the Kara dialects. "Yabba" is father, "munga," ear, "yamba," house.

I am to some extent indebted to Mr. Curr's book on the aboriginal languages for these comparative studies, which demonstrate the indubitable fact of one and the same rootstock for all the languages and dialects of Eastern Australia.


GENERAL SECTION OF THE CRETACEOUS ROCKS OF ALABAMA,
FROM WETUMPKA TO THE GULF OF MEXICO.
Sea Level
Recent
Tertiary
Basement Beds
Cretaceous
Rotten Limestone & Ripley Beds (Impervious)
Tuscaloosa Beds (Waterbearing)
SECTION FROM DENVER TO ATCHISON.
Golden
Denver
Bennet
Republican R.
Bird City
Allwood
Oberlin
Atchison
Sea Level
Glacial Drift
Basaltic Lava
Tertiary
Plains Marl
Tertiary Grit (Llano Estacado)
Upper Cretaceous. Laramie Beds Waterbearing
- do - Colorado & Montana Beds
Upper Cretaceous Dakota Sandstone Waterbearing
Basement Beds


GEOLOGICAL SECTION FROM MILLSAP TO GALVESTON, TEXAS.
Sea Level
Millsap
Fort Worth
Handley
Arlington
Eagleford
Dallas
Terrel
Houston
Galveston
1
2
3
4
Recent
Pliocene
Miocene
Eocene
-UPPER CRETACEOUS- Eagleford Clays, Austin Chalk and Ponderosa Clays (Impervious)
Lower Cross Timber or Dakota Sands (Waterbearing)
-LOWER CRETACEOUS- Commanche, Fort Worth and Denison Beds (Impervious)
Upper Cross Timber or Trinity & Paluxy Sands (Potomac) Waterbearing
Basement Beds
IDEAL ARTESIAN BASIN.
Impervious Beds...
Porous Waterbearing Rocks.....
Basement Beds...

THE GEOLOGICAL STRUCTURE OF EXTRA-AUSTRALIAN ARTESIAN BASINS.

(Plates I. and II.)

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[*Read before the Royal Society of Queensland, April 17, 1896.*]

PART I.

Among the multifarious duties of an official geologist in a country like Queensland, not the least important are those which affect the question of water supply. In the years 1889 and 1891, and still more in 1894, my attention was directed to the geological structure of the artesian water area of Western Queensland. A summary of the mass of evidence accumulated by Mr. Jack and myself in this region has already been given by him in a paper read before the Brisbane Meeting of the Australasian Association for the Advancement of Science.* In order adequately to explain what may be called the permanence of the water supply, it was shown that the water-carrying beds must have an outlet to the sea.

With the view of ascertaining whether in other parts of the world the artesian water-bearing strata have a like connection with the sea, or present facilities for the escape of water at a lower level than that at which it is received, I have been led to study the structure of artesian basins in general, so far as is possible from a careful perusal of the literature and maps available. In the hope that these notes, which are essentially a

*Artesian Water in the Western Interior of Queensland; R. L. Jack, Bulletin No. 1, Geological Survey of Queensland. Brisbane. By authority: 1895.

compilation, may be of use to other individuals engaged in similar investigations, I have been induced to lay them before the members of the Society.

North America.—Australians are largely indebted to the Americans for instruction in the art of well-boring, hence it is not unnatural that attention should be first directed to a country which counts its artesian wells by the thousand. The total number of wells in the western part of the United States, as ascertained by the Census of the year 1890, was 8,097. These were found in North and South Dakota, Nebraska, Kansas, and the states and territories to the west of these, and on to the Pacific Coast.

The United States Government, recognising the importance of having an exhaustive scientific examination made of the arid regions of the interior, with the object of amelioriating the conditions of life therein, appointed a commission consisting of geologists and engineers for this purpose.

A perusal of the official reports of the Commission reveals the fact that the great bulk of the supplies of water are drawn from Cretaceous strata, to which may be added the less copious yield of the Tertiary and Recent Beds.

The Cretaceous Rocks of North America have been divided into two series, an Upper and Lower, each of which has been further subdivided by different observers into different horizons. The relations of these formations have been very much misunderstood, and the nomenclature much confused—different writers having applied different names to the same formations. Without entering into the much-debated question as to the classification of the American Cretaceous Rocks and their correlation, it will suffice for the purpose of the present paper to mention that each series may be divided into an Upper, clayey or impermeable, and a Lower, in which sandy or porous beds predominate.

The Potomac horizon lying at the base of the Cretaceous may be traced from Central New Jersey through the Atlantic and Gulf States to Northern Mississippi for a distance of fully one thousand miles. The Dakota horizon is known only in the interior part of the Continent, and is regarded by some of the American geologists as forming the base of the Upper Cretaceous.

On examining any recent geological map of the United States, it will be found that the lowest member of each series occurs on the surface along the Atlantic coast from Long Island as far as the James River in Virginia. It reappears from beneath a mantle of Tertiary and Recent beds on the western boundary of the State of Georgia, and continues without interruption as far into Kentucky as the junction of the Ohio and Tennessee Rivers, resting alternately on impervious beds of Carboniferous and Archean age. The Cretaceous rocks again rise from beneath Tertiary rocks in Arkansas, near the head of the Onachita River, and cover a large area in the western interior, flanking the Rocky Mountains, from Texas northwards through the States of Kansas, Nebraska, and Dakota, as far as the Canadian frontier, and thence through Manitoba, Saskatchewan, Athabasca, British Columbia, and Alberta. The western boundary of these rocks in the United States is in Montana, from whence it travels southwards through Wyoming, Utah, Colorado, and New Mexico. Cretaceous beds, having no physical connection with those above mentioned, are known along the Pacific border in the ranges to the west of the Sierra Nevadas.

The Atlantic Border Region, in which the water-bearing strata crop out, consists of land rising gradually from the sea to the foot of the Appalachian Ranges, increasing in width to the south, and attaining a greater elevation as the mountains are reached. The western edge of this coast belt in Pennsylvania varies from one to three hundred feet; in Virginia it is about 500ft.; while in Georgia it attains a height of from 300ft. to 400ft. above sea level. Everywhere in this region the Tertiary and Cretaceous beds have a gentle dip towards the sea.

In the State of New Jersey, the Cretaceous formation can be divided into an upper and lower series, the former consisting for the most part of impervious clays, marls and sands, about 500ft. thick, the basal bed being a clay marl of some thickness. The lower series is made up of plastic clays, sands and gravels, attaining an aggregate thickness of 347ft.; at the base is a thick mass of sandstone, arkose, gravel, sand and clay, known as the Potomac formation. None of these beds, which are continuous to the northward through Long Island, appear to rise much above 250ft. above sea level.

As showing the dip of the above described beds, the following passage may be quoted :—

"The several borings for artesian wells which have been "made to the south-east of the marl belt, confirm the conclusions "which had before been reached as to the dip of the Cretaceous "strata of Southern New Jersey; and borings on the borders of "the ocean, and even out on the sand beaches, which are some "miles from the upland, show that the strata outcropping at the "high ground in the marl region are continued without change "or disturbance of their regularity, as far out as these borings "have been made."*

The succeeding Tertiary beds for the most part consist of marls, clays and sands.

An artesian well at Winslow, Salem County, penetrated the Tertiaries to a depth of 335ft., and after passing through two thick beds of sand, respectively 95ft. and 107ft. thick, separated by impervious clays, was carried down 15ft. in pure green sand. These two thick beds of sand, known as "Glass Sands," form no less than one-fourth of the whole of the New Jersey Tertiaries, and supply the bulk of the water from this formation.

Another well at Atlantic City attained a depth of 1,398ft., and obtained its water from a bed of white sand met with at a depth of 1,119ft., after passing through nothing but impervious clays and marls. Not far from the Atlantic City well, another was sunk to a depth of at least 1,125ft., but no particulars are available.

The dip of the Tertiary Rocks in New Jersey is to the south-east, at from 20ft. to 40ft. per mile.

From the above it will be seen that the artesian wells in the State of New Jersey fall into two main groups. First, those associated with Tertiary strata; these are necessarily located upon the ocean side of the State. In these beds, eight water-bearing horizons have been proved. At three localities, Beach Haven, Atlantic City, and Ocean City, on the sea coast, only a few feet above the high water mark; the lowest horizon has been pierced at depths varying from 575ft. to 720ft. The wells of the second group are associated with Cretaceous strata. These are located along a belt from 15 to 20 miles long, bordering the

*Annual Report of the State Geologist of New Jersey, for the year 1881; p. 21.

Delaware River, and also on the east and west line, extending from Trenton to Woodbridge, New Jersey. These wells cannot possibly draw water from the Tertiary strata, because the latter are entirely absent from this belt. The wells in the Tertiary region may be continued till they tap the water in the Cretaceous beds, in which four distinct water-bearing horizons have been proved.

The New Jersey Cretaceous series is continuous across the narrow portion of the State of Delaware, whilst the sandy series, resting on Archean Rocks, passes through the City of Wilmington to the north-west corner of the State, and thence into Maryland. To the Cretaceous succeed the Tertiary beds, which have a low dip to the south.

In the State of Maryland, as is the case in the two last mentioned, the Cretaceous beds are divided into an upper and lower series. They occur in what is known as the Coastal Plain, comprising an area between the Atlantic Ocean and a line passing north-east and south-west from Wilmington to Washington, through Baltimore. The surface of the Coastal Plain is characterised by broad level-topped stretches of country, which extend, with gradually increasing elevations, to its western edge, where heights of 300ft. are found.

The Lower or Potomac series rests directly upon ancient and impervious crystalline rocks. It consists chiefly of sands and clays, with gravels at certain localities. An attempt to subdivide this series into a lower sandy and an upper clayey member has not been altogether successful. In the centre of the State, the width of the outcrop of the Lower Cretaceous is about 15 miles. The formation is continuous into the Gulf Region, where it is known as the Tuscaloosa Group.

The Upper or Severn series consists of fine sands and laminated clays, and is on the whole much more argillaceous than the Potomac beds. To the south of Maryland, the Upper Cretaceous does not again appear at the surface until North Carolina is reached, in which State, and in South Carolina as well, as throughout the Gulf region, it is well developed.

The Potomac River crosses the catchment area of the artesian water-carrying beds from Washington to Glymont for about 20 miles. According to the various sections exposed, these beds dip south-eastward at a low angle, which will carry them below the level of Chesapeake Bay.

In Virginia, few exposures of the impermeable Upper Cretaceous beds have been noted, which is partly due to the extensive area over which the surface of the State is occupied by Tertiary beds, which surface erosion has not entirely denuded.

At Fort Monroe, the water-carrying sandy strata (the Potomac Group) were met with in a well at a depth from 835ft. to 907ft. The overlying impervious Cretaceous beds were apparently absent. The total thickness of the Potomac Group has not been ascertained, but the United States Geological Survey estimates it at from 500ft. to 600ft.

In the States of North and South Carolina, the sandy porous beds at the base of the Cretaceous, are seldom exposed. Those which are known are few and unimportant, but such as they are they afford evidence of the continuity of the formation throughout the whole of the Atlantic Border region.

In a deep well at Aiken, South Carolina, the full thickness of the Potomac Group is exhibited. The formation consists successively of sand (55ft.), fine white sand and kaolin, locally called chalk (30ft.), and sand and soft sandstone, with some clay (335ft.), reaching a total thickness of 420ft. The well ended in granite. The few exposures of the Cretaceous strata in North and South Carolina, demonstrate the dip of the beds to be seaward, and the overlying Tertiary strata have a similar inclination.

With reference to the Cretaceous beds of the Atlantic region, the northern New Jersey section shows that the western margin of the formation reaches an altitude of 300ft. above sea level, while the eastern margin is 900ft. below high water mark; the North Carolina section shows a similar state of affairs, but the depth of the eastern margin beneath the sea level is not nearly so great.

From the Atlantic Border, the Cretaceous and overlying beds are continuous into what is known as the Gulf Border Region, which includes a portion of the States of Georgia, Alabama, Mississippi, Louisiana, Tennessee, Kentucky, and the whole of Florida. The maximum elevation of this region is scarcely over 600ft.

In its geological structure, the region bordering the Gulf of Mexico is identical with that of the Atlantic Border. The formations exposed belong respectively to the Cretaceous, Tertiary, and Recent. The dip, which is practically the same throughout, averages 20ft. per mile. There is a much greater thickness of beds in the Cretaceous series here than in the States on the Atlantic Border. The thickness nowhere exceeds 2,600ft., and the width of the outcrop is not far from 50 miles in places.

In the State of Alabama, the water-bearing strata have been studied in considerable detail, and accurately mapped. The results have been published on the Geological Map of the State, issued in 1894. The beds from which the bulk of the water is derived are known by the name of the Eutaw and Tuscaloosa beds, which represent the Potomac Group in the States to the north-east. The strata consist of about 1,300ft. of cross-bedded sands, sandy clays, and thin pebble beds. These are estimated to cover an area of about 8,000 square miles.

The group enters the State on the eastern boundary, at the town of Columbus, in the neighbourhood of which the width of the outcrop is about 10 miles, and is crossed almost at right angles by the Chattahoche River. From the eastern boundary of the State, the outcrop extends due west to the town of Wetumpka, from which place its width gradually increases to the north-western corner of Alabama. As measured along the western frontier, from the base of the Lower Cretaceous to the base of the impervious strata, the width is about 120 miles. Nowhere does the surface occupied by these beds rise to a greater altitude than 300ft. above sea level. (Plate I, fig. 1).

The aggregate thickness of the formations exposed in what may be called the Coastal Plain region has been found to be about 5,500ft., of which 2,500ft. may be referred to the Cretaceous, 1,800ft. to the Eocene, and the rest to the later Tertiary and the Quarternary. The whole of the beds dip at a low angle, about 40ft. per mile to the south, which carries them below the level of the Gulf of Mexico.

At the town of Livingston, Sumter County, at an altitude of 150ft. above sea level, and situated just to the north of the lowest Tertiary beds, a bore was put down to a depth of 1,062ft. The drill passed through pretty nearly the whole of the impervious strata, and stopped in a bed of very fine green sand, belonging to the Eutaw Group, and did not apparently penetrate to the base of the water-bearing rocks. The top of tbe water-bearing rocks was met with at 960ft.; two small supplies of overflowing water were met with at 964ft. and 1,005ft. respectively.

An artesian bore at Bladen Springs commenced in Tertiary rocks, and terminated in that formation at a depth of 1,345ft.

At Pollard, Escambia County, 80ft. above sea level, a supply of water was obtained from Miocene Beds at a depth of 70ft., with a pressure capable of forcing the water to a height of 30ft. above the surface.

Another well at Mobile, near the head of Mobile Bay, was carried down 650ft. in Miocene Strata, but was not continued far enough to pierce the beds of the Potomac Group.

From Alabama, a similar series of beds extends northward through the State of Mississippi, and as far into Tennessee as the junction of the Ohio and Tennessee rivers. The geological structure of the Cretaceous and Tertiary areas of these two States is identical with those last described.

I have been unable to find any reference to artesian wells in the favourable area, but there is little doubt in my mind that efforts in this direction would be crowned with success.

Owing to the enormous area covered with Tertiary and Recent strata, the water-bearing Cretaceous rocks do not reappear at the surface nearer than the western corner of the State of Arkansas, not far from the head of the Onachita River.

The eastern portion of Texas is mainly a continuation of the Great Coastal Plain, other portions of which constitute both the Atlantic and Gulf Border regions, and a part of the North Mexican district, but that plain here gradually merges into the higher lands of the Great Plains of the interior. The inland boundary of the eastern part of the Texan region corresponds to the line of surface junction between the Palæozoic and Mesozoic rocks. The general elevation above the sea of much of the greater part of the surface of the region is comparatively slight, and that along the inland boundary seldom reaches 1,000ft., even at places fully 400 miles from the Gulf coast. The general dip of the strata, in and around the Gulf of Mexico, to the east of the Palæozoic area, is towards the present outline of the Gulf coast, at a very slight angle, a little greater than the slope of the surface; the beds to the west of the Palæozoic area have a gentle dip to the west.

The Cretaceous beds are largely developed in Texas, and portions have been studied in considerable detail in some localities, more especially in the neighbourhood of the Colorado River.

In this neighbourhood the base of the Lower Cretaceous consists of a group of rocks made up for the most part of sandstones, coarse conglomerates, and grits, separated by impervious argillaceous limestone and calcareous sandstone. This series is known by the name of the Trinity Sands, or Upper Cross Timbers. These strata are the great water-receiving beds of Texas, and, owing to the outcrop consisting chiefly of unconsolidated sands, nearly every drop of rain which falls upon them is absorbed and transmitted underground. The thickness of the Trinity Sands varies from 300ft. to 600ft.

The Upper Cross Timber Series (or the Trinity and Paluxy Sands), enters the State on the western border of Arkansas, and occupies a comparatively narrow strip of country, extending eastward as far as the Onachita Mountains, from whence it sweeps round to the south, with an outcrop of varying width, through the towns of Millsap, Dublin, Burnett, and Travis Peak, to somewhere about the 30th parallel of latitude, where the tongue of older Palæozoic rocks ends. The Trinity Sands form conspicuous escarpments, resting directly upon the Palæozoic rocks at altitudes varying from 650ft. to 1550ft. above sea level. In some localities the catchment area is rarely more than half a mile in width. In nearly every county between the 97th and 98th meridians and to the east of the outcrop, artesian water has been obtained in wells at depths varying from ,200ft. to 2,000ft. (Plate II, fig. 1).

Further to the east of these beds is the outcrop of the Dakota Sands, or Lower Cross Timber Series, forming the base of the Upper Cretaceous formation. The Dakota Sands consist in this region of white sandstones, sands, and sandy clays, which are well displayed between Dennison, Fort Worth, and Waco. The beds decompose on the surface into rich sandy soil of highly absorbent properties. These Lower Cross Timber Beds are the same as those Dakota Sands of Kansas, Nebraska, and Dakota, and are equally valuable sources of artesian water supply, since they possess unusual capacities for imbibition. The Lower Cross Timber Series is the source of the water in the wells at Pottsborough, Dallas, and Midlothian ; the depth at which water was obtained in these wells was under 700ft., and the supply was moderate, as might have been expected. Had these wells been continued to the Paluxy and Trinity Sands no doubt better yields would have been obtained.

To the north of Colorado River the outcrop of the Trinity Sands is in part concealed by the Tertiary beds, which form what is known as the Llano Estacado or Staked Plain.

The Llano Estacado merits a little detailed description on account of the part it plays in supplying water to the Trinity Sands, in addition to that which is absorbed by the portion exposed directly to the surface. In this respect it bears a close resemblance to the Desert Sandstone of some parts of Queensland.

The Llano Estacado is a smooth plain of at least 50,000 square miles in extent, and is surrounded on almost every side by a precipitous escarpment often visible for a distance of 50 miles. This escarpment is said to form one of the most remarkable topographical features of the North American continent. The western margin has an altitude of 5,000ft., while on the east it is only 2,500. The geological structure of the Staked Plains is very simple, consisting of beds of unconsolidated porous waterworn sands, gravel, and silt. These beds dip practically at the same angle as the surface of the ground, which is to the seaward, at about 20ft. per mile. The Llano Estacado is, with the exception of occasional ponds formed in the depressions after copious rains, singularly devoid of water. Running Water, Dickens County, is said to be the only stream on the Staked Plains. A writer describes it as " a bright sparkling stream that suddenly breaks out of the ground, ripples over pebbly porous bottoms for a distance of 10 miles, and then mysteriously disappears like many other streams west of the Pecos River."

The rocks of the Staked Plains are as porous as a sponge, and nearly every drop of rain that falls is absorbed and percolates downwards, until it reaches an impervious stratum. No artesian water occurs in these beds, for the reason that there is no continuous impervious cover above them. There is an abundance of water at the base of the formation, and the elevation is sufficient to force it to the top of the plains, along the eastern or lower edge, if there were an impervious cover above, and a similar floor below. Over 1,000 wells have been drilled in the beds of the Llano Estacado, and in every one an adequate supply of sub-artesian water has been obtained.

In the south-eastern area of the Llano Estacado the Tertiary strata rest directly upon the Trinity and Paluxy Sands, along the old north-western shore-line of the Cretaceous, and nearly all the water that is in the Lower Tertiary is at once absorded by the Trinity Sands, and carried by them to the lower level. The wells of Marienfeld and Big Springs draw their supplies from this source. Nowhere in the Llano beds does the water rise much in the bores, but where those wells have been continued down to the Cretaceous sands, the water often rises to considerable altitudes above the level of the water-bearing stratum.

In addition to the supplies of artesian water obtained by boring in the catchment area of the sandy strata, wells have been bored in the Tertiary beds of the Great Coastal Plain. One of the great groups of the Tertiary beds is known as the Fayette Sands, whose outcrop extends as a broad band south-westward from the Mississippi to the Rio Grande. The Fayette Sands present a remarkable resemblance to those of the Llano Estacado, of which there are good grounds for believing them to be the representatives. As will be seen by an inspection of a geological map of the county, the Fayette Sands have now no physical connection with the tableland of the Staked Plains.

Several coastal places derive their water from these beds, viz., the towns of Gonzales, Houston, &c. Perhaps the most notable of these is the deep well on the Island of Galveston, situated at a very short distance from the coast of the Gulf of Mexico. Galveston is supplied with water derived from thirteen wells, which vary from 810ft. to 1,346ft. in depth. These draw their supplies from the Fayette Sands. Owing, however, to the large quantity of impurities, chiefly common salt, the water of these wells was found to be quite unsuitable for domestic use, though it was employed to a large extent for manufacturing purposes. With the view of ascertaining whether a more wholesome supply could be obtained from greater depths, the municipal authorities of Galveston decided to bore to a depth of 3,000ft., at about which depth it was expected that the water in the Trinity Sands would be tapped. The section in the deep well gives an idea of the thickness of the strata pierced, as well as the amount of their dip. The well passed through 315ft. of recent and coastal clays, and about 2,000ft. of Tertiary beds. From the known elevation and distance of the outcrop of the different series, the dip has been calculated, and turns out to be about 18ft. per mile towards the sea. When the Galveston well reached 3,070ft., the authorities concluded that the experiment had gone far enough; as, though the water obtained was brackish, it was much less so than any of the other shallow wells in the city. (Plate II, fig. 1).

Wells have been sunk on the mainland near Galveston, and these furnish a decidedly better quality of water than those on the island. Further inland, at the town of Houston, there are over 100 wells, whose depths vary from 115ft. to 564ft. The water contains no impurity in the form of common salt.

The strata of the Gulf Border region have been proved to be continuous southwards into that portion of the Republic of Mexico which fringes the shores of the Gulf, to a point about 20degs. north of the equator. According to the researches of the Mexican geologists, representatives of both the Lower and Upper Cretaceous have been recognised, the latter being unusually well developed. I have been unable to get access to the maps and publications of the Mexican Geological Survey, which deal with the formations and district in question; hence the information is much more meagre than I could wish.

Having described in some detail the coastal areas, the central portion of the continent known as the Great Interior Region now remains to be dealt with.

"The eastern boundary of the great Cretaceous area of the "interior may be designated as corresponding to the western "border of the great Palæozoic area, which extends northward "and southward through the Central part of the Continent, and "which terminates by a comparatively narrow prolongation in "the Texan region. . . . . Tracing the line of such a "boundary, we find it extends northward through Western "Texas to the southern boundary of Kansas, near the north-"western corner of Indian Territory; thence north-eastward to "North-eastern Kansas; thence through Eastern Nebraska to "the mouth of the Big Sioux River; thence north to the Red "River of the North, and down that river to its mouth, at the "south end of Lake Winnipeg, and thence north-westward to "the north-east corner of the district of Athabasca. The "western boundary of this great area may be designated as "approximately corresponding to the line of the great watershed "which separates the Pacific drainage from that of the Arctic "and Atlantic oceans, and as extending from the 60th parallel "of north latitude to where the watershed line meets the 113th "meridian in Western Montana; thence south upon that "meridian to the 33rd parallel of north latitude.* . . . . .

So little is known of the geology of Northern Canada, that the exact limits of the Cretaceous and Tertiary beds cannot be defined. It may, however, be mentioned that Cretaceous strata have been proved in the valley of the Mackenzie River, which flows into the Arctic Ocean, between Cape Bathurst and the Alaskan frontier. They occupy a large area at the head of the Mackenzie, also on the north-western shores of the Great Bear Lake, and are in considerable force in the country on the Arctic Ocean, at the mouth of the Mackenzie, as well as along the coast from Demarcation Point to the head of Franklin Bay. It is possible that these beds may be continuous beneath the Tertiary and Recent beds from Athabasca to the Arctic Ocean.

Our knowledge of the geology of the water-bearing formations of the region above defined is more deficient than that of the coastal districts; the salient features, however, have been grasped, and have been described in the writings of those pioneers to whom geological science owes a debt of gratitude.

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* Correlation Papers. Cretaceous. C. A. White, pp. 141. Bulletin, No. 82, U.S. Geological Survey, Washington. By authority: 1891.

It is found that, as is the case in the Atlantic and Gulf Border regions, the great bulk of the artesian water is derived from the sandy beds lying at the base of the Cretaceous formation. The overlying Tertiary beds also yield generous supplies of sub-artesian water.

In the centre of the North American continent, the Upper Cretaceous alone is represented. The formation has been subdivided into the following four groups, in ascending order :—Dakota Sandstones, Colorado, Montana, and Laramie Beds.

The Dakota Sandstones lying at the base are, with minor exceptions, extremely well adapted for the absorption and transmission of large quantities of water ; and, in addition, the beds attain in places considerable thickness. In New Mexico, they measure 1,700ft. Here, however, they are associated with shale partings and beds of impure limestone.

In North-west Wyoming the outcrop of the Dakota Sandstones occupies a considerable area on the east and west flanks of the Big Horn, Rattlesnake, and Owl Mountains. The beds consist essentially of quartzose sandstone, with a few minor shaly beds. The base is formed of a conglomerate, in which the pebbles and matrix are more or less silicified. According to the researches of the United States Geological Survey, the Dakota Sandstone in Colorado is "a white quartzitic sandstone "with a fine-grained conglomerate at the base, formed of very "well-rounded pebbles of the most dense and resisting siliceous "material, generally light or dark chert and jasper. . . . .

"The white quartzite generally occurs in one or two "benches, with seams of clay near the middle. The conglome-"rate at the base of the granite is usually 2ft. to 5ft. thick." *

In South Nebraska and a portion of Kansas, the Dakota Sandstone is more or less altered into quartzite. The quartzite type is fortunately exceptional, but such as it is it must play an important part in preventing the absorption and transmission of water along certain portions of the Dakota Sandstones.

The next succeeding group is the Colorado, consisting of black clayey shales, which reach a maximum thickness of 5,000ft.

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*Evidence of the Director of the United States Geological Survey, before the Committee of the House of Representatives on Irrigation, Feb. 27, 1890; Eleventh Annual Report, Geol. Surv., Pt. 2, Washington. By authority: 1891.

To the Colorado succeed the Montana Beds, which are made up of drab clay shales with, near the top, some arenaceous strata, yielding overflowing water at the towns of Greely and Ranton. The maximum thickness of the group is 8,000ft., but it appears to thin out rapidly to the east.

The uppermost group of the North American Cretaceous is the Laramie. At the base of these beds is a very persistent coarse sandstone or pure conglomerate, which yields water; the highest beds consist of clay shales and sandstones, with thin coals. In Wyoming, the group attains a thickness of several thousand feet; in North-east Colorado it does not exceed 750ft.; in South-east Colorado and North-east Mexico, the thickness has increased to 1,800ft.

For our purpose it may be said that the North American Cretaceous rocks consist of a porous sandy series at the base, overlaid by a varying thickness of watertight clay shales.

The structure of these beds in the region in question is (omitting all minor details) that of almost one-half of a synclinal trough, whose western rim is about 5,000ft. above the eastern.

The water supply of the Dakota Sandstone is received along the continuous outcrop of the group in the foothills of the Rocky Mountains.

In the State of Dakota deep artesian wells occur along a belt of country extending from Yankton to Devil's Lake, and the greater part of the watershed of the James River.

Wherever borings have penetrated the Dakota Sandstone, artesian water has been found at depths varying from 900ft. to 1,500ft. In the south of Dakota the water-bearing strata are arranged in a low broad synclinal trough, with its axis approximately north and south.

The western edge of the catchment area in Dakota is along the flanks of the Black Hills, to which the metamorphism of the group does not extend. These hills which have an elevation of from 5,000ft. to 8,000ft. above the sea level, send practically all their drainage eastward, conveying the rainfall directly to the outcrop of the water-bearing beds. These porous beds form an escarpment round the hills, while the underlying impervious Trias-Jura Strata have been so denuded as to form a huge ditch along the inner edge of the sandstones which aids in conveying to, and keeping the water in the Dakota Sands.

The eastern edge of the basin is exposed in Eastern Nebraska, and North-eastern Kansas, as well as in the south-east corner of Dakota. Along a part of the eastern edge the overlying impervious Colorado Shales overlap; were it not for this fact, since the western outcrop of the Dakota Group is over 3,000ft. above the eastern, the water would not accumulate, but would escape at the lower eastern rim almost as fast as it could be absorbed at the western.

At Devil's Lake, 1,470ft. above sea level, a supply of 204,000 gallons per day was obtained from a depth of 1,511ft., in the upper part of the sandy series, which consist of a very fine loose white sand, which was penetrated for 80ft.

A series of calculations has been made by Mr. Warren Upham, of the United States Geological Survey, from the pressure recorded by the wells drawing their water from the beds at the base of the Cretaceous, showing the height to which the water would rise if confined in a tube. These calculations show that in the States of North and South Dakota the water would rise to heights varying from 35ft. to 432ft. above the mouth of the bores. In every case the height of the head of water is far less than the known altitude of the outcrop of the water-bearing series; the difference may be accounted for by the frictional resistance of the rock through which the water flows.

From Colorado northwards to the Canadian frontier the outcrop of the Dakota Sandstone reaches the surface on the west by a very steep curve, thus presenting only a narrow exposed belt, which is estimated to occupy an average width of only 800ft.

The Tertiary rocks of the Great Interior occupy the eastern portion of New Mexico, Colorado, Wyoming, the country to the south of the Cheyenne River in South Dakota, three-quarters of Nebraska, and the western portion of Kansas, Oklahoma and Indian Territory.

The beds occur in the form of a tableland identical with that of the Llano Estacado previously described; the eastern edge of this tableland is about 300ft. below the level of the western. The rocks forming this tableland are open porous cross-bedded sandstones, sands and gravels, covered in places by a thin mantle of marl which is not entirely impervious to water.

What may be called a modified ideal artesian water basin occurs at Denver in Colorado; the basin has a width of about 50 miles. Artesian water was obtained from the Arapahoe conglomerate, the basal bed of the Miocene Tertiary, in 1883.

This conglomerate, or gritty sandstone, varies in thickness from 600ft. to 1,200ft. It is overlaid by a varying thickness of sandy shales, clays, sandstones, and basalt.

The Arapahoe beds reach the surface on the west at the town of Golden, at an elevation of about 6,500ft., by an upward curve, and thus present but a narrow outcrop.

"The flow yielded by the first well was so large, and the "water was of such superior quality for domestic use, that other "wells were put down with great rapidity. There are now "(1889) in the city and its vicinity about 300 wells. Many "of the first wells had sufficient pressure to force the water into "tanks, or to the tops of the highest buildings in the city, bu "as the number of wells was increased the pressure and flow of "the older wells began to diminish, and finally in the region "where they are most closely grouped they have failed to furnish "water without the aid of pumps. Outside the region of closest "grouping pressure and flow have been diminished, but not to "so great an extent. Deep wells are still bored at Denver, but "not with the expectation of obtaining an artesian flow."* (Plate I., fig. 2).

The amount of water which can be taken from an underground reservoir of this nature depends not upon the total quantity stored therein, but the rate at which it can flow through the rocks, and after the first wells have drawn upon the accumulated supply the amount which can be taken afterwards is governed by the rate at which the water can travel to the well.

In the Atlantic and Gulf Border regions there is only one side of the synclinal trough present.

The Great Basin of the Interior is really in the form of one-half of a synclinal, whose western rim is 3,000ft. above the eastern. The Tertiary rocks, which dip eastward at about 10ft. per mile, absorb water like sponges, and their position upon a

* Evidence of the Director of the United States Geological Survey before the Committee of the House of Representatives on Irrigation. February 27, 1890. Eleventh Ann. Rep., U.S. Geol. Surv., pt. 2, p. 262. Washington. By authority: 1891.

floor of impervious Cretaceous shales insures the return of this moisture to the surface, in the form of powerful springs. The underlying Cretaceous beds are similarly arranged.

The rainfall of the drainage area of the Mississippi amounts to 620 cubic miles per annum. The elaborate experiments of Messrs. Humphreys and Abbot have shown that of this amount only 107 cubic miles reaches the Gulf of Mexico by surface water channels, leaving 513 cubic miles to be accounted for.

Experiments as to evaporation have been made at different times in various parts of the world. These show that the amount of rainfall lost by evaporation varies within very wide limits, doubtless depending upon different climatic conditions.

In the case of the Mississippi, assuming that 50 per cent. of the rainfall is evaporated, this would leave a balance of 310 cubic miles, which must precolate below the surface. To provide against all possible contingencies, taking even 75 per cent. as evaporated, this would still leave the large quantity of 155 cubic miles per annum as available for underground use. In other words, 3,611,310,743,484 gallons per diem must disappear beneath the surface of the drainage area of the Mississippi watershed.

In the Great Plains of Nebraska, Kansas, Oklahoma, and Eastern Colorado, there is no lack of means whereby the surface waters reach the permeable strata, in addition to that which falls directly upon the catchment area.

"There are a number of so-called 'creeks,' some of them "of considerable length, having broad sandy beds and numerous "tributaries, draining large areas of country, and through which "great floods of water pour at times, yet which have no outlet "into any other stream or visible body of water. Among the "most notable of these are White Woman Creek and Bear Creek. "The former rises in Eastern Colorado, in Kiowa County, "traverses Greely and Wichita Counties, in Kansas, and ends "in a broad basin in the centre of Scott County, through the "bottom of which the water, which sometimes comes down in "great quantities, quickly escapes to the sheet-water below.

"This creek drains an area of some 1,500 square miles; "*i.e.*, it is the outlet for such of the surface waters as escape above the surface of the ground. Bear Creek rises in Baca

"County, in South-eastern Colorado, traverses portions of "Stanton, Hamilton, and Kearney Counties, in Kansas, and is "lost in a line of sandhills south of the Arkansas River. With "its tributaries, it affords drainage for a scope of country over "100 miles long, and averaging probably 40 miles wide. This "creek affords perhaps the most visible means of losing water "throughout its course, instead of retaining it, of any of the "numerous streams of its class. From first to last it cuts "through ledges of a hard stone, containing so much iron that "the exposed and weathered surfaces are of a dark colour. "This stone lies in strata which uniformily dip away from the "bed of the stream towards the south-east, and which rest upon "a porous sandstone, in and from which the artesian wells of "Morton and Hamilton Counties, Kansas, secure their flow."*

This sandstone readily permits the passage of water, and the Bear Creek Section at the Five-Mile Waterholes, Baca County, Colorado, shows how readily the water of this stream constantly escapes from its channel into the porous sandstone. Only in times of copious local rains does any water flow visibly through the whole course of the stream down into its basin in the sandhills.

Another typical instance may be quoted:—"Between the "Pecos and the Rio Grande there is a great area of country "having no surface drainage seawards. I refer to the area "lying between the Organ and San Andreas Range on the west, "the White Mountains and small outlies on the north, the "Sacramento and Guadolupe Mountains on the east, and the "Hueco and El Paso Mountains on the south. Between these "mountains is a great basin, which for the want of a better "name, I shall call the Gypsum Plains. The length of this "basin is 125 miles or more, and the width varies from 10 to 30 "miles. From Sierra Blanca, which attains an elevation of "11,892ft., and is snowcapped the greater part of the year, and "from other portions of the White Mountain Range, there are "several brooks of good size flowing into the enclosed basin. "The principal ones are the Tula Rosa Creek, Bonito Creek, "and the Three Rivers. Each of these, after emerging from the

* The Underwaters of the Great Plains; J. W. Gregory. Washington. By authority: 1892. pp. 40-41.

"mountains, quickly disappears in the loose gravels of the "basin."* . . . . . .

Many other similar instances may be quoted. The case of the Llano Estacado, to which reference has already been made, may be mentioned.

The Llano Estacado is bisected by the Canadian River, one of the eastern tributaries of the Rio Grande; the continuation of this tableland northwards covers about 10 degrees of latitude in the States of Kansas, Colorado, Nebraska, Wyoming, and South Dakota. The western edge of this tableland is in places over 5,000ft. in height, while the eastern edge does not reach more than 2,000ft. It is drained by a far greater number of streams than the portion to the south of the Canadian River. This tableland is of importance in that it affords a means of actually witnessing the escape of the water absorbed by the strata on the higher ground to the west.

"Many streams have a steadiness of volume, and that "volume unaccountably large, if the rainfall of their several "basins be regarded as the only source of supply, which indicates "that they have eroded their channels down to the level of some "sheet of water which feeds them with perennial springs and "maintains a steady volume in spite of long continued drought. "Take for example Frenchman River, the chief affluent of the "Republican River. It has a catchment basin of about 700,000 "acres, upon which 38,000,000,000 cubic feet of water falls "each year. More than one-third of this amount is delivered "by the Frenchman to the Republican, and it flows on with "very little change, month by month and year by year, without "regard to variations in the rainfall. A smart shower may fall "in that region without starting any surface flow upon the "parched slopes and tablelands to swell the volume of the "stream. In order to maintain so large and constant a volume, "it must be fed from subterranean sources, and observation of its "head waters discloses the actual existence of numerous and "strong springs of a perennial character." †

Drainage Systems of New Mexico; R. S. Tarr, American Geologist. Vol. 5, 1890; pp. 269-270.

† The Stratigraphy and Hydrology of Nebraska. L. E. Hicks. Preliminary Report, Artesian Water Investigation, west of the 97th meridian. Washington. By authority: 1890, pp. 72-73.

A further instance may be mentioned in the Loup River which lies to the north of those last quoted. The constant volume of this river, in spite of drought or down-pouring rains, neither of which cause a few inches less or more water, is easily accounted for when it is known that from Fullaton to Genoa its channel is cut through the Llano Estacado beds down to the impervious Cretaceous shales, and catches pretty well the whole volume of water flowing through the Tertiary Beds.

In some cases powerful artesian springs rise in the beds of the rivers at places where erosion just reaches the top of the water-bearing strata. Fine examples of this are seen in Victoria Creek at New Helena, Custer County, and in the North Loup River, where Big Spring rises in its channel. The garrison at Fort Robinson, Dawes County, is supplied from one of these springs which yields from 50,000 to 60,000 gallons daily, or 18,250,000 gallons per annum.

The leakage is not alone confined to the Tertiary Strata. It has been shown that the water supply of the Dakota Sandstones is received along its outcrop at the foot of the Rocky Mountains ; a portion of it may be derived from exposures to the north of the United States frontier. There is evidence pointing to the fact that there is a continuous discharge from its eastern margin.

Between the James River and the Sioux Falls the Colorado Beds overlap the Dakota Sandstones, which do not reach the surface in this locality. The wells of the James River Valley, exhibit a much higher pressure and a greater discharge than further to the south-east. The Dakota Sandstone is covered with a variable thickness of glacial drift in the valleys of the Missouri, the Big Sioux, the James, the Red and Vermillion rivers, and the water from it escapes upward in the form of powerful springs yielding saline and alkaline waters, almost identical in composition with that drawn from the Dakota Sandstone of Jamestown. These artesian springs extend between Chamberlain in the Missouri, and Sioux City, Iowa. This leakage must be held accountable for the diminution in the pressure of the wells in the south-east part of the basin, for where strata carrying water are arranged in such a way as to dip beneath the sea level, or the lower outcrop so covered as to prevent comparatively free circulation, the facilities for the discharge of water are less than are demanded by the quantity capable of being received ; hence the rocks have a tendency to be full up to the brim, and the pressure recorded to be greater. A further indication of the eastern movement of the water is found in the fact that the hydraulic head rises from east to west.

An analysis of the water in the Jamestown well has been made, and shows that it contains in addition small quantities of silica and alumina, carbonates of iron and lime, sulphates of lime, magnesia, soda, and potash as well as 21 grains per gallon of common salt. This mineral matter which gives the water such a characteristic taste is probably derived from the beds through which it percolates for hundreds of miles.

" Much shale, gravel, and detritus, rich in sulphates, are " present in the glacial drift over nearly the entire Red River " Basin, and the percolating rain water found by the fresh artesian " wells in the drift of the southern and northern ends of the " Red River Valley, has acquired minute quantities of alkaline " and saline matter. But where its proportion is large, as in " the brackish water of the wells from Crookston, and Blanchard " northward to the edge of Manitoba, it seems impossible that " so remarkable a difference can be due to diversity in the " material of the drift, or to longer time and better opportunity " afforded to the water for such impregnations while percolating " through porous beds or veins in the drift. The saline and " alkaline artesian waters of the drift, gravel, and sand along " this central portion of the Red River Valley therefore appear " to be received mainly from the same Dakota Sandstone which " supplies the deep wells of the James River Valley. Several " wells in the vicinity of Blanchard and Mayville, 375ft. to 404ft. " in depth, pass through the drift and enter a very fine white " sandstone, proably the Dakota formation, from which they " obtain flows of brackish water. About a dozen miles east of " Blanchard the drift was found to have a total thickness of " 310ft., below which a boring went 107ft. into exceedingly fine " white sandstone, finding, however, no artesian water, apparently " because of the very close texture of the rock. The top of the " sandstone in these wells is 650ft. to 575ft. above the sea. If it is " the Dakota Sandstone, as seems probable, it has an ascent of "about 600ft. in 75 miles east from the meridian of Devil's "Lake and Jamestown, rising in its approach toward the "Silurian, Cambrian, and Archaean areas of Minnesota and "Manitoba. It may be thus the bed-rock on which the drift is "deposited, beneath extensive tracts in the middle part and on "the western border of the Red River Valley, discharging there "its alkaline and saline artesian water into the permeable beds "of gravel and sand in the drift sheet, whence it rises in the "brackish wells of that district.*

Many natural artesian springs rise through the drift in the Red River Valley, both in North Dakota and in Minnesota, the most notable being on the Forest and Park rivers, which on account of the saline and alkaline character of the waters, were at one time called the Big and Little Salt Rivers.

It may be convenient here to mention that in the autumn of 1890, the well at Huron Waterworks, in Beadle County, South Dakota, showed signs of giving out, or at any rate a considerable diminution in the pressure was noticeable. In consequence of this a series of observations extending over a considerable period were made on wells in the neighbourhood. As a result of the investigations it was found that each of these wells, acting in sympathy, suffered a gradual decline in pressure, which continued until the month of December, when it ceased. From December to May the pressure in each well was gradually augmented to an equal amount, while the maximum pressure was recorded in the middle of June. These observations point to dependence upon the seasonal variations along the flanks of the Rocky Mountains where the catchment area exists.

Having briefly described the structure of the North American artesian water area, it remains to mention a few important conclusions which may be drawn from the somewhat dry details previously given.

The most important conclusion is that nowhere except possibly Denver, in the area of country which I have described are the water-bearing rocks disposed in the shape of those ideal basins, sections of which have done duty for many years in geological manuals. (Plate II., fig. 2). Both on the coastal and

* Artesian Wells in North and South Dakota. W. Upham, American Geologist, Vol. VI., Oct., 1890, pp. 219-220.

the great interior regions the water-carrying beds are so arranged that there is only one side of a synclinal trough, the higher rim differing in altitude from the lower, in the former case by not less than 1,500 feet, and in the latter by an amount varying from 3,000 to 5,000 feet. The strata thus present abundant facilities for the escape of the water absorbed by the strata on the catchment area to the west. In the interior, a continuous discharge is actually visible in many places along the eastern margin of the basin. In the case of the Tertiary beds of the Llano Estacado, north of the Canadian River, this leakage supplies many of the rivers flowing from the Great Plains. The discharge from the Cretaceous Dakota Sandstones is well seen in the valleys of the Missouri, the Big Sioux, the James and the Vermillion rivers, where the water rises through the Glacial Drift in the form of powerful artesian springs and in so doing affords a means of adding to the supply yielded by many wells sunk in the drift.

No discharge from the water-bearing strata of the Gulf and Atlantic Border regions is witnessed from the portions of the strata which crop out beneath the sea; but that such must be the case may be inferred from the fact that the pressure on the coastal deep wells is not nearly so great as it ought to be were the water confined in a sealed basin. The hydrostatic pressure of the body of water stored in the inland portion of the strata has a tendency to force the fresh water outwards and thus cause a permanent seaward flow. This water flows with a velocity due to the difference of level between the intake and the level of discharge, less the frictional resistance of the rock through which it flows.

I am not aware of any observations having been made as to the salinity of the water along the sea-bottom, but it appears to me that there must be a difference in the salinity in those localities where a continuous discharge of inland waters takes place.

The objection may be raised against the oceanic discharge that the pressure of ocean water would be quite sufficient to force its way into the porous strata.

" The numerous wells sunk at or near the sea coast (South " of England) as that at Worthing 400ft. deep, Margate 374ft.

"of Upper Chalk, and at Dover Castle prove that the "pressure of ocean water is not sufficient to penetrate the "strata, which is still further supported by the dryness of "collieries and copper mines worked under the sea, and the "plentiful supply of fresh water obtained in the artesian wells "sunk in the sea at Spithead Forts. If the plane of saturation "by artificial means were lowered the fissures or outlets which "allow the escape of fresh water at or beneath the sea level "would no longer have sufficient head or pressure to force "back the sea water, and the sea would flow in. This has "actually occurred at Calais wherein an unsuccessful boring "for water a brackish stream was met in the Upper Chalk "at 160 metres, or 70 feet, and Palæozoic rocks at 336 "metres." *

Where accurate observations extending over considerable periods have been made on the wells in North America, it has been found that the pressure recorded increases and diminishes with a regularity which points to dependence upon the seasonal variations on the higher ground of the catchment area, and also to the permanence of the supply, for so long as the rain falls and the snow melts in that area so long will the supply continue.

* The Water Supply of England and Wales; C. E. De Rance. London: 1882.

ALBATROSS BAY AND THE EMBLEY AND HEY RIVERS.

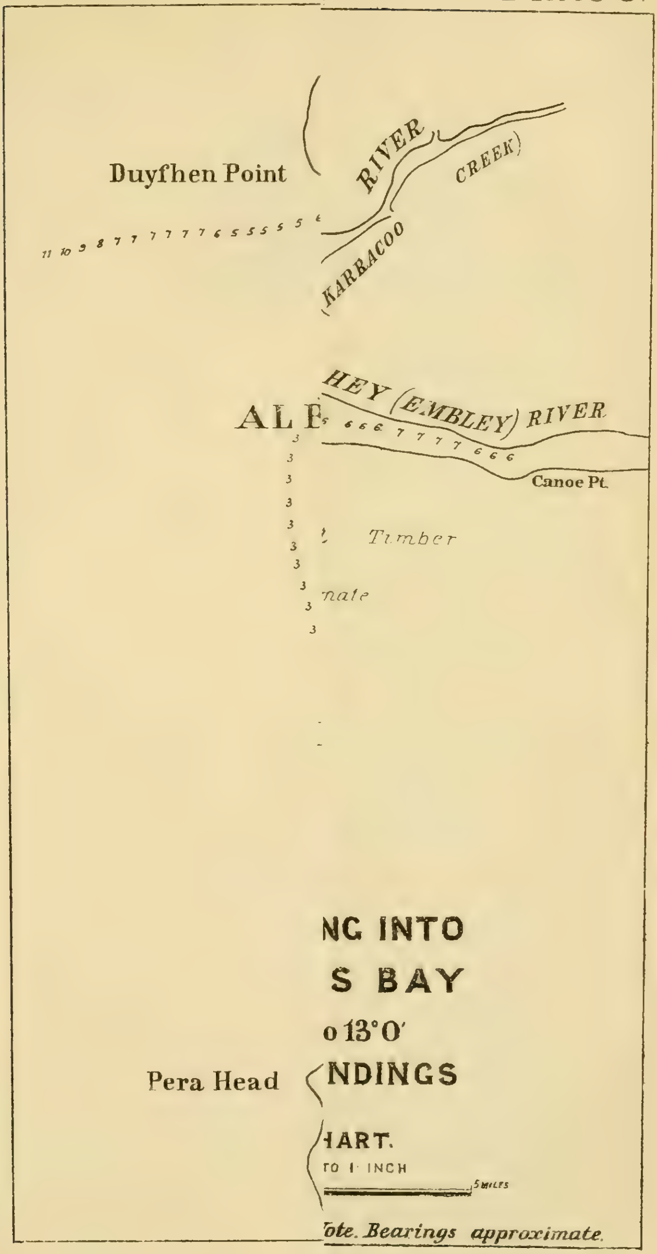
WITH MAP (PLATE iii).

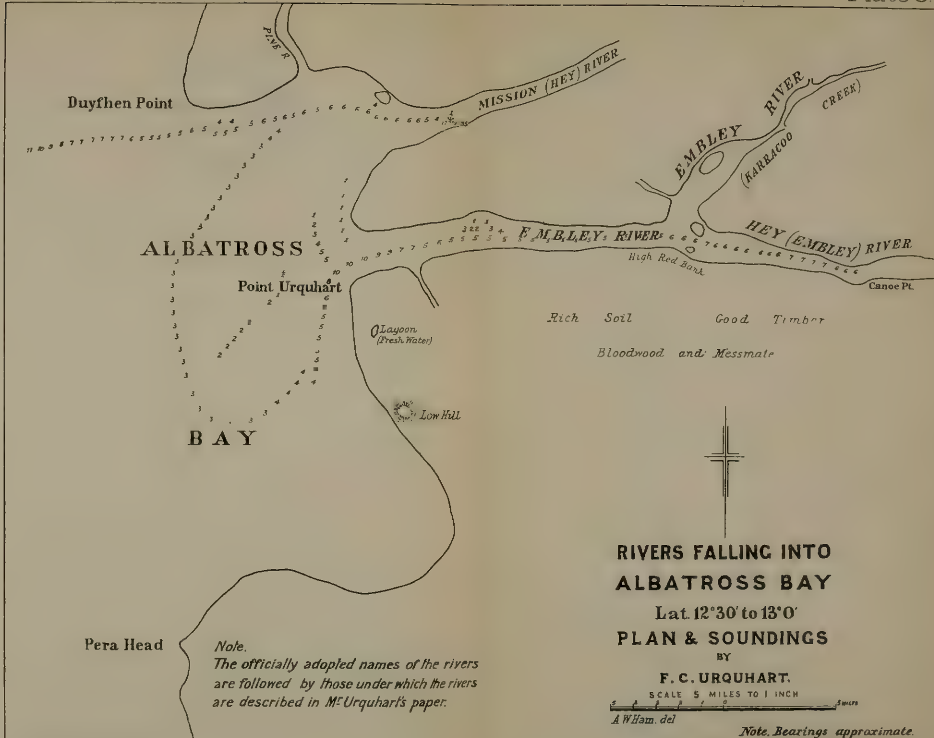
By F. C. URQUHART.

[*Read before the Royal Society of Queensland, May 9, 1896.*]

EARLY in December, 1895, it was reported to the Hon. John Douglas, Government Resident at Thursday Island, by Mr. J. T. Embley, that he had succeeded in reaching his station, York Downs, some 30 miles inland from the west coast of the Cape York Peninsula, in a cutter drawing three feet of water, by means of a river emptying into the large bay situated between Duyfhen Point and Pera Head on the west coast of the peninsula. About the same time Mr. Hey, of the Moravian Mission to Aborigines, at the Batavia River, reported that he had seen the mouth of a large river emptying into the same bay. Six years before this I had seen two large openings in the coast-line of the bay, but I had then no opportunity or time for explorations. Mr. Douglas, with the spirit of his New Guinea explorations strong within him, determined that this part of Queensland should no longer remain a *terra incognita*, and on the 15th December, 1895, he left Thursday Island in the Government steamer *Albatross*, accompanied by me, to examine the bay and the reported rivers.

It should be borne in mind that with the exception of some work done by Mr. Cullen, of the Harbours and Rivers Department, at the mouth of the Batavia River, there has been no nautical survey of this coast since 1802, when Flinders in the *Investigator* first ploughed these waters with a Royal Naval keel. The coast-line is not accurately delineated on the charts, and the


Duyfhen Point
RIVER
KARRACOO
CREEK)
11 10 9 8 7 7 7 7 7 7 6 5 5 5 5 5 5
AL E
HEY (EMBLEY) RIVER
Canoe Pt.
Timber
nate
NG INTO
S BAY
o 13°0'
Pera Head
NDINGS
HART.
TO 1 INCH
5 MILES
ote. Bearings approximate.


PINE R.
Duyfhen Point
MISSION (HEY) RIVER
EMBLEY RIVER
(KARRACOO CREEK)
ALBATROSS
BAY
Point Urquhart
EMBLEY RIVER
HEY (EMBLEY) RIVER
High Red Bank
Canoe Pt.
Lagoon (Fresh Water)
Rich Soil
Good Timber
Bloodwood and Messmate
Low Hill
Pera Head
Note.
The officially adopted names of the rivers are followed by those under which the rivers are described in Mr Urquhart's paper.
RIVERS FALLING INTO ALBATROSS BAY
Lat. 12°30′ to 13°0′
PLAN & SOUNDINGS
BY
F. C. URQUHART.
SCALE 5 MILES TO 1 INCH
A W Ham. del
Note. Bearings approximate.

soundings marked down are few and far between. Hence the explorations I am now to describe were carried out in practically unknown waters and great caution was necessary.

Leaving the Moravian Mission Station, Batavia River, on the morning of the 17th December, 1895, the *Albatross* steamed south about 40 miles, arriving off Duyfhen Point, a fairly bold headland for this coast, about noon. Our navigator, Captain George Kerr, decided that probably a deep channel would be found further south, so we steamed on a southerly course, opening out as we went the fine bay existing between Duyfhen Point and Pera Head, which Mr. Douglas named "Albatross Bay," after the stout little boat that for many years has done good public service in Torres Straits. In about twelve miles we headed in for the southern shore of the bay, and soon the lead-man announced "four fathoms," and we saw ahead of us and apparently about three miles apart the mouths of two large rivers. The whaleboat was now lowered, and with a crew of five men I went ahead of the steamer taking soundings. The water shoaled to three fathoms and remained at that till we neared the spot marked on the plan "Fresh water lagoon," where close inshore I found a five-fathom channel about 200 yards wide, deepening to six and seven fathoms, as the southern head of the river we were approaching began to broaden on the bow. This head Mr. Douglas named Point Urquhart, and it so appears on the plan. As the *Albatross* rounded this point the water deepened to nine fathoms, which varying to ten, we carried up about two miles, when we returned to the point and anchored for the night, Mr. Douglas bestowing the name of Embley on the river, which here at its mouth is quite half a mile wide, carrying its width well up the first reach of five miles and presenting a very fine appearance. Next morning at sunrise, we were underweigh at half speed, passing the creek marked as Mosquito Creek on the plan, and of all the rivers I have entered on the Queensland coast none have given me such an impression of beauty as this unknown and unhonoured Embley. Eight fathoms of water under our keel; instead of the usual monotonous mangrove mud flats, fine high banks with tall forest timber to the very edge, and the broad river dotted here and there with natives in their bark canoes; with the level sun of early morning lighting up the whole made up a picture which in twenty years wanderings in the northern bush I have never seen equalled. Eleven miles up on the north-eastern side, Karracoo Creek junctions with the Embley as shown on the plan. This is the creek up which Mr. Embley took supplies in the cutter *Maori* to his station, York Downs, situated in the York Peninsula, thirty miles from the Moreton Telegraph Station. Opposite this junction we landed on the south-western side, getting four fathoms right into the bank, and walked some two miles along the river about half a mile back from it. The soil appeared a fine rich loam, and samples were taken of it for the Agricultural Department. The grass was chiefly kangaroo grass, but here and there I noticed Flinders grass. The country was open forest extending back from the river as far as we could see, and the timber was chiefly fine bloodwood and messmate—the latter very straight and tall. From the numbers of birds about and from the presence of large numbers of natives, I judged there was plenty of fresh water about, and this was confirmed by blacks who came on board the *Albatross* later in the day, and who, though perfect savages, without a vestige of clothing or a sign of civilization about them, were most friendly; and they seemed a very well fed happy lot a—sure sign that this country was a good and fruitful one.

Returning to the steamer we resumed our course up the river another three miles, bringing us up to the point named by Mr. Douglas and shown on the plan as "Canoe Point,"—the channel all the way being never less than six fathoms and the river and its banks presenting the same general features, but at this point the river begins to trend more to the south.

Here we turned round and steamed slowly down the river, confirming our previous soundings as we went, and reaching our previous anchorage off Point Urquhart, the fires were banked and we turned in for the night, well satisfied with the past two days' work, the net result of which was that we had found a three-fathom channel from the open sea to the mouth of a navigable river, and had explored that river for fourteen miles, and had ascertained that here was rich country ready and adapted for settlement, with a fine port accessible to coasting steamers.

At daylight on the morning following I was off with my whaleboat and crew endeavouring to find a channel across from the Embley to the other large opening, seen as we entered the bay some three miles to the north of the Embley, but after some hours' industrious sounding I was obliged to give it up, the water shoaling in places to five feet, but I ascertained that in the centre of the opening itself there was a six-fathom channel, so I hoisted sail, and before a fair wind flew rapidly back to the *Albatross* with this piece of intelligence. The anchor was raised and the *Albatross* steamed for the open sea until the line of three-fathom soundings previously taken was reached, when she was headed for the northern shore of the bay until the opening I had visited earlier in the day was brought in line with Duyfhen Point. We then steamed straight for the opening, and carrying five and six fathoms of water all the way soon entered the mouth of a large river, up which we proceeded for three miles, still getting the same soundings. Mr. Douglas named this stream the "Hey," after the plucky and enterprising missionary who reported its existence. The banks of the Hey are flatter and less inviting in appearance than those of the Embley, and are thickly grown with mangroves to the water's edge, but no doubt further up the country would become open.

At the three miles' point we turned and steamed out straight for Duyfhen Point, always with five and six fathom soundings, till we reached the open sea, passing on our way the mouth of the Pine River—a very shallow stream flowing into the bay from the north.

Under Duyfhen Point is an excellent anchorage, sheltered from all winds and forming a valuable harbour of refuge for vessels trading to the Gulf ports during the N.W. monsoons.

Had this place been known the hapless *Kanahooka*, lost in 1894, might have succeeded in reaching it, instead of remaining outside to founder in the open sea.

For persons with the pluck to endure the climate (and it is not so very bad) I believe the Embley is well adapted for agricultural settlement, sugar, coffee, maize, and most semi-tropical fruits and vegetables could I think be successfully grown, and markets for such produce are handy at Thursday Island, Burketown, and Normanton, and from the latter place by train to Croydon.

Timber for mining purposes at Croydon could be cut on the Embley and shipped to Normanton, and when railway extension takes place in the Gulf I believe both sleepers and bridge timber could be obtained here in large quantities.

In the press and in public and private life we see and hear much talk of the "resources" of Queensland, but their immensity is very insufficiently realized, especially in regard to the extreme north and north-west of the colony. I shall be greatly pleased if this little paper contributes a mite to the sum of knowledge now possessed on the subject, which I think every faithful Queenslander should endeavour to increase.

Note.—From documents in the Surveyor-General's office, including a report by Mr. Embley, dated 11th January, 1896, accompanied by a sketch-plan, and an account of the voyage of the *Albatross* (17th December), taken from the "Torres Straits Pilot" of 28th December, 1895, it appears that the river which Mr. Douglas originally named the Hey is to be officially charted as the "Mission River;" that the name "Embley River" is to be bestowed on Karracoo Creek; and that the name "Hey River" is to be applied to that part of what Mr. Urquhart called the "Embley" above its junction with Karracoo Creek.—Ed.

NOTE ON THE DISCOVERY OF ORGANIC REMAINS IN THE CAIRNS RANGE, WESTERN QUEENSLAND.

By ROBERT L. JACK, F.G.S., F.R.G.S.,
GOVERNMENT GEOLOGIST.

[*Read before the Royal Society of Queensland, May 9, 1896.*]

On 7th July last, I read before this Society some "Stratigraphical Notes on the Georgina Basin, with reference to the question of Artesian Water," in which was brought forward evidence to show that Palæozoic Rocks existed to the north of a sinuous line extending from the western boundary of Queensland, near the Tropic of Capricorn, to the Georgina River, and thence north-eastward to the head of the Warburton; this line has since been somewhat more closely defined by the borings in search of water, and still more recently a striking confirmation has rewarded the labours of Mr. J. Coghlan, manager of Glenormiston Station.

Mr. Coghlan first sent me on 28th January last, a few indistinct fossils from a locality which he described as "on the east side of the Cairns Range, say twenty-five miles east of the border of this colony, latitude 23 deg. south." . . . Their state of preservation, however, was such that the most that could be said of them was that they were impressions and casts of univalve shells.

On 24th February, however, Mr. Coghlan sent a further collection from the same latitude, about thirty miles east of the border, in which Mr. Robert Etheridge, jun., Curator of the Australian Museum, recognised two undoubted *Orthoceratites.*

Orthoceras is evidently by no means uncommon among the Silurian rocks on the South Australian side of the border, six or seven species having been recognised, as will be seen from two important papers by Mr. Etheridge * and Professor Tate.† As to the classification of the Palæozoic rocks of this region, there is a wide divergence of opinion among the geologists who have written on the subject, viz., Mr. H. Y. L. Brown,‡ Dr. Charles Chewings,‖ and Professor Tate.§ Mr. Brown and Dr. Chewings recognise not only a Silurian, but a Cambrian; while Professor Tate denies the existence of a Cambrian in Central Australia, and divides the district between Pre-Cambrian and Ordovician (Lower Silurian). Professor Tate does not, however, refer to the discovery by Mr. Brown, at Alexandra Station, of a portion of a trilobite, which Mr. Etheridge ¶ says "appears to be, without doubt, an *Olenellus*, and therefore indicative of Cambrian rocks."

It is reasonable to suppose that the Queensland Orthoceratites will turn out to belong to the same horizon (Ordovocian), which has yielded fossils of the same class in the adjacent parts of South Australia. Now there can be little doubt that although the *Orthoceratitidæ* range from Cambrian to Triassic, we have here fossils which are at all events much older than the oldest Queensland formation hitherto proved to be foniliferous, viz:—the Burdekin Beds (Middle Devonian), and the specimens now exhibited are the oldest organic remains yet discovered in Queensland. Mr. Coghlan, to whom the credit of the discovery belongs, promises to make a further collection.

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* On Additional Silurian and Mesozoic Fossils from Central Australia. Adelaide. By authority: 1893.

† Report on the Work of the Horn Scientific Expedition to Central Australia; Part III.—Geology and Botany. London and Melbourne, 1896

‡ Reports on Coal-bearing Areas in neighbourhood of Leigh's Creek, &c. Adelaide. By authority: 1891. Further Geological Examinations of Leigh's Creek and Hergott Districts, &c., Adelaide. By authority: 1891.

‖ Geological Notes on the Upper Finke Basin. Transactions, Royal Society, South Australia, XIV., 247. Notes on the Sedimentary Rocks in the McDonnell and James Ranges. Transactions Royal Society, South Australia, XVIII., 197.

§ Horn Expedition, *ut supra.*

¶ In Appendix B to Mr. Brown's Report on Northern Territory Explorations. Adelaide. By authority: 1895.

THE FLYING FOX: ITS HABITS AND DEPREDATIONS.

By THOMAS P. LUCAS, M.R.C.S.E.,
L.S.A. Lond; L.M. and L.R.C.P., Edin.

[*Read before the Royal Society of Queensland, June 6, 1896.*]

FLYING-FOXES and bats belong to the Mammals, order Chiroptera. The two sub orders, (I.) Megachiroptera, include the flying foxes which chiefly inhabit the tropics, and (II.) Microchiroptera, the bats, which are much smaller, are generally distributed and feed on insects.

The four or five Australian species of flying-fox belong to the genus Pteropus, family Pteropodidæ. The genus contains forty-two described species, most of which occur in groups of islands. One of the species extends five feet in expanse of wing. The creatures are night prowlers, and as they go forth at sundown in thousands they resemble large flocks of birds. They pass the day in camps, hanging by their claws from branches of high trees with the head downward, and in some species hanging on to each other several deep. If the top one be dislodged by a blow or a shot, the line will fall with a thud, and the creatures can be easily killed. When at rest the fore-wings are folded over the breast.

Characters.—Head elongated, approaching the rat type. Ears, mouse-eared type, but with every variety from a circular lobe to oval and oblong, and with acute to obtuse apices. The ears give generic characters. There are fourteen teeth in upper, sixteen in lower, jaw. In a few species another molar is developed in lower jaw. Secreting glands prepare the material which gives the animal its peculiar odour, in *P. brunneus* resembling musk. The stomach is simple. The liver is large, to produce bile and honey or fruit-sugar digestives—

doubtless for the same reason that in the human infant the liver is specially large to aid to digest the excess of hydro-carbons in a milk diet, fats, and sugar. The heart and lungs are specially developed to sustain long flight and rapid motion, and to this same end the thoracic muscles are powerful and large. In land-resting mammals the hind limbs, the legs and leg muscles are specially strong for walking and running, but in the Chiroptera the fore limbs are specially developed for aërial progression. In the flying-fox the forearm is strengthened by a strong curved radius ; the ulnar is rudimentary ; the palms and fingers are specially fitted for grasping. The hind limbs are proportionately minimised. The wing membranes, resembling thin gutta-percha sheeting, are attached between the fore limbs and the body, and in the different species spread out by the hind limbs and more or less along the tail, but the interfermoral margin is deeply emarginate, and in some species scarcely developed in centre. The bones are hollow for lightness, as the huge Pterodactyls of the Oolite periods.

All the species are covered with a longer or shorter fur, which in its colouration is protective. The bats, which roost in cracks and crevices, or hang from roofs in dark caves, need little further protection, and are uniform and sombre-coloured. The flying-foxes, which hang in company from trees, have the head and neck more or less red, or yellowish, or grey ; and to instance the one species which rests at certain times round the leaf-stalks of the cocoanut palm—this colouring makes them resemble the bunches of ripening cocoanuts.

The early life history is not well known. The penis is strengthened by a distinct bone. As far as known, the young are brought forth alive. They are suckled on two teats. It is stated that as many as five are produced at a birth. The smallest discovered in Australia were about an inch and a-half long. One observer living in a bush house says that he noticed under the eaves of the roof what he took to be some mud-cell domiciles of the *larvæ* of hornet-wasps. On sweeping them down, he was surprised to find them to be young flying-foxes. The old ones had been noticed coming in and out. These young ones were hanging in the usual way by their claws. Other observers have noted that when the parents were suddenly startled from the roosting trees, young ones would be left behind as the adults took to flight. Again, when the young are strong enough to cling tightly to the mother's fur, they appear to be carried by the mother in her nightly journeys. Specimens have been shot with half-grown young ones hanging on to the fur of the parent so strongly, as needed to be literally torn away to get them off.

The bats—which are insectivorous—as they sweep swiftly through the air, strike at the insect with the claw, and laying hold of the prey pass it to the mouth. In watching a bat one night, flying round and round an electric light in pursuit of moths, a moth fell from its mouth at my feet. One wing had been torn by the bat in catching. The moth was covered with a viscid gluey substance, which prevented flight when it crawled out of the bat's mouth. The use of such salivary gastric secretion is apparent. As the creature rapidly catches, and, so to speak, places or pitches each insect unkilled in its mouth, every time it opened its mouth for fresh prey, those already caught would escape. The gluing of the wings prevents this, and rapidly and easily digests the dust plume of the insect's wings. The flying-foxes, which feed on soft sugar fruits and honey flowers, appear to try the fruit both with their teeth and claws. They often waste more than they eat in finding food to their taste. Since the pepsin of the pig is manufactured as an artificial human stomach digestive, would it not be possible to utilize the strong digestive secretions of the flying-fox, if not of some of the bats, for the same purpose? The experiment is worth trying.

The flesh of the flying-fox is pronounced to be good gamely food. Uncivilized natives of the islands esteem it as a great luxury, especially at the height of the fruit season, when fat and in good condition.

The two species, Pteropus poliocephalus and P. scapulatus, found around Brisbane and Southern Queensland, are much larger than the two northern species, P. Gouldii and P. conspicillatus. Mr. Broadbent states that he has seen a camp of P. brunneus, which is plentiful on Percy Island, flying over the opposite Australian coast. If so, we have five Australian species.

The flying-foxes are becoming a perfect plague to fruit-growers. Noise certainly frightens these and other wild creatures of nature until they get used to the same. In Viwa, the extreme western island of Fiji, the natives got rid of a camp of P. Samoensis by following them up with incessant kerosine-tin kettling. After repeated dislodgment they flew away in a body to another island fifteen miles off, where they have since remained.

The wild pigs in Fiji are kept from the fruits and vegetables by a weird noise. An empty kerosine tin, with a hole punched in and the top taken off, is hung up and inverted, and dangled by a string from a branch of a tree. Large stones are tied up in a similar manner alongside. Whenever the wind blows the bough shakes and such a *melée* of noise is set up that all the pigs scamper off in terror.

Some years ago I visited Marysville Falls in Victoria. I could not discover a single insect within two hundred yards of the Falls. It would appear from the above illustrations that artificial noises produced and varied should assist the orchardist to frighten away a part, if not all of the pests, from insects to mammals and birds, which injure or prey on the fruit.

Wire lines suspended round a tree, netting thrown over a tree, and other adjuncts have been suggested for keeping off flying-foxes from ripe fruit. These are troublesome, expensive, and only partially protective.

Poison has been used with advantage. Arsenic is the most successful. Mixed with finely-powdered white sugar, it can be inserted into fruits here and there while green, and just before ripening. The wound and the foreign body hasten maturity, and the foxes catch at the bait. After a few are destroyed, the rest instinctively—as sparrows with poisoned wheat, rats with baited traps, etc.—learn danger, and leave the orchard for pastures new. It is urged that the foxes might cause mischief by carrying such poisoned fruit to a distance. The danger would be a minimum if green fruit were baited. Care could also be exercised to have such fallers gathered early each morning and burned.

Chicken cholera microbe inoculation has been recommended. This is but a dream. Nothing is known scientifically of the creature's diseases. And if successful, what a source of danger! Increased stimulation of the glandular secretions would surely cause the sickly animals to infect every fruit they touched. What a danger would the marketing of such fruits be!

The only successful method of extermination is organized wholesale slaughter in the creature's camps. The blacks were accustomed to light fires all round such a camp, which almost invariably is in tropical scrub, on damp or swampy ground. The smoke on a calm day would rise and further stupefy the sleeping hosts. They would throw sticks or boomerangs and knock the creatures off their hold, and so secure them when they fell. A picnic party might be organized, to prevention, amusement, and profit, in the shooting such camps. The fires having been lit all around, a number of guns commence destruction. As numbers fall, non-shooters can easily kill with a stick or knife. The skins can be utilized, as rats' skins are, for making very soft gloves.

After some shots have been fired, the crowd will rise, sweep round, and again alight. The sport and destruction can still be carried on, until the remainder, thoroughly aroused, rise up and fly away to another camp.

This method is the most successful, but should be followed up until the plague disappears from the country. This can only be secured by concerted action. Even Divisional Boards have only limited power. The matter is almost a national one, as the crowds travel hundreds of miles when persecuted, only to return when their tormentors are unwary. It is affirmed that flying-foxes are now appearing northward along the coast of China, where they were hitherto unknown.

The only natural enemy to the foxes, is, as far as I know, the Great Winking Owl of Australia. This is natural, even as the owls all over the world prey on mice and bats.

The economic study is a most serious one, demanding every consideration, as the species as a plague threaten the fruit growing industry of a great portion of Australia. The Natural History study is worthy of pursuit, and should yield prizes of discovery to the diligent student.

NOTES ON THE CONGLOMERATE AND SANDSTONE SERIES OF THE WILD RIVER VALLEY, AND OF THE HEAD WATERS OF THE WALSH RIVER.

With Map (Plate iv).

By ROBERT C. RINGROSE.

[*Read before the Royal Society of Queensland, June 6, 1896.*]

The town of Herberton is situated at an altitude of about 3000 feet in the valley of the Wild River (the northernmost tributary of the Herbert River), which rises on the range that divides the basaltic area of the Barron Valley from the granites, porphyries, and sandstones of the stanniferous country.

The ranges attain their greatest altitude, about 4400 feet, at Stewart's Head.

I am indebted to Mr. E. B. Ranken, Government Mining Surveyor, for the topographical portion of the map attached to this paper.

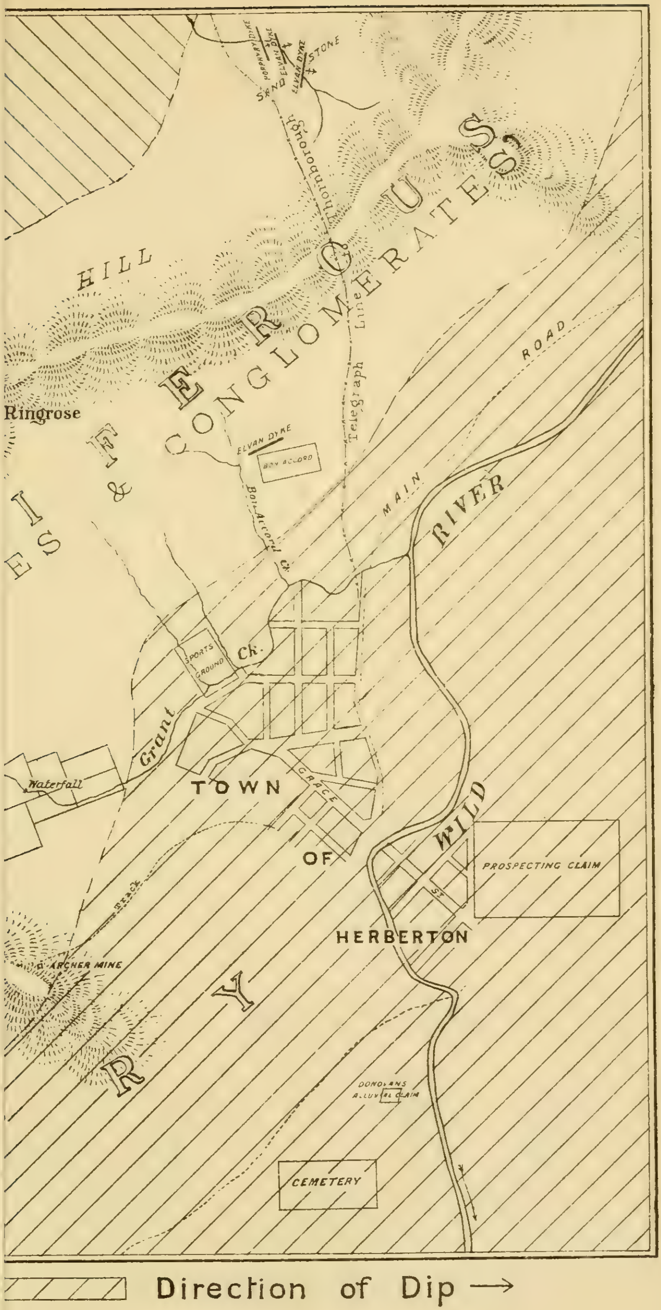
The area to which this paper refers is that portion of the Dividing Range between the head of Slaughteryard Creek, on the south, and the head of the Wild River Valley, on the north.

I have had considerable difficulty in compiling these notes owing to the mountainous nature of the country. The Range between the Walsh and Wild rivers is extremely rough, rocky, and in many places precipitous, and the hills are mostly thickly timbered, and clothed with long coarse grass, so that it has been by no means easy to find creeks or gorges where sections of the rocks were exposed to view.

In the middle of the year 1894, I found a large bed of conglomerate on a lofty ridge overlooking Grant's Creek, and I have since traced the Sandstone series in a northerly direction along the range.

On the eastern side of the town, where the most productive tin mines are situated, there is, so far as my observation goes, no trace of the conglomerate and Sandstone series, and on the

Plate 4


HILL
CONGLOMERATES
Ringrose
PORPHYRY DYKE
ELVAN DYKE
SANDSTONE
Thornborough
Telegraph Line
ELVAN DYKE
BON ACCORD
Bon Accord Ck.
MAIN ROAD
RIVER
WILD
SPORTS GROUND
Grant Ck.
Waterfall
TOWN OF HERBERTON
GRACE
ST
PROSPECTING CLAIM
Track
ARCHER MINE
DONOVANS ALLUVIAL CLAIM
CEMETERY
Direction of Dip →

Sandstone Series
Granite
Porphyry
Direction of Dip →

range going towards Watsonville, west of Grant's Hill, there is no sign of them until the neighbourhood of Federation Hill is reached.

The altered sandstones of the Federation Hill appear to me to belong to the Sandstone series about to be described.

Proceeding up Slaughteryard Creek, from the Watsonville road, the rocks, where visible, consist of the normal Herberton porphyries and elvans, until Isabel Creek, one of the heads of Slaughteryard Creek, is reached, where the rock changes as one ascends to an altered sandstone, approaching quartzite in places. Large blocks of this sandstone have filled up the channel of the watercourse and concealed the natural sections.

Altered sandstones are exposed in another little creek, falling into Slaughteryard Creek, further to the south. These sandstones strike north-north-east and dip to the east-south-east.

The whole of the range from the head of Slaughteryard Creek and Grant's Creek along Crescent Hill to a lofty hill, roughly computed to be 4150 feet in height above sea level, which Mr. Skertchley has named Mount Ringrose, consists of red and yellow sandstones, which are often micaceous.

Following the sandstones down in a south-westerly direction from this hill, a fairly level ridge is reached, overlooking Grant's Creek, which consists of a bed of conglomerate. Looked at from below this bed of conglomerate appears to be like the ruined buttresses of some ancient castle, and it forms a striking feature in the landscape. The components of the conglomerate, which are chiefly of quartz, but also of granite and sandstone, vary from the size of a rifle bullet up to that of a large pumpkin, and in most instances present a well-rounded and waterworn appearance. Possibly this bed of conglomerate is identical with that on the top of the lofty crescent-shaped hill on the opposite side of Grant's Creek, and at about the same altitude. From this conglomerate ridge there is a gradual descent down to Grant's Creek, and about half-way down outcrops of elvan, probably intrusive, are met with, and the same rock is seen in the bed at the crossing of the creek.

On either side of the elvan the sandstones are to be seen standing almost on their edges. On the lower side of the elvan the sandstones, which are dark coloured and hard, apparently strike east 7 degrees south and west 7 degrees north, with a northerly dip.

Following the creek down the gorge, sandstones are met with, either *in situ* or in detached blocks, until the top of the waterfall is reached. The creek here falls a considerable distance over a platform of very hard altered sandstone.

From this point there is a somewhat steep ascent up the side of the crescent-shaped hill on the northern side of the creek, which is about 400 feet above the bed of the creek. Conglomerate is met with on the side of the hill, and the summit of the range for a considerable distance consists of conglomerate. It is not possible to get the strike and dip of the beds here, but the probability is that they are dipping at high angles. Whether there is any connection between the two beds of conglomerate on either side of the creek is difficult to decide, and in any case there must be more than one bed of conglomerate, because there is a marked difference in many respects between the large-grained conglomerates on the hilltops, and the smaller conglomerates found on the sides and at the foot of the range on both the Walsh and Wild rivers.

Descending the crescent-shaped hill into the Wild River Valley, nothing but fragments of sandstones and conglomerates are found, either in the watercourses, or on the ridges.

In two small watercourses, which rise in the range just described, and run down on either side of the Sports Ground Reserve, nothing but fragments of sandstone and conglomerate are visible, until close to their junction with Grant's Creek, where an outcrop of the porphyry of the Herberton series is exposed. On the Herberton side of Grant's Creek the conglomerate series is absent, and the rock, wherever it is exposed, belongs to the Porphyritic series.

Further to the north a track running up Bon Accord Creek presents the same geological features. The porphyry can be seen in the bed of this creek near its juncture with Grant's Creek, and can be traced some distance up.

Proceeding along the track, the point where the porphyry gives place to the sandstone is readily seen. Further up the creek, the shaft of the Bon Accord Claim is sunk close to the junction of the sandstone with an elvan dyke, which can be traced along the surface on the higher side of the lease, running in a nearly north and south direction.

Crossing this lease in a northerly direction on to the Thornborough bridle track, and ascending the range, the rocks, wherever exposed, belong to the Sandstone series, and vary from fine-grained sandstones to coarse conglomerates; and the summit of the range itself, and for some distance on both sides, consists of sandstone.

Along the range, in a northerly direction, after crossing a belt of elvan, sandstones—some fine-grained and micaceous, others of a coarser texture—occur to a point less than half-a-mile from the head of the Wild River Valley, where a belt of porphyry comes in.

Mr. James Williamson, of Herberton, took me to a point about half-a-mile north of the Thornborough track, where a little creek, rising in a spur of the main range, runs down to the Walsh River. On running this creek down towards the Walsh River, the ground is everywhere strewed with fragments of coarse sandstone and conglomerate, and where the creek begins to take a defined course, I was able, after two visits, to get the most satisfactory observations of this series yet obtained.

The following is the order of the rocks crossed over in descending the creek, but as the rocks are not everywhere exposed, I could not determine the thickness of the beds, which are all nearly vertical :—

1. Sandstone, grey and red. Strike north 20 degrees west and south 20 degrees east, apparent dip east-north-east.
2. Porphyry dyke, 20 feet thick, running north and south.
3. Fine-grained dark grey sandstone.
4. Shaly sandstone. Strike north 20 degrees west and south 20 degrees east, with a steep dip to the east.
5. Band of dark coloured and red sandstone.
6. Small waterfall over dark coloured altered sandstone, running north 20 degrees west and south 20 degrees east.
7. Elvan dyke, 80 feet thick, with the same strike as above.
8. Fine-grained elvan of considerable thickness.
9. Dark sandstone. Strike not obtainable.
10. Dark sandstone, running north and south.
11. Coarse sandstone.

12. Porphyry dyke, resembling the Herberton porphyry. There is then a distance of some hundred of yards in which no rock is visible. The Thornborough track is then reached on the Walsh side at the foot of the range.

13. Yellow sandstone.

14. Quartzite band, with same strike as rocks above described.

15. Sandstone.

16. Large masses of elvan.

17. Normal granite of the Walsh Valley.

The above is a fairly correct list of the rocks exposed in the bed of the creek.

The above notes conclude my observations of the details of this series of rock. A reference to the map will give a fair idea of the position and extent of these beds. From the known point of their commencement, near the head of the Walsh River Valley, these beds extend to Slaughteryard Creek, a distance of four miles, without a break, in a direct line.

Two prominent observations are to be noted from the study of this series as found in the Wild River Valley.

1. That the rocks themselves are to be found at the present time only on the sides and on the summit of the range.

2. That intrusive elvan dykes occur in them.

No trace of organic remains has yet been found in any of these beds.

Taking the evidence as a whole, and in the light of further knowledge and investigation, the hypothesis put forward by me in my former paper on this subject—viz., that these rocks might belong to the Desert Sandstone series, appears to be unwarranted.

I have now come to the conclusion that these rocks belong to what were provisionally classed Permo-Carboniferous by Mr. R. L. Jack, extending from the Four-mile, Watsonville, to Irvinebank, Montalbion, and other places.

The proximity of these rocks to those belonging to the Permo-Carboniferous system at and beyond Watsonville, their marked lithological similarity, and the similarity of the elvan dykes at Herberton to those about Watsonville, leave little doubt that the Herberton Sandstone series belongs to the Permo-Carboniferous, or other Palæozoic sedimentary rocks.

THE SUBMARINE LEAKAGE OF ARTESIAN WATER.

By ROBERT L. JACK, F.G.S., F.R.G.S.,
Government Geologist of Queensland.

[*Read before the Royal Society of Queensland, July 11, 1896.*]

In a paper read at the Brisbane meeting of the Australasian Association for the Advancement of Science in January, 1895, I spoke of two kinds of leakage which might possibly affect the bibulous beds at the base of the Lower Cretaceous formation: First, a leakage into the sea—"Suppose the beds to dip seaward and beneath the sea, and either to rise to the ocean bed or to dip at a lower angle than the slope of the sea bed, there would be a leakage into the sea. And, again, suppose (what we believe to be actually the case) the outcrop of the beds to occur at gradually lower levels till it attains the sea level, there would be a leakage in the form of springs, or into river beds along the line." I then referred to evidence in favour of the first kind of leakage—into the sea—afterwards to be recapitulated, and in speaking of the second kind of leakage, as springs where the intake-beds had their outcrops at comparatively low levels, said:—"Nor is evidence of the second kind of leakage to hand. The outcrop of the Blythesdale Braystone, as it falls away from its highest altitude . . . down to the McIntyre River is not very conspicuously marked by springs." In discussing a paper on the subject by Mr. Walter Gibbons Cox, C.E., Mr. J. P. Thomson, President of the Queensland branch of the Royal Geographical Society of Australasia, endeavoured to show that the second kind of leakage is of considerable volume, in evidence of which he quoted Julian E. Tenison Woods' observations* on the occurrence of a

* "Australian Handbook," 1895 Edition.

line of groups of thermal and cold springs. Mr. Woods did not claim that the springs he referred to occurred at the outcrop of the water-bearing formation, and, as a matter of fact, they do not occur there more than elsewhere. Some, for instance, the largest of them all, that on the Einasleigh, well out of Palæozoic rocks. So far, however, as they are known to occur within the boundary lines of the Lower Cretaceous formation, they are, of course, natural artesian wells, but their output is insignificant compared with the intake of the bibulous beds near the base of the formation.

On the latter subject, as my colleague, Mr. Maitland, is now at work continuing the delimitation of the lowest Cretaceous beds between Hughenden and the Gulf, it may be well to record his identification of the Blythesdale beds (the lowest and most important of the intake beds) on the Flinders River and Porcupine Creek, with their base at 2600 feet and their top at 1900 feet above the sea level, and to quote a passage from a letter dated 9th June :—" The Upper Flinders cuts its way through the escarpmenta of the Blythesdale beds, which here are of such a character as to be admirably adapted for the absorption of and transmission of water, and, in crossing the outcrop, has eaten out a channel for itself, in some places 400 feet and 500 feet deep, and not more than 30 feet or 40 feet across—in some places not nearly so wide. Before entering the sandstone, &c., the Flinders is a fine running stream of considerable width ; down the canon by far the greater portion of the water has disappeared ; whilst at Hughenden I could scarcely believe I was crossing the same river." He adds :—" I am told on good authority that the heads of the Dutton and the Cambridge are formed of deep sandstone gorges, identical with those of the Upper Flinders."

In the paper before alluded to I pointed out that several large watercourses—*e.g.*, Blyth's, Bungil, Bungeworgorai, and Amby creeks, the Maranoa River, Hoganthulla Creek, the Warrego River, Birkhead Creek, Torrens Creek, and the eastern tributaries of the Thomson River, which cross the outcrop of the Blythesdale Braystone, while crossing that outcrop, absorb enormous quantities of water, and that the streams, except in flood time, cease to run beyond the outcrop. In the absence of measurements of the amount of water absorbed by these Queensland rivers, I quoted, as a parallel instance, Mr. H. C. Russell's calculations relating to the Darling. "The mean annual rainfall on the Darling River catchment for the past ten years has been 22.14 inches, and of this only 1½ per cent. or 0.33 inches of rain passes Bourke in the river. If 25 per cent. of it, which is equal to 5.53 inches of rain, passed away in this river, as it does in the Murray, there would be seventeen times as much water passing Bourke as now actually does pass. . . . And we ought, therefore, to have an underground water supply at least equal to sixteen times as much water as passes Bourke now. . . . That we do not find it in the Darling is to my mind proof that it passes away to underground drainage." To make Mr. Russell's argument clearer I ought to have had quoted this further passage :—"The Darling carries away only 1½ per cent. of the rainfall, while the Murray, a river existing under similar conditions of climate, wind, rain, and evaporation carries away 25 per cent. of the rainfall. The only difference I can see which seems to offer any clue to this great disparity . . . is in the extremely porous character of much of the Darling basin."

Mr. Thomson, in discussing Mr. Cox's paper, pointed out that recent measurements* show that not 1½ but 6 per cent. of the annual rainfall on the total effective catchment area of the Darling above Bourke (which is 20 inches instead of 22.14 inches†) passes Bourke in the course of the year. Assuming the accuracy of those figures, I do not see that Mr. Russell's argument is impaired. The rainfall is distributed in three ways : One portion sinks into the earth, not to return except through springs or submarine leakage ; a second portion is evaporated ; and a third is carried off by the watercourses which drain the surface. Whatever figure we assume or ascertain for the amount drained by the watercourses, the remainder of the rainfall must be divided between evaporation and absorption. Even if 6 per cent. of the rainfall is carried off as drainage by the Darling valley, the remaining 94 per cent. will surely leave enough both for absorption and evaporation.

* Annual Report of the Chief Engineer for Water Conservation, New South Wales, for 1891.

† Mr. Russell informs me that in 1891 the rainfall over the Darling area was 27.27 inches.

But, says Mr. Thomson, "When it is taken into consideration that the climate of the Bourke district is one of the hottest and driest in the country, it will not, I presume, be difficult to imagine that an enormous volume of the somewhat scanty rainfall must be lost by evaporation as compared with the rather small quantity discharged by the river . . . In the case of our rocks and soils there is rapid evaporation under favourable atmospheric conditions, owing to high temperature produced by internal as well as external heat." What, in this case, evaporation through the agency of "internal" heat means, is that water penetrating the soil may reach a portion of the earth's crust where the heat is great enough to convert it into vapour, and that the vapour may rise through superincumbent strata, and escape at the surface. There could, however, be no such escape, as the vapour would be condensed on reaching the cooler strata near the surface, and, in the form of water, would gravitate inward, retracing the steps of its outward course.

Mr. Thomson does not, however, seriously dwell on the possibility of evaporation by means of internal heat, although from subsequent remarks he seems to see an analogy between the crust of the earth and the moleskins which form the outer integument of many Australians, but passes on to the subject of evaporation by means of solar heat. He asserts that at the Enoggera Reservoir the water evaporates at the rate of a quarter of an inch per day, "and in the central regions of Australia it has been estimated, by a series of experiments and reliable observations elsewhere, that the process of evaporation goes on, under favourable conditions, at the rate of 1 inch per day."* "Just imagine," he adds, "what this means in regions where the annual rainfall is not greater than from 10 inches to 12 inches!" It means, no doubt, that a rainfall spread out in a thin sheet on a non-absorbent clay soil, which does not slope sufficiently to permit of rapid drainage, will be dissipated by evaporation in a few days or weeks, and nobody can deny that

*In a letter dated 22nd July, 1896, Mr. Russell says: "I have, for a number of years, measured the actual evaporation in the Western districts. The greatest recorded evaporation in a year in our hottest country is 5ft. 5in., and this from a tank 4ft. in diameter and 3ft. deep, kept full or nearly so—a condition in which sun and wind have more effect than they have in ordinary reservoirs.

these conditions exist over a large portion of the western interior of Queensland—that portion, in fact, where modern artesian wells are now pouring out enormous volumes of water. I was present at a meeting of the Geographical Society on 29th May last, when Mr. Thomson expressed the opinion that evaporation (through internal and external heat) was sufficient to account for the whole of the rainfall not carried off by drainage. It *must*, indeed, if the same conditions of impermeable soil and excessive solar heat observed in portions of the Western interior apply to the outer edge of the artesian basin, where the water is absorbed. But if these conditions apply, Mr. Thomson's argument proves too much; for it proves, to those who believe that rainfall is the first cause of artesian water, that there is *no* artesian water in the West. It is easier to imagine that the conditions do not apply.

At the January meeting Mr. Thomson gave "some remarkable examples of the atmospheric condition of Central Australia," in order to emphasize his remarks on the adequacy of evaporation for disposing of that portion of the rainfall not carried off by drainage. He is reported to have said: "In one of his exploring expeditions my esteemed colleague and predecessor in office, the Hon. A. C. Gregory, had several hard guttapercha drinking mugs with him. They were left in camp one day on top of the table. When the explorers returned in the evening the mugs had disappeared, the only trace of them remaining being a liquid glutinous substance on the spot where the mugs had been left. On another occasion Mr. Gregory was camped about a quarter of a mile from a creek, and it was necessary to swim it. When returning to camp Mr. Gregory wore a thick pair of heavy moleskin trousers, and in swimming the creek with them on they were, of course, completely saturated; but after walking into camp the whole of the water absorbed had evaporated absolutely, and the trousers were quite dry." The heat on the date of the drinking-cup incident may have been 128 deg., and as guttapercha will melt at 115 deg., I have no doubt that Mr. Gregory contented himself afterwards with pannikins of more difficult fusible material. As for the moleskins, they may have been thick and heavy when they left the shop, but no one who knows Mr. Gregory's active habits can doubt that by the time they had been in use for a few months they were not much thicker than those worn by the average bushman. A well-known mercer in this city informs me that twenty-five folds of the thickest moleskin go to an inch, and it need be no matter for surprise that a film of water supported by a textile fabric one-twenty-fifth of an inch thick should be rapidly dissipated into vapour between the fervour of the explorer within and the ardour of the sun without. It may even be remembered that history records how, in a much colder climate, a party of invaders, after swimming a river which enviously interposed between them and certain rich lands and fat beeves, "danced themselves dry to the pibroch's sound," notwithstanding the considerable quantity of water carried to the English shore in the voluminous accordeon-pleated garment which they preferred to moleskins or corduroys.

Mr. Thomson, at the January meeting, suggested that the disappearance of river water in crossing the bibulous beds, which are now recognised as the principal intake beds of artesian water in the West, might be imaginary, and it is needless to repeat that this disappearance is an observed fact, which can be attested by any dweller in those regions. He cited the bodily disappearance of rivers of which Monsieur E. A. Martel gives many examples in his work, "Les Abimes." There is, however, no analogy between the disappearance of European rivers in the caverns of limestone strata, and the soakage of water into the sandstone and conglomerate beds of the Australian interior, among which the occurrence of elongated caverns is a physical impossibility. No thick beds of limestone crop out at the base of the Cretaceous formation; and if they did, and if the rivers were engulfed by elongated caverns, the artesian water would be found only where the borer had the good fortune to strike the course of such underground channels. As the system of boring pursued is (within the defined limits of the Cretaceous formation) what is known in mining language as "blind stabbing," there would be a hundred unsuccessful for one successful bore if the artesian water ran in narrow underground channels instead of being almost everywhere present within the area represented by the outcrop of the Lower Cretaceous. Underground rivers have nothing to do with the case. Mr. Thomson further (January) remarked that "the whole central basin is nowhere greatly elevated above sea level. . . . and it must be remembered that the levels are so low that it would be difficult, if not altogether impossible, for water to circulate along these by gravitation." I should have thought that the low levels of the surface of the interior, implying still lower levels for the strata in which artesian water is actually met with, coupled with the fact of the high altitudes at which the strata crop out, afforded, on the contrary, the most favourable conditions possible for the circulation of water.

I can only reiterate the observed fact that numerous important rivers disappear on crossing the outcrop of the lowest beds of the Lower Cretaceous formation. There is nothing in the world to lead us to doubt that the water is absorbed by these strata, and carried down by them beneath the impermeable clay shales, which underlie the soil of the interior. That it is so distributed is demonstrated by the bores themselves. The inference follows naturally that if, every wet season, these beds are prepared to absorb a great portion of the rainfall, they must have been emptied, to a corresponding extent, of the water absorbed during previous wet seasons. In other words, if they are full, they can hold no more. The bores and springs combined do not give out a tithe of the water absorbed every wet season, and, as the water does not escape by land, and can hardly be supposed to find a hiding-place in the centre of the earth, the only alternative is that it must escape where the absorbing strata crop out beneath the floor of the ocean. "But," says Mr. Thomson (January): "In support of the theory of leakage it has been stated that the capacity of the water-bearing beds can only be rendered efficient and adequate by the subterranean channels that communicate with the sea; that, in fact, the quantity of water drained off by these compensating or accommodating arteries is about equal to that absorbed by the bibulous rocks. And upon this hypothesis we must conceive that there is an absolutely inexhaustive underground reservoir of artesian water *intra muros* with an outflow so nicely regulated that its capacity is *in equilibrio* and adequate to receive and contain the whole body of water greedily absorbed during periods of rainfall and flood, and that, moreover, the waters of this reservoir never reach sea level, even during times of prolonged drought, as evidenced by the constant and undiminished overflow of our artesian wells. Were cause and effect so easily explained, we should have before us one of the most remarkable examples of natural phenomenon with which students of the century have had to deal—one of the most interesting dynamical problems of the age. It would, indeed, be a remarkable natural process by which an artesian reservoir would never fall to the level of the sea, even during long periods of intense dryness, when there could be no local supply with which to replenish an ever decreasing store." The conception of such a condition of equilibrium is entirely Mr. Thomson's own. It is not difficult to understand that when more fluid is poured into a receptacle than it will hold it runs over, and there is nothing unnatural in the fact that after a heavy wet season, when the absorbent strata have been filled to their utmost capacity, the rivers run longer than usual over the Western interior. Fluctuations in the artesian wells will be looked for by all who admit that the first cause of the supply is the periodical rainfall. To show that I regarded such fluctuation as inevitable, I may quote from the paper read in January, 1895, at the meeting of the Australasian Association :—"The loss of water by the Darling River, and probably a similar loss of water by the Western Queensland rivers, proves that the water-bearing strata must leak into the sea, and hence that unless the strata be periodically replenished the sea level would ultimately become the level to which the water would rise. A drought sufficiently long to bring about this result would, no doubt, have, for a prior result the destruction of the greater part of the land fauna of this part of Australia, including the *genus homo*. Far short of this, however, we can conceive of the temporary diminution or cessation of the flow of some at least, of our artesian wells."

Since this was written fluctuations have been observed in the pressure and output of a few of the artesian wells. Some have even ceased, and after a time have recommenced to flow. The only possible intermittent source of artesian water is the rainfall; but a series of observations on the fluctuations of pressure and output in the wells, only initiated by the Government within the last twelve months, must be carried out for some years before we can arrive at the relations between the rainfall and the activity of the wells. It must be mentioned, by way of caution, that some of the wells obviously owe their stoppage to faults in tubing, and others to the caving-in of the strata. The observations are rendered necessary by the fact that strata in which the grains or granules are massed together with varying and unknown degrees of compactness must conduct water (owing to friction) at a rate different from what would be the rate in the theoretical open tube. It may take one, two, five, twenty, or a hundred years for a given drought to affect any particular bore; but if corresponding curves can be established by observation between rainfall on the one hand, and the output of the bores on the other, we shall have a law by which we can predict in any given year what will be the flow of the bores—barring, of course, such accidents as decay of tubing, filling up with deposited mineral matter, and caving-in of the strata. It is now well known to borers that the nearer they are to the edge or intake of the basin, the less will be the chance of a heavy supply, and the greater will be the chance of an intermittent supply, the obvious explanation being that the head of water in these cases is apt to fall to or below the level of the bore. At the January meeting Mr. Thomson advanced an argument against the submarine leakage, which I am able to quote verbatim:—"I am strongly of opinion that the pressure of the higher specific gravity waters of the ocean would prevent any remarkable leakage at anything like considerable depths." At the May meeting, when I was present, Mr. Thomson further expounded and Mr. Gregory confirmed this view. Given a sufficiently elevated "head" of fresh water, connected by a tube with the salt water of the ocean, an equilibrium, depending on the slight difference between the specific gravities of fresh and salt water, would inevitably be established. This is one of the simplest axioms of hydrostatics. If, instead of salt water, the ocean were filled with glue of a tenacity sufficient to protect the submarine outlet of the strata from the pressure due to the head of water at the outcrop, then we could understand how the strata could fail to be periodically emptied, and prepared to receive further contributions from the rainfall; but on no other supposition is such a failure imaginable. But we know that the strata do annually imbibe an almost incalculably large amount of water; therefore they are partially emptied before the periodical rains set in; and therefore the depths of the ocean are no more filled up with glue than they are with rose water.

At the May meeting of the Geographical Society, Messrs. Gregory and Thomson said they had seen no direct evidence of submarine leakage of artesian water. No more have I, as the depths of the sea are inaccessible. I have not seen it, but I believe in it, on evidence similar to that on which I believe in the existence of Fiji, of which Mr. Thomson and others have furnished us with credible information. Granting that there may be another explanation of the fresh water bubbling up through the salt water of the Australian Bight, there is (besides the disappearance of inland rivers) some direct evidence pointing in the same direction. For instance, I have lately been informed by a thoroughly reliable shipmaster, that there is a spot far out in the Gulf of Carpentaria where almost fresh water can be taken up in a bucket, and that by no means when there is any reason to suspect that local rains or flood-waters from the Gulf country have anything to do with it. Here, at least, there are not, as in the Australian Bight, any Tertiary rocks, which may be suspected of exuding the fresh water; and the Normanton bore, practically on the edge of the Gulf, and sunk from a level of about 30 feet above it, struck the artesian water at a depth of 1983 feet (say 1950 feet below sea level), "when the drill got out of blue shale into sandstone," and entered the underlying granite at 2291 feet, and there is no ground of assuming that this is the lowest part of the basin.

My colleague, Mr. A. Gibb Maitland, read before this Society on the 17th April last the first instalment of a paper on "Extra-Australian Artesian Basins," in which he demonstrated that the principal artesian water-basins of the world "are not," as he says, "disposed in the shape of these ideal basins, sections of which have done duty for many years in geological manuals." "Both on the coastal and the great interior regions" [of America], says Mr. Maitland, "the water-carrying beds are so arranged that there is only one side of a synclinal trough, the higher rim differing in altitude from the lower, in the former case by not less than 1500 feet, and in the latter by an amount varying from 3000ft. to 5000ft. The strata thus present abundant facilities for the escape of the water absorbed by the strata on the catchment area to the west. In the interior, a continuous discharge is actually visible in many places along the eastern margin of the basin. In the case of the Tertiary beds of the Llano Estacado, north of the Canadian River, this leakage supplies many of the rivers flowing from the great plains. The discharge from the Cretaceous Dakota Sandstones is well seen in the valleys of the Missouri, the Big Sioux, the James, and the Vermillion rivers, where the water rises through the glacial drift in the form of powerful artesian springs. . . . No discharge from the water-bearing strata of the gulf and Atlantic border regions is witnessed from the portions of the strata which crop out beneath the sea; but that such must be the case may be inferred from the fact that the pressure on the coastal deep wells is not nearly so great as it ought to be were the water confined in a sealed basin. The hydrostatic pressure of the body of water stored in the inland portion of the strata has a tendency to force the fresh water outwards, and thus cause a permanent seaward flow. This water flows with a velocity due to the difference of level between the intake and the level of discharge, less the frictional resistance of the rock through which it flows." Mr. Maitland adds: "I am not aware of any observations having been made as to the salinity of the water along the sea bottom, but it appears to me that there must be a difference in the salinity in those localities where a continuous discharge of inland waters takes place." No doubt there is, but it would take such an extended series of observations to prove it that we can scarcely hope for its accomplishment within the present century.

The May meeting of the Geographical Society had for its chief object to allow Mr. Gregory an opportunity of discussing Mr. Cox's paper, and Mr. Thomson, as President, added some remarks before declaring the discussion closed. As the "Proceedings" have not yet been published, I can only speak from recollection of what took place while I was present. Both speakers agreed in everything, and among others that they had never witnessed the alleged submarine leakage, and this statement must pass unchallenged. Both gave equally indisputable instances of high temperature and rapid evaporation in the West. Mr. Gregory treated the Western interior, as it seemed to me, as if it were a homogenous mass of porous rock in place of having a subsoil of water-tight clay-shales, and insisted on the impossibility of water sinking beyond the reach of evaporation. He insisted again on the impossibility of fresh water rising up through an ocean of salt water. Finally, he produced a small map of Australia, on which he had drawn a red line round the heads of the Darling, Thomson, Diamantina, and Georgina, and described this line as one along which an anticlinal axis of Palæozoic rocks comes to the surface, interrupting the continuity of the Cretaceous formation. Such statements receive no support from any geological map ever published. The fact is that Palæozoic rocks only crop up along a small portion of the line in question, and that when they do crop up no synclinal axis coincides with the line; on the contrary, where Palæozoic rocks underlie the line they present the upturned edges of strata disposed at such angles as to prove that they were thrown into anticlinal and synclinal folds, whose axes for the most part cross the divide at right angles. Mr. Thomson summed up by saying that a few facts, such as Mr. Gregory had brought forward, were worth more than all the theories which had ever been invented. I am still under the impression that the facts accumulated on the spot are on the other side, and that Mr. Gregory's "facts" are fancies only.

The question at issue is no longer whether the water which, when tapped by bores, issues in artesian wells, occurs in porous strata lying underneath impermeable strata. The bores themselves have settled that, and the outcrops of the strata have been to some extent mapped, and found at altitudes sufficient to give a "head" capable of forcing the water to the surface in the lowlands of the West. These outcrops, moreover, have been detected in the act of absorbing, year by year, more than water enough to supply the wells and springs. The question is, whether the strata form a sealed basin, or crop out beneath the ocean in such a manner as to give rise to a circulation of the underground water. A mass of evidence has been accumulated to prove that, as the strata are periodically filled up with water, they must first have lost a certain amount by leakage. In the case of Australia the only possible escape is beneath the ocean, and although we cannot observe this leakage with the bodily eye, we may believe in it, as we believe in many things we cannot see. A powerful confirmation of this view is supplied by the fact that some important artesian basins elsewhere leak out on land, while the rest have the physical conditions which must inevitably lead to submarine leakage.

CHEMICAL AFFINITIES BETWEEN RUTACEÆ AND UMBELLIFERÆ.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, July 11, 1896.*]

One of the greatest geniuses of botany, and one who is nearly forgotten by so-called modern botanists, was Linnæus, who was born in a desolate spot of cold Sweden, and whose grave, which I visited in 1879, is in the Botanic Garden at Upsala.

In one of his numerous books, called "Philosophia Botanica," he gives it as his opinion that plants belonging to the same genus, and genera belonging to the same order, are nearly allied in physiological and therapeutical action, as they contain the same or nearly allied chemical substances. On the other side, he states that plants of different orders are different in respect to their physiological power and their chemical constituents. These statements have, during the last 100 years, been found to hold good for the majority of plants, and the reverse has been found to be the exception.

One very interesting case of exceptions of this kind was detected by me in November last, when I found that some species of the genus *Evodia* belonging to Rutaceæ, contain ready formed substances hitherto supposed, in the ready-formed state, only to occur in plants of the order Umbelliferæ.

Our renowned Colonial Botanist, Mr. F. M. Bailey, had the kindness in October last to put in my hands for chemical examination, a resin, which was derived from *Evodia alata* (Rutaceæ), and which had been sent to him by Mr. Macartney, of Forest Hill, Mackay.

The brown resin, hard and brittle at ordinary temperature, softens under the pressure of the finger after a while. It is tasteless, but has a sweetish smell, especially when rubbed or warmed. Its specific gravity is 1.07. It is soluble in sulphuric acid, with claret colour, and with a pale yellow colour in alcohol, ether, and chloroform. Cold water, caustic potash solution, and benzol have no apparent action on it. The alcoholic solution of the resin is stained bluish-brown by an alcoholic solution of ferric chloride. Caustic potash in spirits stains it greenish yellow.

If boiled in water the resin gives off to it a body, which changes the clear colour of the water to a brilliant iridescence of peacock blue, looking in the reflected light exactly like the green lakes so renowned for their beauty in the hot lake district of New Zealand.

The body which causes this brilliant iridescence was found to crystallize from the water after cooling, in rhombic needles, which on combustion gave figures pointing to the formula $C_9 H_6 O_3$, showing the identity of the substance in question with umbelliferone, a body the constitution of which is that of oxycoumarin, $C_6 H_3 OH \left\{ \begin{matrix} CH{=}CH{-}CO \\ O \end{matrix} \right.$).

The fluorescence in the Evodia resin solution, caused by the umbelliferone is destroyed immediately by ferric chloride, cupric sulphate, sal ammoniac, and the least trace of an organic or inorganic acid (including boric acid), so that the infusion is as good a reagent for acids as an alkaline solution of phenolphthalein, and a much better one than the test papers of litmus and turmeric. The addition of some alkaline solution after the acid, restores the fluorescence immediately, but after some hours it vanishes again.

Permanganate of potassium is reduced by an umbelliferone solution, without destroying the fluorescence. Iodine, chloride of lime, and borax have no action on the fluorescence at all.

The fluorescent solution absorbs the violet and blue rays in the spectroscope.

Hitherto ready-formed umbelliferone has only been found in the resin of umbelliferous plants, *i.e.*, in the gum resin of *Ferula galbaniflua* (the so-called Galbanum), and in that of *Ferula Asafœtida*, but in none of them in such a large quantity as in the Evodia resin.

Dry distillation of many resins yields umbelliferone. There are more affinities between Evodia and the Umbelliferæ, which will be pointed out another time.

ON BAIERA (OR JEANPAULIA) BIDENS, *Ten. Woods.*

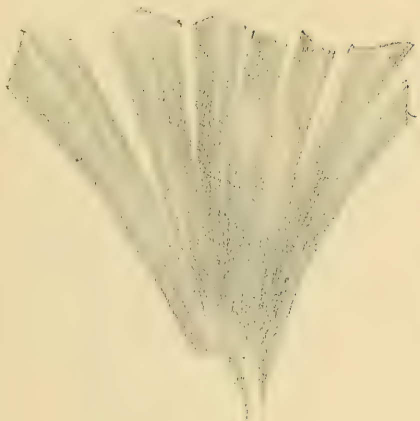
(WITH PLATES V AND VI.)

By JOHN SHIRLEY, B.Sc.

(District Inspector of Schools.)

[*Read before the Royal Society of Queensland, July 11, 1896.*]

Round the shores of the Pacific Ocean, on its western side, are found a number of species of coniferous trees, evidently belonging to decaying and fast dwindling races, many of which are endowed with peculiar characteristics. Such are the four genera—Diselma, Microcachrys, Arthrotaxis, and Phærosphæra, now limited to Tasmania, where Arthrotaxis is represented by three species, and the others by one each. Another disappearing genus is Phyllocladus, whose real leaves are reduced to small appressed scales, except in the seedling; and in which cladodia, or appressed branchlets, play the part assumed in other plants by true leaves. The cladodia are variously lobed and divided, and roughly resemble in shape the lobe of a celery leaf; and, on this account, the tree is called in Tasmania the celery-topped pine. Species of Phyllocladus also occur in New Zealand and Borneo. On the eastern coast of China is found, growing near sacred edifices, an ally of Phyllocladus, known botanically by its Chinese name—Ginkgo. It is not now found in its native state in any portion of the globe; but the piety of generations of religious Chinese and Japanese has preserved uninjured those planted near religious institutions in their respective countries. This tree, called *Ginkgo biloba*, or the maiden-hair tree, receives its trivial names from the fancied resemblance of its cladodia to fronds of a gigantic maiden-hair fern; and to a correspondence in venation in the two organs. Its seeds are plum-like, and arranged in pairs at the ends of axes that resemble cherry



Ginkgo (sp.)

Ginkgo (sp.)

Ginkgo bidens
Ten-Woods.

Ginkgo bidens
Ten-Woods.

stalks ; the integument is bright orange coloured and succulent ; and the seeds resemble a drupe. The plant was first made known to the world by Kæmpfer in 1712, who found it in cultivation in China, between 30 deg. and 55 deg. N. lat., from whence it was introduced into England in 1754, and afterwards to the whole of Europe and the European colonies. This species has also been found in a fossil state ; and its allies were formerly much more numerous, especially in the Jurassic period.

M. B. Renault in his "Cours de Botanique Fossile," Quatriéme Année, pp. 56-61, names seventeen fossil species of this coniferous division. These are reported from Greenland, England, Hanover, Spitzbergen, Central Russia, and Siberia in the northern hemisphere ; and one (*Salisburia* or) *Ginkgo antarctica*, from New South Wales.

Feistmantel in the "Palæontologia Indica," Fossil Flora of the Upper Gondwana System, Series II., Vol. I., 4, pp. 31-221, and Plates XV. 6-9, XVI. 12, 13, describes and figures two species, *Ginkgo crassipes*, Feist., and *G.* s.p. In the flora of the Jabalpur Group, Series XI., 2, p. 98, the same author places a plant, formerly arranged under Cyclopteris, as *Ginkgo lobata*, Feist. ; and in the Fossil Flora of the Gondwana System, Series XII., Vol. IV., Part I., a fragment of a Ginkgo from South Rewah is figured in Plate III., fig. I.

Fossil species closely connected with Ginkgo, are, Baiera, *F. Br.*, Trichopitys, *Sap.*, Czekanomskia, *Heer*, Phœnicopsis, *Heer*, Rhipidopsis, *Schmal.*, Ginkophyllum, *Sap.*, and (*fide* Renault), Dicranophyllum, *Grand 'Eury*, and Whittleseya, *Newberry*. Of these Baiera is separated from Ginkgo on account of its compound dichotomously divided leaves, or cladodia, with short leaf stalks, and narrow ribbon-like segments; Ginkophyllum by its decurrent leaves ; and Phœnicopsis by its leaves being fasciculate at the extremity of branches, their bases surrounded by many persistent scales.

In the "Proc. Lin. Soc., N.S.W.," Vol. VIII., Part I., p. 131, the late Rev. J. E. Tenison-Woods described as a new species a fossil plant from the Burnett River coal seams, Queensland, which he named *Jeanpaulia bidens*, and placed under the ferns in the order Ophioglossaceæ ; in his notes he draws attention to its resemblance to a living fern, *Helminthostachys zeylanica*. In the Geology and Palæontology of Queensland and New Guinea, p. 319, Mr. R. Etheridge, jun., rightly removes the species from the ferns to the conifers, and places it under the genus Baiera, *F. Br.* An examination of a number of specimens in the museum of the Geological Survey of Queensland, and more particularly of a plant specimen recently obtained from Petrie's Quarry, by Messrs. E. Heden and R. L. Jack, jun.,* proves that the Rev. Author's plant is not properly placed under Baiera, as the leaves are simply palmately lobed, but not dichotomously branched or divided, the segments are not narrow linear, and the veins in each segment may number six to ten. In all these points the plant differs from the well known *Baiera Munsteriana*, and the genus Baiera generally.

The following is the Rev. J. E. Tenison-Woods' original description :—" Jeanpaulia bidens, n.s., Plate 4, fig. 3. Frond broadly flabellate ; segments somewhat short, often becoming broader towards the apex, and ending in a short wide bifurcation, or in a curved, falcate, acute or acuminate point ; veins not conspicuous, numerous (6 to 10), parallel, not branching. The longest of the segments in the specimen figured is 55 mm., and the width is from 3 to 6 mm." To this must now be added :— " Leaf segments 5 to 7, gradually narrowing to the base, closely and digitately inserted at the apex of a slender petiole, which is one-third shorter than the segments themselves."

On one of the specimens was found an impression of a female amentum, with four cupular bracts, each solitary on short branchlets of the common pedicel, bearing the drupe-like seeds, which were not more than 2 lines long. Without further proof these cannot be accepted as the fruits of G. bidens.

The plant should be known as Ginkgo bidens, *Ten. Woods* ; and its nearest allies are G. (Salisburia) sibirica, *Heer*, G. lepida, *Heer*, and G. Schmidtiana, *Heer* ; fossil plants from Jurassic beds, Ust-Balei, Eastern Siberia.

In the museum of the Geological Survey of Queensland the following belong to this species :—Nos. 9 (a), 9 (b), 9 (c), 81, and 82 ; and, doubtfully, 41 (a), 41 (b), and 47 (a). These are all from the Ipswich Formation, Permo-Carboniferous Series, Nos. 81 and 82 from Petrie's Quarry, and the others from railway cuttings at Oxley or Yeronga.

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MICRO-ORGANISMS FROM THE BRISBANE AIR.

By A. JEFFERIS TURNER, M.D., Lond.

[*Read before the Royal Society of Queensland, July 11, 1896.*]

During the past eighteen months I have made a series of observations on the bacterial flora of the air of Brisbane, and I propose to give a short account of the results so far obtained, reserving fuller details for a subsequent occasion, when my observations shall have been more complete.

The method employed was simple. It was not my object to estimate the number of micro-organisms present in the air, but to obtain pure cultures of the different species, and to examine their morphological and cultural differences. The ordinary nutrient agar jelly (2 per cent. agar, 1 per cent. peptone, 0.5 per cent. common salt in beef broth) was poured into a sterilised Petri dish and allowed to cool. The plates so obtained were usually kept covered for a few days in order to allow the superfluous moisture to evaporate, and were then exposed by removing the cover for from two to five minutes. Some of these exposures were made in the laboratory, but the greater number in a small paddock outside, the dish resting on the top of a six-foot post. These agar-plates I have found preferable to gelatine plates for this purpose, inasmuch as they can be kept longer; whereas the latter rapidly liquefy, so that slowly-growing organisms may be lost. Further, on the old plates the colours of the pigment-producing organisms become far better marked than on recent plates.

The desiccated condition of the organisms deposited from the air is unfavourable to rapid development, and colonies are not visible to the naked eye before the second day. A few barely visible specks then can be usually detected by careful observation. Watching these from day to day they will be seen to increase in size; new specks will appear in other parts of the plate; and differences between the colonies soon manifest themselves. Every day increases their diversity, and at the end of a week or longer the plate displays the variegated condition of those now exhibited. Every germ, where it has fallen, has given rise to its own characteristic growth, and we get as a result a small garden of various lowly organised vegetable forms, as diversified as the weeds which spring up in a fallow field.

The larger growths on these plates are readily recognised as those of the filamentous fungi commonly known as moulds. These occur in considerable variety, but as they are not the object of the present research, no attempt was made to study them minutely, although they are certainly well worthy of investigation.

We will now turn our attention to smaller growths on our plate which, even by the naked eye, are readily distinguishable from those of the mould fungi. These are circular, sometimes irregularly lobed or crenated at the circumference, more or less raised from the surface, and very variable in colour. They are colonies, each consisting of an immense number of a particular species of bacterium developed from parent organisms which have fallen on to our plate from the air. Some of these growths are whitish, some yellow, some more or less vivid orange, some pink. We can readily infer that they are of various species. But for the investigation of these special care is necessary, for we are here dealing with the most minute forms of life known to exist, and it is quite impossible to differentiate the species by morphological characters only. So simple are they in structure that it will need the most thorough examination by various methods of cultivation to decide whether any two colonies we may pick out belong to the same or different species. Our first object must be to obtain a pure culture of each sort. For this it might seem sufficient to at once inoculate our various culture media from the different growths. But, though this is sometimes successful, I have found it a very uncertain and untrustworthy method. It not unfrequently happens that two or more parent bacteria of different species have fallen close to each other on the plate, and that what appears to be a single colony is really a mixed growth. In the case of most of the organisms first cultivated from apparently single colonies, I have had to avail myself sooner or later of the method of isolation by gelatine plates; and I now always adopt this in the first instance. Though tedious, no trouble is superfluous that assures the observer of the purity of his cultures. The original colony is touched with a sterile platinum wire, which is rinsed in a tube containing sterile bouillon. A very minute platinum loopful of the bouillon is then transferred to a tube of melted gelatine, which, after gentle agitation, is poured out into a sterilised Petri dish, where the separate colonies develop within two or three days and are utilised as the starting-point of pure cultures.

I have here a number of pure cultures secured from the Brisbane air of sixteen distinct species or varieties. It must not be supposed that these are anywhere near the total number of distinct forms that may be obtained in this locality by the method I have described. I have preferred to concentrate my attention in the first instance on a few forms, and more particularly on those presenting some distinguishing feature, such as the development of pigment.

The first culture to which I draw attention is not a bacterium at all, though indistinguishable in its method of growth. It belongs to the group of torulæ or yeasts, and consists of comparatively large oval, often vacuolated, cells which multiply by budding. The growths produced by it are of a beautiful pink colour, and do not liquefy gelatine. It resembles, and is probably identical with, a species of yeast organism commonly found in air cultivations in Europe. It has developed rather frequently on my plates, where its conspicuous colour readily attracts observation.

The bacteria proper are represented in the first place by eight different forms of cocci. These smallest forms of life are exclusively found in the form of excessively minute spheres. In the process of growth they divide into pairs, which, clinging together, form what are known as diplococci. Three or five cocci are not infrequently observed clinging together in chains. Longer chains were not observed in the species shown. Sometimes the diplococci divide transversely, forming tetrads. This, with a slight variability in the size of the individual cocci, exhausts the morphology of these simple organisms. After careful and repeated examinations, I was unable to find any ground of distinction from microscopical appearance in the eight varieties. None of them exhibited any independent motility, though Brownian movements were, of course, very marked. The distinctions between them depend entirely on their mode of growth on various media. In describing them it will be convenient to denote the varieties by letters of the Greek alphabet, as it would not be justifiable to give them distinct names until they have been compared with cocci previously described. In two, Coccus γ and Coccus μ, the growths are pink; in Coccus ζ, vivid orange; in Coccus η and Coccus λ, bright yellow; in Coccus θ and Coccus ν, whitish; in Coccus ξ, brownish. Another point of distinction is the presence or absence of the power of liquefying gelatine. Two, coccus ζ and coccus λ, never liquefy the gelatine, however old the growth may be. On the other hand, coccus θ liquefies the gelatine rapidly; coccus η, coccus ν, and coccus ξ slowly; coccus γ and coccus μ, after growing for a long period without any sign of liquefaction, slowly give rise to this after the lapse of several weeks. The slow occurrence of liquefaction is best determined by streak cultures on the surface of gelatine which has set in an obliquely inclined tube. The first sign of liquefaction is the formation of a groove in the surface of the gelatine occupied by the growth; at a later period the growth slides down to the bottom of the tube. By noting the date on which the groove is first distinct, the comparative rapidity of liquefaction can be estimated. For instance, in one experiment, during which the temperature ranged between 16 deg. C. and 22 deg. C., coccus θ and coccus ν formed a groove on the second day, coccus η on the fifth day, coccus ξ on the nineteenth day, coccus γ on the twenty-fourth day, coccus μ on the forty-eighth day.

Growths of these cocci on potato show no peculiarity except in their coloration and rapidity of growth. Growths in liquid broth show no peculiarity of any kind—merely a turbidity with a fine deposit formed by the organisms. Coccus θ is an exception. Broth cultures and liquefied gelatine cultures of this organism contain a ropy substance like mucus, evidently a product due to some chemical fermentation. Agar cultures too of this coccus, form a very coherent film, which sticks glutinously together when distnrbed by the platinum needle.

The bacilli, or rod-shaped bacteria, show much greater morphological variety than the cocci we have been considering, and it will be convenient to describe the seven forms I have isolated from the air separately. Bacillus α, when examined under the microscope in a hanging drop of fluid, presents a very lively appearance, for each rodlet or sphere is actively motile, swimming about the field of view with great agility. It is a stout bacillus, usually short, but varying greatly in length, for very long motile rods are sometimes seen. On the other hand, the great majority may be so short as to be round and indistinguishable from cocci and diplococci. But some oval forms are always distinguishable. These roundish forms appear to be commoner in agar cultures, the longest rods in gelatine cultures. At first I suspected that I might be dealing with a mixture of organisms, but by making gelatine plates and examining individual colonies this was negatived. The growth on agar is rapid and of a pale orange or yellowish colour. Gelatine stab cultures show rapid liquefaction, the gelatine being in time completely liquefied, the growth sinking to the bottom of the tube. Gelatine plate cultures show rapidly spreading liquefaction of the individual colonies. I have not observed any spore formation in this bacillus.

In its morphological characters, bacillus β is extremely distinct from the preceding. It is an excessively minute, very slender bacillus, varying in length from roundish and oval forms to short rods. I have never observed it form rods of any considerable length. It shows no independent movements. On agar it forms a deep, somewhat greenish, yellow growth, provided the temperature at which it is grown is not too high. A streak culture on gelatine forms a narrow yellow streak which shows no sign of liquefaction for the first two weeks, but slowly liquefies at a later date.

Bacillus δ resembles the preceding in forming a yellow growth on agar and potato. But the colour, though well marked, is not so deep and has no greenish tinge. Cultures on the surface of gelatine show a wider streak than the preceding, and stab cultures spread more widely at the surface. Liquefaction occurs tardily after the first week. It is a moderately stout bacillus, occurring in roundish, oval, and short rod-like forms, but does not appear to form long rods and is non-motile.

Bacillus κ is a moderate-sized, fairly stout bacillus, very similar to the preceding in morphological characters, but somewhat larger. It has no power of movement. Growths on agar develop rapidly, are whitish, with a faint yellowish tinge, which is better developed on potato cultures. Grown in gelatine it causes rapid liquefaction.

Bacillus π is a large, stout bacillus with rounded ends, very variable in length, but never forms long filaments. In young cultures many individuals show well marked, but sluggish, independent movements. Like all the preceding it does not appear to form spores. Its growth on agar is white, the centre of the various colonies being opaque, the periphery thin and transparent. It has a very feeble power of liquefying gelatine in old cultures. A stab culture develops slightly along the track of the needle, and spreads for a moderate distance at the point of entry. Occasionally feathery whorls spread out from the upper part of the stab into the substance of the jelly.

Bacillus σ is a very interesting organism. Its growths on agar spread at the edge in looped skeins of filaments, closely resembling the well-known growths of *Bac. subtilis*. If an old colony is examined, it will be found to consist at the edge of these filaments, which readily break up into rods, but the central portions consist almost entirely of a mass of spores. Its growth on gelatine at once differentiates it from *Bac. subtilis*. There is a slight growth along the track of the needle. From the point of entrance, a fine feathery growth spreads all over the surface, and the gelatine never liquefies. On a gelatine plate the colonies develop much more slowly than those of *Bac. subtilis*, the early stage of which they resemble, but differ in the entire absence of the circular liquefaction and rapid growth characteristic of the latter. On potato, bacillus σ develops slowly and scantily. The best method of observing its growth and spore formation is in a hanging drop of bouillon. When such a drop, on a hollow slide carefully sealed with vaseline, has been in the incubator for twelve hours, it is observed to be full of actively motile rods, similar to those of the hay bacillus, but more slender. Filaments are not developed. After twenty-four hours most of the rods are unaltered, but a considerable number have lost their motility and show commencement of spore formation. The first change observable is a fusiform thickening near one extremity of the rod. This is at first devoid of structure, but soon is observed to contain a highly refractile particle, which gradually increases in size to form a mature spore. The spore-bearing rods have somewhat of a drumstick form, but the enlargement is seldom quite at the extremity of the rod, and has not the circular form displayed by the spore-bearing rods of *Bac. tetani.* The spores and rods can be doubly stained by suitable methods. For the formation of spores, a plentiful supply of oxygen appears to be necessary, When grown in broth this bacillus does not form any scum, but a deposit is formed at the bottom, which, when disturbed by the platinum needle, appears to be of a ropy consistence like mucus. A hanging drop of this ropy deposit shows immotile rods, some of which show fusiform enlargements, but none contain spores. If the hanging-drop preparation be kept a day or two in the incubator, the ordinary motile and spore-bearing rods are developed. The spores, are, however, only formed in scanty numbers, and most of the rods grow into long filaments, which are not observed in primary hanging-drop cultures.

Bacillus ϵ is a large, stout, non-motile bacillus occurring in straight rods with rounded ends, and in long, curved, jointed filaments. Grown in a hanging-drop of bouillon in the incubator, it forms within twelve hours a massive growth of tangled filaments; after twenty-four hours these break up into rods, many of which contain spores. On agar, and on potato, it forms a copious thick white growth. In an early stage this is seen under a low power to consist of convoluted bands or skeins like those of *Bac. subtilis*, but not throwing out isolated loops at the periphery. The growths, unlike those of the preceding, rapidly increase in thickness, so as to disguise their structure. Stab cultures in gelatine undergo rapid liquefaction, and small superficial floating flakes form at the periphery of the liquefied portion.

The question now arises, How far do these distinct strains of organisms represent distinct species?

Their individual differences are for the most part constant; that is to say, they breed true. I have cultivated most of the forms through a succession of generations during twelve months, and find them still true in minute detail to my original descriptions. But it is important to note that one of their characteristics, development of pigment, is much affected by temperature. To test this point I have made simultaneous agar cultures of all the coloured forms, growing one tube of each in the incubator at 36 deg. to 38 deg. C., and another at the temperature of the room, which at the time of the experiment varied from 16 deg. to 22 deg. C. In six cases the result was identical. The higher temperature stimulated the early growth, which was more rapid, sometimes much more rapid in the incubated tube during the first forty-eight hours, but the growth remained whitish and never developed the characteristic coloration. This was true of coccus γ, ζ, μ, and ξ, and bacillus α and β. During the hot summer months these bacteria lost their power of producing pigment, to regain it again the next winter; all except coccus ζ, in which the vivid orange growth was never regained. It now develops only a pale orange. On the other hand, in four cases the coloration was equally well, or even slightly better developed in the incubated culture. This held good of coccus η and λ, and bacillus δ and κ. All these were yellow growths. On the other hand, bacillus β, which has a yellow growth, was decolorised in the incubator, as were all those which had a pink or orange growth.

We see, therefore, that one of the most prominent distinctions between our varieties varies with the temperature. This does not impair its value as a real distinction; but the fact that in one form—coccus ζ—the power of colour formation has diminished, irrespective of temperature, certainly is of significance. But when we take a general view of the differences between the various forms, we find that some are as distinct as—for example—roses from brambles; while others present but minor differences, with a close general resemblance, like the various kinds of roses and brambles respectively, as to whose specific value no two botanists are in agreement. For instance, the distinction between the various bacilli is wide and patent. But among the cocci, coccus η differs from coccus λ only in the one point that it has a feeble power of liquefying gelatine, while the latter has no such power Again, coccus γ is very close to coccus μ, and it needs close observation to distinguish that the former has a more luxuriant growth on agar, that its growth is at first whitish but very gradually attains a pink colour ; while the growth of the latter is distinctly pink from the first. These differences, so far as I have observed, are constant, but they are slight, and of doubtful specific value. Again, among the bacilli, I have lately isolated a culture which appears to exactly resemble bacillus α, except that it possesses a less active power of liquefying gelatine. A larger experience will probably multiply the number of these closely similar varieties ; and their occurrence raises a doubt as to whether they may not in some cases be merely different forms of the same species, and may not actually be transformed by different conditions of growth from one form to the other.

In one instance I have actually succeeded in breeding two sub-varieties from a single species. In an agar culture of bacillus α, I observed two different kinds of colonies—one a very pale ochreous yellow, the other of an orange tint. The parent agar culture had been kept through several hot months, and was descended from a gelatine-plate colony. My first impression was that the originally pure culture had become contaminated. Microscopical examination of hanging-drop preparations showed that both kinds of colony consisted of morphologically indistinguishable actively motile bacilli of the form I have described as characteristic of bacillus α. From each growth I made a gelatine plate, and from this again gelatine and agar cultures. The gelatine growths of the two forms were absolutely indistinguishable and quite characteristic ; the agar growths presented the same differences of coloration that I have mentioned. The difference is not a very great one, but so far it breeds true, and the evidence seems conclusive that the two varieties have a common origin.

EXPERIMENTS WITH RÖNTGEN RAYS.

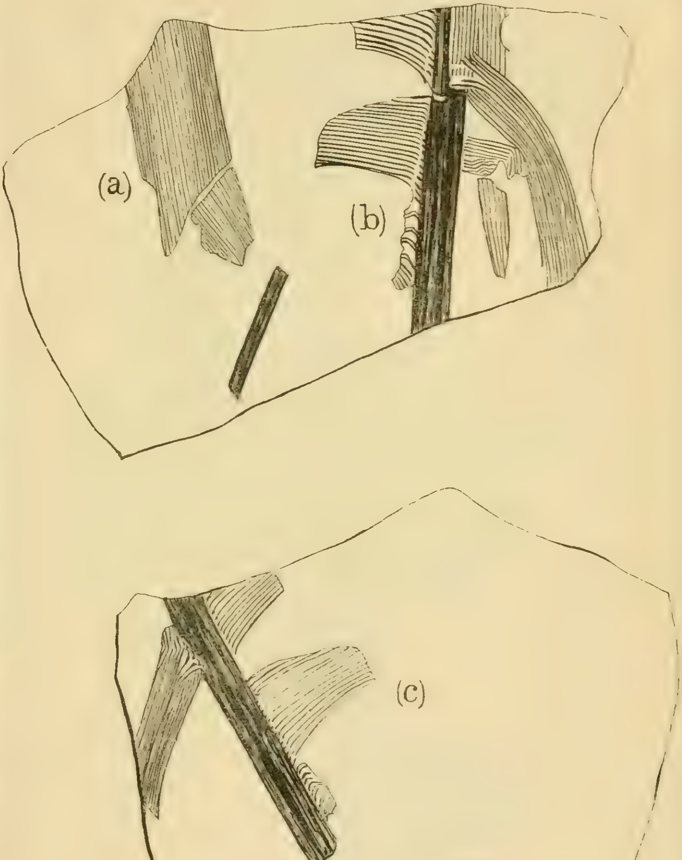
[Made by Mr. J. W. Sutton before the Royal Society of Queensland, on Saturday, August 8, 1896.]

Mr. J. W. Sutton, to whom is due the honour of having first introduced to Brisbane the wonderful "X" rays, recently discovered by Professor Röntgen, gave the first public demonstration in Queensland of the same before a meeting of the Royal Society on Saturday, August 8. Mr. Sutton, since his first demonstration in his own laboratory, about two weeks ago, before a few of the leading medical men in Brisbane, has been experimenting in the direction of preparing for himself a fluorescent screen by which the effects of the "X" rays can be at once seen without the necessity for exposing a photographic plate to the rays, and taking a "radiograph." His efforts have been quite successful. The screens are manufactured and sold for the use of experimenters with the Röntgen rays, but so far none have been received in Brisbane. After giving a popular sketch of the historical side of his subject, Mr. Sutton directed the attention of his hearers to a black board on which he had a diagram illustrative of the rays of the spectrum. On the right of what was marked the "visible spectrum" there was shown the "infra red" spectrum, and, outside them again, heat rays, while to the left of the visible spectrum there was shown the "ultra violet" spectrum, and, to the left of them, "unmapped" rays. He proceeded to state that photography had revealed the fact that photographically active rays extended a distance of nine or ten times the length of the visual spectrum, and both from the ultra violet and the infra red portion of the spectrum, there emanated a long series of rays which, though quite invisible, possessed chemical energy and heat, and with which it was quite possible to make radiographs through many opaque substances, and it was supposed that somewhere in these outskirts of the spectrum, the "X" rays would be found if they are associated with light at all. Shadowgraphs were produced years ago, Mr. Sutton remarked, in the early stages of electric lighting, by placing sensitive plates protected from ordinary light in the magnetic field in the dynamo armature, and it had also been noticed that some persons emitted phosphorescence from their fingers sufficient to imprint itself upon a sensitive plate. But still, notwithstanding all that was known previously, the discovery by Professor Röntgen was accidental, and it was made while he was experimenting with a Crookes tube in the presence of a packet of sensitive plates. The plates were fogged, that is they had been acted upon by some kind of light other than ordinary, but to an experienced experimenter like the professor, the cause was apparent, and thus the world was startled by a wonderful discovery. He would be a bold man, indeed, who would predict the developments that are likely to take place within the next two or three years.

Mr. Sutton proceeded to explain the apparatus he had provided in illustration of his remarks. Having briefly referred to the electric battery and the large induction coil by which the necessary current was provided to illuminate the Crookes focus tube, he called the attention of his audience to an ordinary vacuum or Geissler tube. He passed the electric current through this tube, which was a large three-bulb one, and it was immediately filled with the well known phosphorescent glow. Doubtless, said Mr. Sutton, there were "X" rays emanating from the tube, but they were so diffused as to be of no effect. In Crookes tube, through which the current was next passed, a more complete vacuum had been obtained and other improvements made. It was while experimenting with one of these tubes that Professor Röntgen stumbled across the famous "X" rays. The next step was to improve the vacuum tube still further by obtaining a more complete vacuum and introducing an arrangement of aluminium and platinum discs by means of which the "X" rays were focused. Next Mr. Sutton introduced his audience to the subject of fluorescent screens. Fluorescence was a peculiar property possessed by some substances, and to it in 1852 Professor Stokes called attention. Balmain's luminous paint was a familiar example. It had been found that certain of these fluorescent or phosphorescent substances had a peculiar connection with the "X" rays, and that when the "X" rays fell upon them they at once became brightly illuminated, and anything which was opaque to the rays, on being placed in the back of the screen, cast a shadow on it. Thus observers were able to see at once the bones of the hand, coins in a book, &c. The screen Mr. Sutton had succeeded in making was after the method of Edison, he having used tungstate of calcium to coat the screen with.

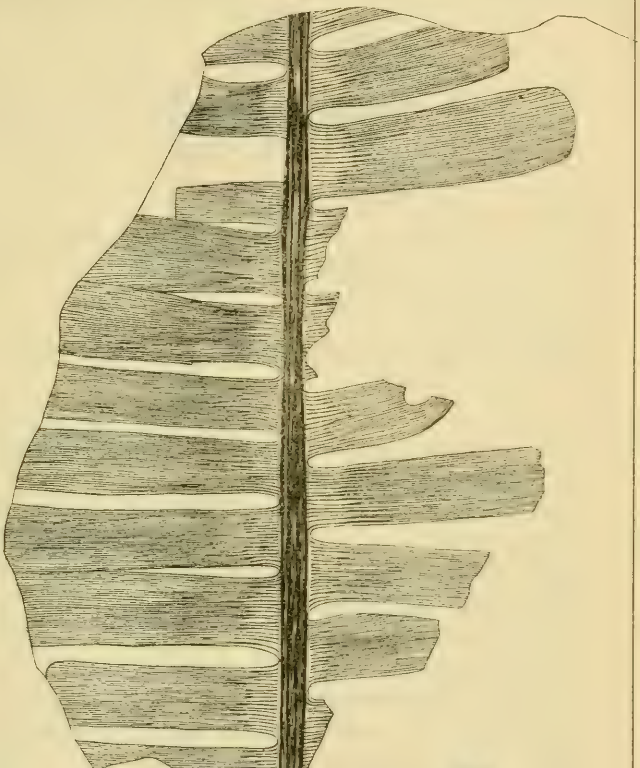
Having thus explained the apparatus, Mr. Sutton made several exposures of plates with remarkably good results. One interesting exposure was a collection of various articles, offering various degrees of opacity to the rays. The development of the plates was admirably carried out by Mr. Ferguson under circumstances decidedly unfavourable to such delicate work, with capital results. The exhibition of articles on the fluorescent screen, where the wonderful effects of the "X" rays were at once visible, called forth frequent applause. Coins placed in a cigar case were plainly seen, and so were similar articles placed between two-inch thick deal boards, or in the middle of a thick book. Neither the wood nor the paper seemed to offer much resistance to the light.

The proceedings were terminated by a hearty vote of thanks to the lecturer and demonstrator.



(a) PTEROPHYLLUM, SP.

(b) & (c) PTEROPHYLLUM YERONGENSE, *Shirley.*



PTEROPHYLLUM MULTILINEATUM, *Shirley.*

A. W. Ham, del.

TWO NEW SPECIES OF PTEROPHYLLUM

(PLATE VII.)

By JOHN SHIRLEY, B.Sc.
(District Inspector of Schools.)

[*Read before the Royal Society of Queensland, August 8, 1896.*]

In examining the various formations for plant remains, it is universally observed that the more recent the formation, the more the flora resembles that of the present day; and the more ancient the formation the more numerous become the points of divergence between the ancient flora thus revealed and that now in existence. But however far back we go, the flora of any given region has a stamp and quality of its own that links it to living forms, however it may have changed through the course of ages. Unfortunately all plant remains are not equally endowed with the qualities which favour preservation in the different strata; some, as the conifers, cycads, and ferns, have tough membranous leaves which resist pressure and decay until their forms have been impressed upon the sedimentary layers; and are thus preserved against injury until revealed by the miner, engineer, or geologist. A considerable number of these have been unearthed in Australia; and, as is elsewhere the case, they bear ample testimony to the now almost universally accepted theory, that, through these ancient forms, the existing plants of the same orders have descended. This evolutionary descent has been likened to a tree; the numerous species of to-day, like the branches of a tree, being traceable to one archaic form represented by the parent trunk. But the typical tree may not always be a vigorous and healthy one; but may be withering and decaying with only a few live twigs, the present species, to represent what in the past was a number of strong, well represented branches.

The order Cycadeæ is one that in our time is dispersed in little groups over large areas. Species are met with in the southern part of the United States, in tropical America, in Australia, in the south of Japan, in southern and subtropical Africa, and in the archipelagoes and coasts of the Indian Ocean. Australia has three living genera—Cycas, with pinnate leaves, the pinnæ with the midrib prominent beneath; Macrozamia with pinnate leaves devoid of midrib; and Bowenia with bipinnate leaves. In the Flora Australiensis these genera are credited with seven species in all; in Baron F. von Mueller's Census for 1889 the number is fourteen, thirteen of which are peculiar to Australia; the genus Cycas has a wide range from Madagascar on the west to Japan on the north-east.

The fossil remains of Cycadeæ seem to have attained their greatest development in the Mesozoic formations, especially in the series of beds of the Jurassic system; and at that period they were generally distributed over the northern hemisphere. Few Palæozoic forms are known; and these few are chiefly remains of stems from the Permian formations and the coal-measures; but among these are some undoubted Cycadaceous leaves, which have been mainly referred to the genus Pterophyllum. Very little can be said of the position occupied by Cycads in the Tertiary flora, as this flora has only been deeply studied in Europe, and to a less extent in the Arctic zone—regions where these plants no longer live. In Europe they existed during the Tertiary period, but in much diminished numbers, and they were confined to a small number of genera.

In Dr. Feistmantel's work on the Geological and Palæontological relations of the coal and plant-bearing beds of Palæozoic and Mesozoic Age in Eastern Australia and Tasmania, he figures and describes eight species of fossil Cycads, ranged under four genera. In the Geology and Palæontology of Queensland and New Guinea, Mr. R. Etheridge describes ten species of fossil Cycads divided between four genera, including two species of Pterophyllum.

When lately examining, by the kind permission of Mr. R. L. Jack, a number of fossils obtained from a railway cutting at Yeronga, I found, among other plants, the remains of two species of Pterophyllum, which have not yet been described.

1. Pterophyllum Yerongense, *Shirley*, sp. nov. (Pl. vii, figs. *b* and *c*.)

Frond pinnate with a very broad striate rachis; pinnules alternate, elongate, equal (?), strap-shaped, margins parallel; apex (?); base slightly broader than remainder of pinnule, sinuses strongly curved upwards, attachment horizontal by whole of base; veins strongly marked, parallel, 16-22 in each pinnule.

It differs from P. abnorme *Eth. fil.* in the number and non-furcation of the veins. It approaches P. Strahani, *R. M. Johnston* Pl. xxviii. fig. 1 and 1 (a), Geology of Tasmania, but this last has very unequal pinnules.

Under this name are placed Nos. 15 and 15 (a) of the fossils from Yeronga exhibited in Case 64.

2. Pterophyllum multilineatum, *Shirley*, sp. nov.

Frond large, delicate, rachis less stout than in P. Yerongense; pinnules large to $\frac{3}{4}$ inch wide, strap-shaped, alternate, equal (?); apex rounded; marked by many fine parallel veins, to thirty in number; insertion of pinnules perpendicular on the rachis and attached by the whole of the base, which is slightly widened at the upper angle of insertion; sinuses narrow, rounded.

Approaches P. princeps *O. and M.*, but differs in possessing equal pinnules, which are usually inserted alternately, while P. princeps belongs to s. Anomozamites, *Schimper*.

Under this name is placed No. 8, Case 64, Geological Survey Department.

NEW NATIVE MEDICINAL PLANTS OF QUEENSLAND.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, September 12, 1896.*]

In the United States of America great efforts are made by the leading authorities in Medicine and Chemistry to utilize for practical purposes every native plant endowed with medicinal virtues or containing any active principle. The Americans have indeed gone so far as to put into the Pharmacopœia and to introduce into commerce on a large scale preparations of American plants said to be possessed of medicinal properties, but really altogether void of active principles. It is an established fact that for instance the Witch Hazel, *Hamamelis virginica*, a shrub which blossoms late in autumn and grows abundantly in my garden in Germany, does not contain any active substance, except a very small amount of tannic acid, though different kinds of elegant preparations are thrown on the market by the well-known firm of Park, Davies and Co., Detroit.

In Australia the native medicines are neglected. The gums of the Eucalypts, the very best healing astringents in the world, are called by the misnomer of "kino," and the special tannins contained in them striking blue with ferric salt is still called kinotannic acid, which really is one of the very worst tannins met with in the vegetable kingdom. There is one excuse for the evident neglect of our Australian medicines: the chemistry of our plants is only very superficially known.

The tannins have been worked out to a great extent by the author of this paper, and a new series of experiments concerning the tannins of the Eucalypts has been started lately by him. For external use a soap has been devised as the best means to act on a diseased skin.

Mr. Strüver manufactured three different kinds of Eucalyptus soap for the author of this paper. Ordinary soap is made from 70 to 75 parts of fat, 40 to 45 parts of water, and 10 parts of soda.

Mr. Strüver was instructed by me to use only from 6 to 9 parts of soda to avoid any unnecessary irritation of the skin, and he made an excellent improvement of his own by adding a large proportion of vegetable slime to the soap. The young branches and twigs of *Eucalyptus tereticornis*, *E. hæmastoma*, and othe gum trees of the same group are exhausted with water, and this water is used for exhausting more twigs, until it is saturated with the constituents of the eucalypts.

On addition of soda, of course, the tannic acid is precipitated as sodium tannate, but it is still in an active state if it meets albumen or gelatine or the glue-furnishing constituents of the living skin. This sodium tannate all goes into the soap and acts as a healing agent, which has already stood the trial. The soap, as it is here exhibited, can be obtained from Mr. Strüver on application.

I now have to deal with the root of a leguminous plant—a Galactia—named *G. varians* by our renowned Colonial Botanist, Mr. F. M. Bailey. The plant occurs at Coolgarra, and was sent to Mr. Bailey by Mr. Matthew Butler, J.P., who with the specimens sends the following marvellous statement about its medicinal properties: "On the 24th December, 1894, I was sent for to make the will of an old man who was, as he thought, dying from rheumatism. In a fit of abstraction he pulled up the root and ate it. Fancying it gave him relief, he pulled more, boiled it and drank the liquor. Within a week there was a marked change in him, and now he is quite well and looks ten years younger. A miner, who has been suffering for over two years from a scrofulous affection took a decoction of this root for a fortnight, and his skin seems now perfectly clear, and he tells me he feels a new man. I had a slight touch of rheumatism in the leg and tried a decoction of the root, with the result that the pain has gone and the stiffness is wearing away."

So far the report of Mr. Butler to the Colonial Botanist. Mr. F. M. Bailey had, in November last, the kindness to put the material in my hands for a trial and for chemical investigation. The root is fusiform, three to four inches long, grey outside, yellow like a turnip inside, is destitute of a peculiar smell, but has an acrid taste which made me suspect saponine in the drug. On further examination I found the root to contain neither saponin, nor any alkaloid or glucosoid, but to be full of a sticky acrid yellow resin to the amount of thirty per cent. of the whole weight of the dry root.

This resin dissolves in alcohol, ether, chloroform, benzol and petroleum ether with a yellow coloration having a greenish tint, It has no smell, but an acrid taste. On an opal plate the yellow colour is seen best. On addition of ferric chloride it changes to a bluish grey. Caustic potash throws the iron out of the combination with the resin and changes the colour of this into a golden yellow. Nitric acid stains the alcoholic yellow solution into a golden yellow which on addition of ferric chloride turns into bluish grey again. Bleaching powder acts in the same way. Sulphuric acid dissolves the Galactia resin with yellow colouration. Saliva dissolves it likewise. It has an acrid taste.

An infusion of Galactia root gets turbid on cooling and deposits an amorphous sediment which consists of nothing else but the resin. The Galactia resin is chemically related to the Guaiacum resin, and therapeutically it comes near the same. Galactia resin might be recommended in rheumatism, skin diseases, scrofulosis and syphilis, and in rheumatism and skin diseases it might surpass guaiacum in quickness and certainty of effect.

NOTES ON THE OCCURRENCE OF CONTEMPORANEOUS BASALT IN BEDS OF THE "GYMPIE FORMATION," AN CANNINDAH STATION.

By WILLIAM H. RANDS, F.G.S.
(Assistant Government Geologist).

[*Read before the Royal Society of Queensland, September 12, 1896.*]

When on my way in June last to visit the newly-discovered copper and gold deposits at Mount Cannindah on the Cannindah Run in the Burnett District, I was delayed a day on account of rain at the Head Station.

In the Station yard I noticed some blocks of limestone lying about, which had been used in the construction of old outbuildings, and in which there were impressions of crinoidal stems.

On inquiry I was pointed out the place, not many hundred yards west of the Station house, from which this limestone had been obtained, and I at once started out in search of it in the hope of coming across some fossiliferous remains; but with the exception of finding a few crinoidal stems, and some badly preserved, and Brachiopoda in the limestone and shales, I was unsuccessful. There was, however, no difficulty in recognising the beds as part of the Gympie Series, the lowest member of the Permo-carboniferous System, as developed in Queensland.

I was fortunate enough to come across a very interesting section of these rocks, in which a very slightly altered olivine basalt occurs interbedded.

The rocks in question have a general strike of north-north-west and north-north-east, and they dip east-north-east at an angle of 50 degrees from the horizontal.

Traversing the rocks from east to west I obtained the following section :—

Grits	about 240 ft. thick.
Hardened Shales with crinoidal stems	,, 335 ,,
Shales and Sandstone	,, 320 ,,
Bluish Limestone with crinoidal stems and Brachipoda ...	,, 175 ,,
Break in Section (probably shales)	,, 280 ,,
Olivine Basalt	,, 50 ,,
Shales	

The grits, limestone, and basalt crop out somewhat prominently, forming three small parallel ridges, running of course in the same direction as the strike of the beds. I followed along these beds for a distance of about one quarter of a mile, and could trace them with my eye for some distance, but the inclemency of the weather prevented me traversing them further.

At the edges of the basalt, in places, a dip coincident with that of the other beds is observed.

These few notes have been written with the object of placing on record the occurrence of a comparatively unaltered basalt, and one which resembles in nearly every respect many of our late Tertiary basalts in the "Gympie Beds," as, so far as I know, this is the first time such a thing has been observed.

My colleague, Mr. R. L. Jack, in his Report on the Bowen River Coalfield, 1879, has reported the occurrence of interbedded basalts, which he informs me are somewhat similar to the specimen produced, in the volcanic ranges of Mount Macedon and Mount Devlin in rocks of the Lower Bowen Formation, the middle member of the Permo-carboniferous System.

In my Report on the Gympie Goldfield, 1889, I myself have described interbedded volcanic rocks in the type district, but these are much altered amygdaloidal diabases.

Scale 2 feet to an Inch

R. H. Mathews del^t

ROCK CARVING BY THE AUSTRALIAN ABORIGINES.

(PLATE VIII.)

By R. H. MATHEWS, Licensed Surveyor.

[*Read before the Royal Society of Queensland, September 12, 1896.*]

In a paper contributed to the Royal Society of Victoria in 1894,* I stated that I had obtained authentic information respecting the age of aboriginal paintings drawn in caves in the Wollombi district, New South Wales, about the year 1843, which settled the question of rock painting having been practised by the blacks for many years after the settlement of the colony by Europeans. Mr. R. L. Jack, the Government Geologist of Queensland, in describing some aboriginal paintings which he found in caves on the Palmer goldfield in that colony, states as his opinion that the drawings seen by him were probably not more than twenty-five years old.†

In the paper referred to I also described some aboriginal rock carvings, but up to that time I had not succeeded in finding anyone who had seen these carvings in course of production. Since then I have been more fortunate. Whilst recently on an expedition amongst the Darkinung tribe on the Hawkesbury River for the purpose of studying their customs, I met a native named "Andy," who showed me a carving on a rock which he had seen done by a blackfellow when he himself was a lad of about fifteen years old. Some of the white people who had known Andy from his boyhood told me that he was then (1896) about fifty-five years of age, so that it would be about forty years since the execution of the drawing, which would make the date about 1855.

My informant stated that the blackfellow who carved the figure was known as "Hiram" by the white people amongst whom he occasionally worked. He was a middle-aged man at the time the drawing was done, and has been dead for a number

* Proc. Roy. Soc. Victoria, VII. N.S., pp. 143-156, Plates VIII and IX.
† Proc. Roy. Soc. Queensland XI., pp. 91-98, Plate I.

of years. The position of the right leg, and general style of the drawing (see Plate VIII.) shows that the artist had evidently taken notice of European pictures, which he had no doubt seen in the huts of the white settlers.

The carving is evidently intended to represent a white man going into the bush to cut timber, carrying his axe over his shoulder. He has only his shirt and trousers on—the latter being turned up at the bottoms, a common practice among bushmen. He is wearing what appears to be a "cabbage-tree" hat, an article very much worn by early colonists. The shape of the axe shows that it also belongs to the same period, before American axes were introduced.

The outline of the figure is defined by means of a continuous groove cut into the rock in the manner described by me in other papers,* but in the present instance an iron tomahawk has apparently been used in doing the work. It is well-known that blackfellows invariably throw away their rude stone implements of all kinds as soon as they get the more perfect tools of the white man.

The height of the man, from the top of his head to the soles of his feet, is five feet seven inches and a-half. The axe-head is nine inches long, and three inches across the head, with a handle twenty-one inches long. This carving is on a large flat mass of Hawkesbury Sandstone, level with the surface of the ground, within Portion No. 146 of 79¾ acres, in the parish of Wilberforce, county of Cook. The figure is close to the western side of a road reserved through the Portion mentioned; and may also be described as being a few chains in a north-westerly direction from the north-east corner of Portion No. 14 of 40 acres, in the same parish and county.

As this is the only instance of which I am aware where a blackfellow has been seen in the act of carving these figures on rocks, I have thought the matter of sufficient importance to bring it before this Society. Assertions have been made that carvings found on rocks in New South Wales have been executed at a comparatively remote period, but I have always opposed this view,† and am glad to be able to bring forward evidence of the existence of the practice within the last half century.

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* Jour. Anthrop. Inst., XXV., 149-150.
† Proc. Roy. Geog. Soc. Aust., Qd., X., 56-57.

NOTE ON THE "MERIDIONAL ANTHILLS" OF THE CAPE YORK PENINSULA.

By ROBERT L. JACK, F.G.S., F.R.G.S.
(Government Geologist).

[Read before the Royal Society of Queensland, September 12, 1896.]

From the Laura railway terminus northward to Somerset a peculiar type of anthill is met with. The anthills in question are particularly noticeable wherever there is a flat piece of poor soil which is a bog in the wet season. Their frequency and distribution is such that nothing can be added in the way of description to the name which the bushman has bestowed upon their sites, " graveyard flats." They are just about as numerous and as regularly disposed as the headstones in an old metropolitan cemetery.

From the Laura to Somerset the anthills gradually increase from three feet to such a height that I have frequently been unable to touch the top with a riding whip while standing in the stirrups.

The foundations and summits are strictly north and south, so much so that a man " bushed " could steer by them, so long as he was able to distinguish north *from* south. The average ratio of the length of the base to the height is as four to five, and of the breadth of the base to the height as two to five. The top is sharp but serrated, culminating in a series of sharp peaks. To give stability to the structure, however, buttresses are thrown out, like those of some species of *Ficus* and other trees in the tropical jungles. These buttresses interfere with the regularity of the plan of the foundation, but not with that of the top, as they always taper to a point when they cease to be necessary as supports.

Over many a camp fire, and in the company of many naturalists, I have heard the question argued : *Why* are the anthills north and south? And yet the answer seems to me simple—even ridiculously simple. The ants (or, more properly speaking, termites) build in such a direction as to secure the maximum of desiccation.

During the long Northern droughts the anthills remain unaltered, except by weathering, and are fairly compact. They form attractive targets for spear or bullet practice, and as such are eagerly taken advantage of by idle blacks or whites in the piping times of peace. I have seen the breaches made in this manner, or the accidental damage done by a passing bullock dray, remain unrepaired for months; but with the advent of the first heavy rainfall the termite starts into an activity which can only be compared to that of a mining camp which has been stacking washdirt through a long dry season. After a heavy rain the breaches are repaired, and perhaps a foot is added to the height of the anthill in a single day, The termites build with great difficulty, and in fact scarcely attempt to build at all, except in the wet season.

When the conditions for building are most favourable, that is, during heavy rains, the gum or cement secreted by the termites naturally suffers dilution to an extent which must seriously interfere with its adaptation to the purpose for which it is provided. When dry the structure can resist most of the ordinary forces of nature; but while still wet a wind-pressure of half-a-pound to the square inch will lay it in ruins. If wet enough it will simply behave as wet sand, and its own weight will destroy it. Its safety lies in being dried as quickly as possible. In tropical latitudes it is obvious that this drying can best be secured by placing the longer axis of the structure north and south, so that the rays of the sun may beat upon it during the greater part of the day.

REPORT ON PRESERVATION OF CERATODUS.

By D. O'CONNOR.

[*Read before the Royal Society of Queensland, September 12, 1896.*]

To the President and Council of the Royal Society of Queensland.

Gentlemen,

I have the pleasure to inform you that the work of procuring Ceratodus and transferring live specimens to new *habitats* which you entrusted to me is finished.

The fish, which were fairly abundant, were caught in the Mary River, near Miva, excepting five which were taken in Munna Creek. A total of one hundred and nine were caught. Of these eleven escaped, twelve died soon after capture, and nine in transit. Seventy-seven arrived safely at their destination; eight have since died, leaving sixty-nine which may be regarded as quite sufficient to ensure the success of the experiment. During my first month at Miva only one Ceratodus was secured; this was kept in a tank seventeen days, during which time it did not appear to eat. Having failed to obtain any more, and it being the general opinion that the season had passed, I returned to Brisbane and put the solitary specimen I brought in a pond in the Botanical Gardens, where it remained fifteen months. It was re-captured and sent to the Bowen Park Exhibition, where it excited a good deal of interest.

On 7th May, 1895, eight were put in the North Pine River, about a mile above tidal influence. The next, a lot of five, were on 17th November placed in a lagoon near the Albert River, on the property of Messrs. Collins and Sons. On the 15th December I took eight to Messrs. D. C. McConnel and Sons, Cressbrook; these were liberated in a dam which communicates with the Brisbane River.

On returning from a visit to New Zealand I recommenced the work, and on 28th May liberated eighteen in the Enoggera Reservoir. Twenty-one were taken to Warwick on 31st July and put in the Condamine. On 29th August sixteen were liberated in the waters of the Upper Coomera. Two were the same day placed in a pond at the Botanical Gardens.

It is difficult to distinguish the sexes of the Ceratodus; so far as I could judge, about two-thirds, or more, were females. The fish were at first transported in tanks of water, but latterly this method was abandoned and they were carried in boxes divided into compartments, each fish being enveloped in river weed, which was kept moist by occasionally sprinkling with water. No fish died in transit when treated in this manner, besides which advantage space and weight were greatly economised. Only large fish were procurable; they ranged between thirty-three and forty-five inches in length, and were from nine to fourteen pounds in weight.

Nearly six months was consumed in executing the work, the distance travelled 2,848 miles, and the total cost £55 6s. 10d.

I have to thank my fellow-members of the Society for placing the interesting work in my hands. I fully recognised its importance, and did my best to bring it to a successful issue. I have to tender my grateful acknowledgments to the various officers of the Railway Department for the courtesy and assistance at all times extended to me; also to Mr. John Atherton, of Miva Station, and Mr. W. C. Wilson, of Bimbirrim, and their families, for their hospitality and help.

I am, Gentlemen,

Yours faithfully,

Oxley, 7th Sept., 1896. D. O'CONNOR.

OCCURRENCE OF SAPONIN IN AUSTRALIAN ACACIAS AND ALBIZZIAS.

By JOSEPH LAUTERER, M.D.

[*Read before the Royal Society of Queensland, October 10, 1896.*]

It is a well established fact that the physiology of plant life cannot be thoroughly understood without a keen knowledge of the chemical processes which take place in the living vegetable tissues. Many instances corroborating this view have been observed by the author of this paper in the course of his chemical investigations of Australian plants. Chemistry alone shows us the migration of certain substances from one organ of the plant to another where it is needed, and the transformation of one chemical body into another one by the vital power of the living plant.

One good instance of these migrations and transformations is laid by me before the Royal Society to-day. This same paper also proves that there exist many plants which have been thought to be quite inert, though they are highly poisonous at certain periods of their life.

Who ever thought a wattle to be a poisonous plant? Who would not laugh at anybody calling an Albizzia a poisonous tree? And still it is beyond any doubt that our Brisbane "black wattle," *Acacia Cunninghamii*—although quite innocent when it blossoms and after it has borne fruit—contains a large amount of saponin in the unripe pods, and a small amount of it even in the leaves and in all green parts of the plant. Saponin has been found in Acacias as far back as 1871. The "Pharmaceutical Journal" of that year mentions *Acacia concinna*, Phil., of Chili (not *A. concinna*, D.C.) as a source of commercial saponin, besides the other plants from which it is generally drawn, such as *Silene*, *Dianthus*, *Anagallis*, *Vaccaria*, and *Agrostemma Githago.* In 1886 Dr. T. L. Bancroft, in a scrub on the Gregory River, by accidentally biting the pod of *Acacia delibrata*, found that it had a very disagreeable, acrid taste. It seemed so strange that an Acacia should have any but an astringent taste that a quantity of the pods were gathered with a view to ascertain if they contained a physiologically active substance. The result of Dr. T. L. Bancroft's investigation was the discovery of saponin in the pods of *Acacia delibrata.*

After Dr. Bancroft, Mr. M. Thiel, in 1889, drew attention to the occurrence of a variety of saponin (called moussenin) in the bark of the Abyssinian *Acacia Anthelmintica*, which is used as a taenicide, or remedy against tapeworm, by the natives, by whom it is alleged to be more effective for the purpose than Kuosso, whilst less disagreeable in taste. Many of the 320 species of our Australian Acacias have been found by me to contain saponin all the year round, *e.g.*, the New South Wales species (*Acacia vernicifilua*, Cunn.), which is called "dog-wood" by the bushmen around Bathurst, and which is used as a fish poison by them.

Other species are quite free from saponin at certain times of the year, and rich in it at other times, such as *Acacia Cunninghamii* and *A. penninervis.* These Brisbane "black wattles" blossom in the spring month of September, and show the pretty flowers for about a fortnight. After fertilization has taken place the pods begin to grow. In about three weeks they attain the length of 2 inches, with a narrow width and twisted appearance which has gained them the name of "wattle curls" from the sohool children in the bush. In this state the pods have a purely astringent taste. They contain about 20 per cent. of catechutannic acid, and not a trace of saponin. They continue to grow during the fourth week. The tannin then disappears gradually, whereas saponin by degrees takes its place. The astringent taste gives way to an extremely nauseous, acrid, and disagreeable sensation on the tongue, especially on the back parts and the sides of it. This taste creeps over the whole tongue, if even only the tip of it is brought into contact with the bruised pod. It continues long, and leaves a slight sense of numbness on the tongue. If the juice of the pod is allowed to reach the back part of the tongue, it seems to irritate some branches of the *nervus vagus*, as it produces a short hacking cough, and the same sensation as when the inside of the ear or the skin behind the ear is scratched with a sharp instrument.

A watery infusion of the "wattle curls" froths and forms a lather, when agitated, like a solution of soap, and this property is due to the saponin, which has been obtained pure by me from the pods. The tannin has to be removed first from the inspissated infusion or watery extract by shaking with ether, which does not dissolve the saponin. Chloroform then takes out the saponin, which can be estimated quantitatively after evaporation. It is a white powder, and is dissolved by sulphuric acid with a red coloration. I found 3 per cent of saponin in the unripe pods of *Acacia Cunninghamii*. Saponin is a strong poison for the muscle and the nerve, producing anæsthesia very much like the cocaine, but, besides this, it acts as a powerful irritant. I have seen many cases of so-called "sandy blight" of the eyes of bush people at times when there was no sand and no wind, and in people where every suspicion of a specific infection was excluded. In one case it was easy for me to trace the real cause. The bushman, who suffered from a very acute conjunctivitis, with swelling of the lids, had the fingers of both hands covered with a sticky substance, which, on being washed away in a small basin, caused a very marked frothing in the water. The "sandy blight" of the woodcutter was caused by the juice of the "wattle curls," brought in contact with the eyes by wiping them with the hand.

The hypodermic injection of the extract of only one unripe pod of *Acacia Cunninghamii* into the arm of a person caused great pain, swelling, and redness of the injected spot, nausea, and shivers; the extract of two pods caused headache, formications in the legs and arms, and paralysis of the accommodation of the eye and mydriasis. It is beyond doubt that the juice of six wattle pods, hypodermically injected, will kill a man. Injected in the leg of a frog (*Hyla coerulea*) it produced total insensibility of the leg against even the strongest local irritation, and total paralysis of the muscles.

As the commercial saponin, in doses of 2 drachms, is a deadly poison to dogs, it may well be supposed that a dose of 6 drachms would kill a man; and this quantity is contained in the extract from only 2lb. of "wattle curls." In Europe many fatal cases of poisoning by saponin occurred sometimes, as the seeds of the common weed, *Agrostemma Githago*, get mixed with the grain and go into the bread. The symptoms have been headache, vertigo, vomiting, hot skin, rapid pulse, great difficulty in standing erect, and, finally, deep coma and cardiac palsy.

Respecting the medicinal value of the black wattle curls, it must be stated that they can be used for exactly the same purposes to which the drugs containing saponin are applied in medicine. Sapwort has been used in Germany as a remedy in venereal and scrofulous affections and cutaneous eruptions. It appears to act as an alterative, like sarsparilla, to which it has been deemed superior in efficacy by some physicians.

As a taenicide wattle curls might be used in rustic medicine, as an infusion very likely would not produce more irritation in the alimentary canal than oil of turpentine, which is still much used for tapeworm in some parts of Europe. Finally, there is not the slightest reason for thinking more of senega root than of the black wattle pods as an expectorant in indolent respiratory complaints. I must state here, however, that I have now and have always had a great aversion to all saponin containing drugs, and that I never used—and never will use—any of them for my patients, be it senega or black wattle.

There is one point left to be discussed—the occurrence of saponin in the acacia leaves at the time when it is found to prevail in the pods. Is it formed in the leaves, and does it migrate to the pods? Or is it formed in the pods, and does it go to the other parts of the plant from there? The question is a difficult one; still an answer is given (1) by the fact that saponin makes its appearance first in the unripe pods, and only after some days in the leaves; (2) the analogy with similar processes shows that tannic acids in many instances are formed in unripe fruits, to be transformed into sugar when the fruits ripen. Unripe bananas are very rich in gallotannic acid, and even when they are cut off, the tree will lose nearly every trace of tannin and get rich in sugar and vegetable slime. In a similar way the catechutannic acid—very likely under the influence of sunlight and by means of the chlorophyll in the unripe pods—is desoxydized and hydrated, and is in this way transformed into saponin.

$$2.\quad \underset{\text{Catechutannic acid.}}{C_{15}\,H_{14}\,O_{6}} \div \underset{\text{Water.}}{6\,H_{2}\,O} \div 14\,H\,(\div 2\,C) = \underset{\text{Saponin.}}{C_{32}\,H_{54}\,O_{18}}$$

Very likely saponin is found in many acacias, and the albizzias are rich in it, too. In fact, the above-mentioned *Acacia anthelmintica* is really an albizzia. Our native and ornamental tree, *Albizzia Lebeck*, which extends also to Africa and Asia, has been found, as early as 1886, to be very rich in saponin in the flowers and in the whole inflorescence.

FISH ACCLIMATISATION IN QUEENSLAND.

By D. O'CONNOR.

[*Read before the Royal Society of Queensland, November 7, 1896.*]

QUEENSLAND offers a wonderfully extensive and suitable field for the operations of the fish acclimatiser. She possesses some very fine rivers, many of which are, however, remarkably poor, both in variety, in quantity, and in quality of the finny tribe.

Hitherto nothing has been done or even attempted towards stocking any of our rivers, and yet the work may be accomplished easily and without incurring any great expense.

Our earliest attention should be given to the magnificent stream that flows through our city.

The first fish we should deal with is *Lates calcarifer*. It is known in the Norman River as Barramundi, in the Pioneer as the Palmer, and in the Fitzroy as the Giant Perch. It was first known as the Palmer. This multiplicity of names for one and the same fish is, to say the least, confusing, as is also the equally objectionable application of one name to several varieties of fish—for instance, Barramundi, by which name the *Ceratodus* is known on the Mary River, the Palmer in the Norman, and *Osteoglossum Leichhardti* in the Upper Dawson. It is to this last-mentioned fish, which was discovered by the ill-fated Leichhardt, that the name was first applied, to which it properly belongs, and by which it should be retained. By whatever name *Lates calcarifer* is known, it is everywhere regarded as a table fish of the highest excellence. As a sportsman's fish it is unrivalled by any fish in Australia. If size may be regarded as a recommendation, the specimen before you speaks for itself; it measures 4ft. 3in. in length, 2ft. 8in. in girth, and must have weighed over 50lbs. This is said to be the proper time to transfer the Palmer to the Brisbane. The work should be undertaken without further delay. The next fish to be recommended is the Barramundi, before referred to. The Barramundi ranks as one of the choicest of our food fishes; it is also, like the Palmer, a first-rate sportsman's fish, and in beauty it is almost unrivalled. The Barramundi might without difficulty be taken from the Dawson to Miles and placed in the Condamine. This work might well engage the attention of our recently formed Acclimatisation Society of Southern Queensland. An attempt should also be made to establish it in the Brisbane. Now is the time. The Golden Perch, *Ctenolates ambiguus*, of the River Murray, is commonly known there and in Melbourne (whence it is sent in considerable numbers) as the Yellow-belly. This fish is, in some respects, even more beautiful than the Barramundi. It is thus described in Tenison Wood's "Fish and Fisheries of New South Wales":—"When fresh this fish is "coloured very beautifully. The body is of a magnificent green "and the sides and behind the dorsal; the upper parts of the "body are rich golden. The head is a beautiful mixture of "green, purple, yellow, and scarlet, with fine golden tinges; the "belly is white; the dorsal fin purplish green and scarlet, with "its base yellow and its end purple; pectorals, scarlet at their "base and yellow at their second half. The eye is purple, with "an interior white ring. These colours are subject to great "variation and the belly is sometimes red. The young fish have "little of the fine hues of the adults, and they are much more "elongate. The head is purple and the dorsel fin is grey "bordered with black. It is a very rich and delicate fish, and "attains a weight of seven pounds or more." This perch can be obtained in the Condamine; live specimens might easily be transferred to the Brisbane, where the species would be regarded as a great acquisition.

The Murray Cod, described by Gunther as *Oligorus macquariensis*, is another member of the perch family which bears a high character; it is one of the two fishes that Dr. Gunther thought worthy of being acclimatised in England. No attempt, however, appears to have been made in this direction. The Murray Cod is said to be known in the upper part of the Brisbane. Its advent nearer to us would be hailed with delight. This fish is too well known to need further description. As an edible fish it is universally and justly regarded with high favour.

Lates colonorum is commonly known as "the Australian perch.' It is, I believe, confined to Australia, ranging from the Gippsland Lakes, in the south, to the Pine River, in the north, and probably beyond. It is equally prized by the angler and the epicure. It does not attain so large a size as most of the before-named fishes; one of seven pounds would be considered large. This fine fish is not known in the Brisbane. Its non-existence is probably owing to the enormous number of shags that are permitted to infest our river.

There are other fresh water fishes of considerable merit in Queensland waters that deserve, and will repay, the trouble and cost of removal to other habitats, but seeing that heretofore not the least effort has been made or expense incurred in the matter, I fear that those I have named will be regarded as "a very big order." I must not, however, omit to mention one exotic fish, the acclimatisation of which in Queensland should receive our immediate and earnest attention—the Gourami, *Osphromenus olfax.* This very valuable fish may be compared to a trout, as a domestic fowl to a quail, or a turkey to a partridge. It is not caught in lagoons, lakes, or rivers, any more than you would shoot Dorking fowls on hill-sides or plains. It is a fish that is kept in a domestic state; a pond in your yard or garden is sufficient. But, being kept in confinement, the Gourami must be fed. It is omniverous; any waste food from your table or garden is acceptable to the Gourami, and you will have in return for your care a fish of rare excellence. It grows quickly and to a large size; a Gourami of ten or twelve pounds is regarded as being in its prime. Your fish may be swimming about in its pond at noon, and by the aid of a hand-net and your cook you may have it on your table at 1 o'clock. Its flesh is of a pale straw colour—firm, flaky, and very delicious. The Gourami was taken to Mauritius a century and a-half ago, where it was successfully acclimatised, and is universally regarded as a fish of the highest excellence. There is, probably, no animal in the world that it would be so advantageous to introduce into Queensland as the Gourami. Why it has not long since been acclimatized is a puzzle that I have failed to solve.

INSECTIVOROUS PLANTS.

By JOHN SHIRLEY, B.Sc.

[*Read before the Royal Society of Queensland, November 7, 1896.*]

TABLE SHOWING RAINFALL AT BULIMBA, NEAR BRISBANE, DURING 1896.

By Mrs. CHARLES COXEN, M.R.M.S.

[*Presented at the Annual Meeting of the Society, January 23, 1897.*]

Month.	Total rainfall in each month.	Aggregate rainfall from 1st Jan. to end of each month.	Heaviest rainfall in 24 hours.	Number of days on which not less than ·01 of rain fell.	Aggregate number of such days from 1st January up to the end of each month.
January	3·88	3·88	2·07	10	10
February ..	17·87	21.75	4·40	20	30
March	2·33	24·08	·94	10	40
April	·53	24·61	·24	9	49
May	1·49	26·10	1·16	8	57
June	·48	26·58	·28	3	60
July	4·05	30.63	1·25	9	69
August	·23	30.86	·12	4	73
September ..	·52	31·38	·34	4	77
October ..	·42	31·80	·26	3	80
November ..	9·21	41·01	1·95	19	99
December ..	5·25	46·26	1·37	13	112

PROCEEDINGS

OF THE

ANNUAL MEETING OF MEMBERS,

HELD ON SATURDAY, 23rd JANUARY, 1897.

The Annual Meeting of the Society was held on Saturday, 23rd January, 1897. The President (Dr. J. Lauterer) occupied the chair.

The Hon. Secretary read the following report of the Council for the Year 1896 :—

To the Members of the Royal Society of Queensland.

Your Council have pleasure in submitting their Report for the year 1896 :—

Ordinary meetings have been held monthly, with the exception of December. A list of the papers read at these meetings will be found in Appendix B.

Twelve Council meetings were held during the year, at which the attendance was as shown in Appendix A.

In April last Part 2 of Vol. XI. of the Proceedings was published. This contained the papers read during 1895. Vol. XII. is nearly all in type, and will be issued shortly, "author's copies" having, as a rule, been distributed shortly after the respective papers were read.

During the year 28 new members have been elected, and 5 members have resigned. A list of the members and their addresses will be published in Vol. XII. of the Proceedings.

It is with regret that the Council have to record the deaths of Baron Sir F. von Mueller (one of the first Corresponding Members of the Society), Col. E. R. Drury, C.M.G. (Member), and Mr. A. T. O. Preston (Associate).

It will be remembered that the Society, with the help of a subsidy from the Government, undertook the removal of the *Ceratodus* from its native habitats to other waters of Southern Queensland, in the hope of preserving this rare and historically interesting fish from extinction. This work, which the Council left solely in the hands of Mr. D. O'Connor, has been successfully carried out. A full report by Mr. O'Connor is contained in the volume of Proceedings now in the Press.

The Microscopical Section has held two meetings during the year, at one of which Mr. C. J. Pound gave an exhibition of microscopical illumination. Mr. F. Whitteron has accepted the Secretaryship of the Section. The Council last year approached the Government with a request to reduce the duty (25 per cent.) on microscopes, and it is gratifying to notice that the duty has now been removed altogether, which will prove of great benefit to students in this branch of science.

In April last a special meeting was held to confirm the two following rules which the Council wished to add :—

1. That members of the Royal Societies of New South Wales, Victoria, South Australia, and Tasmania, non-resident in Queensland, be admitted to ordinary meetings of this Society by virtue of their membership in such societies.
2. That during the present year (1896) the rule which requires the payment of one guinea entrance fee be suspended, and new members be required to pay only the annual subscription.

It is proposed to extend the operations of the latter rule (2) to the year 1897.

A new departure has been made during the year, viz., the holding of Popular Lectures on scientific subjects. The first of these was held in July last, when the Rev. G. D. Buchanan lectured on "Star Photography," and the second in November, when Mr. R. H. Roe delivered a lecture on "Darwin and the Darwinian Theory." Both lectures were very successful, except from a financial point of a view. There was a small debit balance in each case, but it must be remembered that members of the Society and many others were admitted free. The propagation of scientific information may be held to justify the expense, more especially as it is anticipated that an increased membership will result from the interest taken in the lectures by the general public. Mr. C. J. Pound, Director of the Stock Institute, has consented to deliver the third of the series next month, when he will lecture on "Rabbits in Queensland, and their Ravages," illustrated by limelight views of the infested country, &c.

At the request of the Queensland University Extension, this Society extended its patronage to a course of lectures delivered by Mr. S. B. J. Skertchly, entitled "The World: What it Is, How it Works."

There has been a marked increase in the donations to the Library during the year. It is to be hoped that the funds will allow the binding of some of these works.

The following committees were appointed during the year:

1st, consisting of the President, Vice-President, Hon. Treasurer, Hon. Secretary, Hon. Librarian, and Messrs. Jack and Shirley; to arrange for a series of Popular Lectures on scientific subjects.

2nd, consisting of Hon. A. Norton and Messrs. Jack and Shirley; to consider papers for printing in the Society's Proceedings.

3rd.—In reply to a request from the Hon. The Chief Secretary, that this Society should furnish him with an account of the scientific literature of the colony for the information of the International Catalogue Conference, Messrs. Jack and Shirley were deputed to furnish him with the information desired.

The condition of the finances will be seen by reference to the Treasurer's Statement (Appendix C).

In accordance with the Rules, all the officers of the Society, viz.:—

President: Joseph Lauterer, M.D.

Vice-President: P. R. Gordon.

Hon. Treasurer: Hon. A. Norton, M.L.C.

Hon. Secretary: J. F. Bailey.

Hon. Librarian: A. J. Norton.

Members of Council: F. M. Bailey, F.L.S., R. Edwards, J.P., R. L. Jack, F.G.S., J. Shirley, B.Sc., and Hon. W. F. Taylor, M.D., M.L.C.

Hon. Auditor: Alex. J. Turner

retire, but, with the exception of the President and Vice-President, are eligible for re-election.

JOS. LAUTERER, M.D.
President.

J. F. BAILEY,
Hon. Secretary.

BRISBANE, 4TH JANUARY, 1897.

APPENDIX A.

ATTENDANCE OF OFFICERS AT THE TWELVE COUNCIL MEETINGS HELD DURING 1896.

Office.	Name.	Numbe attended.
President	Joseph Lauterer, M.D.	7
Vice-President ..	P. R. Gordon	7
Hon. Treasurer ..	Hon. A. Norton, M.L.C.	10
Hon. Secretary ..	J. F. Bailey	11
Hon. Librarian ..	A. J. Norton	11
Members of Council	F. M. Bailey, F.L.S.	10
	Richard Edwards	7
	R. L. Jack, F G S	9
	J. Shirley, B.Sc.	9
	Hon. W. F. Taylor, M.D , M.L.C. ..	0

APPENDIX B.

List of Papers Read during 1896.

No.	Date.	Title.	Author.
1	February 8	Vocabularies of the Gowrburra and Koolaburra Languages	J. Shirley, B.Sc.
2	,,	Some Undescribed Queensland Gums	J. Lauterer, M.D.
3	March 6 ..	The Aboriginal Languages of Eastern Australia compared	J. Lauterer, M.D.
4	April 17 ..	The Geological Structure of Extra - Australian Artesian Basins	A. Gibb-Maitland
5	May 9 ..	Albatross Bay; the Embley and Hey Rivers	F. C. Urquhart
6	,,	The Discovery of Organic Remains in the Cairns Range, W. Queensland ..	R. L. Jack, F.G.S.
7	June 6 ..	The Flying Fox: Its Habits and Life History ..	T. P. Lucas, M.D.
8	,,	The Conglomerate Rocks of the Wild River Valley and the Head - waters of the Walsh River	R. C. Ringrose
9	July 11 ..	Chemical Affinities between Rutaceæ and Umbelliferæ	J. Lauterer, M.D.
10	,,	Micro - Organisms from the Brisbane Air	A. Jefferis Turner, M.D.
11	,,	The Submarine Leakage of Artesian Water	R. L. Jack. F.G.S.
12	,,	On Baiera Bidens	J. Shirley, B.Sc.
13	August 8 ..	Experiments with Röntgen Rays	J. W. Sutton
14	,,	Two New Species of Pterophyllum	J. Shirley, B.Sc.
15	Sept. 12 ..	The Occurrence of Contemporaneous Basalt in Beds of Gympie Formation at Cannindah Station	W. H. Rands, F.G.S.
16	,,	Aboriginal Cave-drawings ..	R. H. Mathews
17	,,	The Meridional Ant-hills of Cape York Peninsula ..	R. L. Jack, F.G.S.
18	,,	New Native Medicinal Plants of Queensland	J. Lauterer, M.D.
19	October 10	The Occurrence of Saponin in Australian Acacias and Albizzias	J. Lauterer, M.D.
20	Nov. 7 ..	Acclimatisation of Some Queensland Fishes ..	D. O'Connor.
21	,,	Insectivorous Plants ..	J. Shirley, B.Sc.

APPENDIX C.

THE ROYAL SOCIETY OF QUEENSLAND.

FINANCIAL STATEMENT for 1896.

Dr. Cr.

RECEIPTS.	£	s.	d.	PAYMENTS.				£	s.	d.
To Balance from last Report	12	8	3	By Printing				42	9	6
,, Subscriptions	85	0	0	,, Advertising				7	4	0
,, Sale of Proceedings	4	4	0	,, Rent	£26	0	0			
,, Proceeds of Lectures	6	6	0	Less Amount received for Letting Room	5	14	0			
								20	6	0
				,, Furniture				4	1	0
				,, Postage, Petty Cash, and Cheque Books ..				14	2	6
				,, Hall-hire for Lectures				5	0	0
				,, Balance at Bank				14	15	3
	£107	18	3					£107	18	3

Examined and found correct —ALEX. J. TURNER, *Hon. Auditor.* A. NORTON, *Hon. Treasurer.*

Brisbane, 5th January, 1897. Estimated Liabilities: Printing, about £28.

On the motion of Mr. J. Shirley, seconded by Mr. R. Edwards, the Report was adopted.

The adoption of the Financial Statement was moved by the Hon. Secretary, seconded by Mr. G. Watkins, and carried.

The President then delivered an Address, entitled—

PROGRESS OF SCIENCE IN AUSTRALIA.

One of the most interesting histories of science is that relating to Australia—its aborigines, its animals and plants, its fossils and minerals, its physical and geographical features. The first man who took any information respecting our Continent to Europe was Dampier, who visited the west coast of Australia with the pirates (called "buccaneers") in 1688, and a second time in the "Roebuck" in 1699. He took notice of the kangaroo, observed divers sorts of trees, saw the red gum of a eucalypt, and identified it erroneously with dragon blood. He even collected specimens of plants in the vicinity of Shark's Bay, and conveyed them to Europe, where they are still preserved in the museum of Oxford, identified partly by the late Baron von Mueller. The Desert Pea (*Clianthus Dampieri*) and the genus Dampiera still perpetuates his name. Dampier was the first white man who took home information respecting the Australian aborigines, and it is to be regretted that he condemned them erroneously as the lowest and most miserable people in the world. Setting aside human shape, he thought them to be very little different from brutes. Dampier's misrepresentations of our blacks were believed in Europe, and—according to the Latin proverb, that calumny always leaves something behind—the bad opinion of them has prevailed to the present day, in spite of the contrary experience of explorers, missionaries, and teachers. Seventy years elapsed ere Australia was brought again before the notice of Europe, especially before the botanists of the old country. The illustrious Cook brought with him to our shores in 1770 two enthusiastic naturalists—Joseph Banks, a wealthy man, then only 27 years old, and Karl Solander, born in Sweden, a pupil of Linnæus, then in his 34th year. A large collection of Australian plants was conveyed to the British Museum by the naturalists. Solander, who died twelve years afterwards, arranged the plants according to the Linnean system, and Banks, who lived to the good age of 77, was knighted, and held the position of President of the Royal Society for many years. The plants of this expedition were never described in a separate work.

The first Australian Flora ("Novæ Hollandiæ Plantarum Specimen") was edited in Paris in 1804 to 1806 by Houtton de Labillardière, who, at the age of 36, accompanied D'Entrecasteaux's expedition, sent in search of La Perouse, in 1791. De Labillardière's Flora follows the Linnean System, and contains plants from Tasmania and from Western and South Australia. Soon after De Labillardière, Robert Brown, a Scotch military surgeon, then 28 years of age, set his foot on our shore in 1801; he was persuaded by Sir Joseph Banks to join as botanist Captain Flinders's expedition for surveying the coasts of Australia. After four years of collecting he conveyed to London 4,000 species, mostly new and collected on the eastern half of Australia. In 1810 his "Australian Flora" appeared in London under the title of "Podromus Floræ Novæ Hollandiæ." This work shows the genius and the great assiduity of Robert Brown. Many years had to be spent in comparing the Australian specimens with similar or identical ones from other parts of the globe. The book was for a long time the best Flora of the world, and was chiefly instrumental in abolishing the antiquated system of Linnæus. Robert Brown came to high honours in all Europe, and died at the age of 85 years.

Sir Joseph Banks, after having initiated Robert Brown, rendered another highly valuable service to our botanical knowledge of Australia by recommending, in 1814, Mr. Allan Cunningham, of the Kew Gardens, as a collector of Australian plants. Allan Cunningham, then only 23 years of age, collected first for nineteen weeks with Oxley on the Lachlan and Macquarie, and then accompanied King's surveying expedition in the "Mermaid" to the western and northern coast, making valuable additions to the Australian flora. He also was in New Zealand. As an explorer, he was the first man who entered the Darling Downs and who examined Mount Lindsay. His brother Richard was appointed Government Botanist for New South Wales, and was murdered by the blacks when he accompanied Mitchell's expedition to the Darling River in 1835. Allan Cunningham was at this time in London, and returned to Sydney to take his brother's vacant place. He died soon after Robert Brown. Up to this time about 7,000 species of Australian plants had been described.

From 1842 to 1844 Ludwig Leichhardt made an ample collection of plants in the back country of Moreton Bay. This collection went partly to Paris and partly to Sydney, and the specimens have been described by the late Baron von Mueller. The narrative of Dr. Leichhardt ("Journal of an Overland Expedition in Australia, 1847") contains as much geography as botany. and is by far the fullest published account on the tropical vegetation of the north and north-east tracts and adjacent interior parts of Australia that we possess.

In his excellent "Flora of Tasmania" Sir J. D. Hooker, late of the Kew Gardens, gives a very valuable essay on the Flora of Australia, throwing light on the geographical features of our plant life.

In 1855 it was first contemplated in the leading scientific centres of London and Australia to bring out a general Flora of Australia under Government sanction. Dr. Ferdinand Von Mueller, who will be mentioned directly, was naturally looked to as the botanist best qualified for undertaking the task of preparing it, but as it was indispensable to compare the herbariums of Banks, Robert Brown, and Cunningham, the task was placed in the hands of Mr Bentham, President of the Royal Society in England. Dr. Ferdinand Mueller, in Melbourne, assisted him with his ample collections, and the first volume appeared in 1863.

Now let us have a look at Dr. Ferdinand Mueller, the late Government Botanist of Victoria. This energetic man, who never lost a minute of his long life, and who used to work day and night, was born in 1825 at Rostock, in Meckelburg. During his early training as a pharmacist in Kiel, which then was under the Danish flag, he took great pleasure in botanizing, and rendered valuable assistance in composing the "Flora of Denmark" at an early age, between 16 and 22. Having finished his University studies in 1847, he migrated with his sister to South Australia. From 1847 to 1852 he botanized in South Australia and Victoria, where he rambled seven times over the

Australian Alps, and gathered a great amount of material for his herbarium, the half of which went to London to Sir W. J. Hooker and Mr. Bentham. In 1855 and '56 he accompanied Gregory's expedition across Australia, and in 1856 he was appointed Government Botanist to the Colony of Victoria. This position he held until his death in 1896. He added 2,000 species to those previously known in Australia, all of which he described and named himself in a classical way. He re-examined and re-arranged all the other Australian plants, to the number of 7,000. He was knighted by the English as well as by the German Government, and Sir William Hooker called him the prince of Australian botanists. This was a just reward for his lifelong exertions; still, sorrow and grief were not spared to him in his old age, as the Governments of the Colonies wanted to save money two years ago by withdrawing the scientific appointments. It is true the sword of Damocles (as Baron von Mueller called the impending trouble in a private letter to me) did not fall on his head, but the uncertainty caused many sleepless nights to the old decrepid man. In 1896 I had the last New Year's gratulation from him. He expressed his belief that that year would be the last of his earthly career. He died on the 10th October, 1896.

Of the 120,000 vascular plants which are described on the globe, Australia possesses about 10,000. South Australia has now a good local Flora by Prof. Tate, and New South Wales was presented with a good one by Mr. Moore in 1893. Mr. Maiden and Mr. Campbell, of the Agricultural Department, are publishing excellent pictures of the plants growing wild in New South Wales.

Queensland and the Royal Society can look with pride on our Colonial Botanist, Mr. F. M. Bailey, the never-resting author of the "Synopsis of the Queensland Flora"—one of the best local Floras in the world. The first edition is completely sold off, and it is to be hoped that the learned author will soon start to compile a second edition of the excellent book, though it will only bring him toil and sleepless nights, and no recompense but glory. Mr. Bailey's knowledge is not restricted to the native plants of Australia (which is mostly the case with other botanists). He gave us an excellent catalogue of the plants grown in the public gardens of Brisbane, and a treatise on the economic plants of Queensland. He did much for the elucidation of the Algæ and the other Cryptogams.

Mr. Shirley, one of the Past Presidents of the Royal Society, who is well known to the public as the General Secretary to the Meeting of the Australasian Association for the Advancement of Science in 1895, published a concise and very useful Lichen Flora of Queensland, which appeared in the Royal Society's Proceedings in 1888.

As we have now a "Flora of the Australian Fungi in 1892" by Dr. M. C. Cooke, in London, we can really boast that students of botany in Queensland have better and much more accessible books at hand than they have in any country of Europe. It may be added that our amiable Colonial Botanist, Mr. Bailey, is ever ready to help and to give advice and encouragement, so that during my travels in Europe I never found such an excellent opportunity for studying botany as is given here in Brisbane.

Respecting the cultural industries of Queensland, much has been done by the Acclimatisation Society of Queensland and its able and energetic secretary and manager, Mr. Soutter. The Past President of the Society, Mr. Lewis Adolphus Bernays, published in 1883 a very valuable book on the cultivation of useful plants suitable to the climate of Queensland. The book is full of useful information for the scientist and the grower, and occupies a prominent place amongst the books of this kind.

The Technological Museum of Brisbane, which is under the care of our Secretary, Mr. Bailey, contains a splendid collection of Queensland woods, most of which were collected in 1886 for the Indian and Colonial Exhibition in London. The Colonial Botanist, Mr. F. M, Bailey, has written a complete catalogue of the whole collection. There exists also an "Official Guide to the Museum of Economic Botany," by Mr. F. M. Bailey.

The insect and fungus pests on the cultivated plants of Queensland have been investigated and published by Mr. Henry Tryon, of the Agricultural Department. Much benefit has been derived by the planter and grower, and it is to be hoped that the author will put before the public the result of his further researches.

Zoological knowledge has made a vast progress since the discovery of Australia. Dampier took to Europe the first report of the kangaroo, which he named "a racoon jumping on his hind legs." In the zoological garden of Batavia, according to Le Brun (1717) were kept, under the name of Philander, some kangaroos, very likely from Dutch New Guinea. Cook, in 1770, saw the first Australian grey kangaroo (*Macropus major*), and compared it with the spaniel of the old country.

Dr. George Shaw, of the British Museum, wrote the first work on the zoology of New Holland in 1794, in one volume with twelve coloured plates. In 1799 he described the Duckbill (*Ornithorrhynchus paradoxus*), and named it Platypus anatinus. Since that time zoological progress in Australia went hand in hand with the advancement of knowledge in Europe and America.

Linnæus and Fabricius described and named some beetles and butterflies taken home by Banks and Solander. Walkenaer embodied Australian spiders in his classical work; Milne Edwards, and Haime described corals and crustaceæ from Australia. Grey wrote, in 1841, a pamphlet respecting the geographical distribution of animals in New Holland. In 1866 Professor McCoy gave a report on animal life of Victoria to the Intercolonial Exhibition. Of the 2,300 mammals on the whole globe, Australia possesses only 200 species, namely 3 monotremata, 132 marsupials, 23 bats, 1 dog, 38 mice, and 3 seals. Gray, Gould, and Waterhouse have described and named most of them. In 1884 Mr. Caldwell, a young British scientist, who visited Australia expressly to study the habits of the monotremata, discovered the fact that the female lays eggs, which are afterwards hatched and the young nourished by the milk of the mother, although no teats are observable. In 1884 Lumholz discovered the tree kangaroo, which was named Dendrolagus Lumholzi by Collett. Mr. De Vis described two other species of tree kangaroos from Tropical Queensland.

Of birds the whole globe has about 6,000 species; Europe contains 500, Australia possesses 600. Gould's grand illustrated work is the chief source of reference for Australia. Gray, Schlegel, Latham, and E. P. Ramsay are the prominent workers in this field of knowledge. Mr. De Vis enriched the Queensland Museum with a magnificent collection of Australian birds, including many new ones and many species from New Guinea, described and named by this distinguished ornithologist.

Of the 9,000 species of fish on the globe, Australia has, according to Sir William Macleay's catalogue, about 1,000. In 1872 Count de Castelnau gave a monograph on 140 Victorian fishes, with full descriptions from Dr. Gunther's great catalogue of fishes in the British Museum. The Rev. Tenison-Woods has written a nice book on Australian fishes, with photographic plates. J. Douglas Ogilby, A. H. Lucas (who gave a census of Victorian fishes), Johnson (who published a catalogue of Tasmanian fishes), and C. W. De Vis are the workers in this field. Professor Semon, of Jena, investigated the development of Ceratodus, which is acclimatised now around Brisbane by the efforts of our energetic member, Mr. D. O'Connor.

Of the few Australian Amphibia, we have Fletcher's catalogue for New South Wales, and one by Lucas for Victoria.

Krefft has named and described the most Australian reptiles. Professor Tate, Mr. Cox, Mr. Brazier, and our old friend, Mr. Hedley, have worked on the molluscs.

There exist about 80,000 species of beetles on the whole globe. Nearly 8,000 of these have been described from Australia, belonging to 1,644 genera. Masters' catalogue of the described Coleoptera of Australia is a very good work of reference for the collector. Blackburn, Macleay, Olliff, Sloane, and Marsen have worked out the different families. Walker described the Diptera, Smith the Hymenoptera.

The butterflies of Australia are nearly all endemic; still, some of them, like *Danais Erippus*, have a world-wide distribution. Walker, Meyrick, Miskin, and Dr. Lucas have worked in this field. Mr. R. Illidge gathered a splendid collection, and Dr. A. J. Turner, of Brisbane, described new Micro Lepidoptera from Moreton Bay in the "Transactions of Royal Society of South Australia," 1898.

The classical work of Koch and Keyserling, on the Australian Arachnidæ, with drawings of all species, is the best existing Spider Fauna on earth. It is written in German, which is considered a drawback for Australian collectors.

Fletcher, Dendy, and Tryon have worked on worms and the interesting Perpatus ; and Thomas Whitelegge published in 1889 a work on the "Marine and Freshwater Invertebratæ Fauna of Port Jackson and the Neighbourhood."

Mr. Saville-Kent, one of our Past Presidents, did valuable work on oysters, corals and fish during his stay in Brisbane.

Mr. Pound's investigations on lower animal forms, like the tick, are known beyond the colony.

The development of mineralogical knowledge of Australia depended mostly on the geological survey and on the mines. Queensland got a catalogue of minerals in 1887 by our late friend, Mr. E. B. Lindon, who studied mineralogy in England and had been analyzing in Brazil for some years. The arduous young man came to an untimely end by a rotten rope to which he trusted going down a miserable gold-claim. The rope broke and Mr. Lindon was killed—it is to be feared, not instantaneously. The catalogue contains 97 different minerals, and was compiled chiefly from his own knowledge and the reports on geology by Messrs. Gregory, Jack, Rands, Daintree, and A. W. Clarke. In 1888 Professor Liversidge, in Sydney, published a splendid work on minerals of New South Wales.

In 1890 a mineral census of Australasia appeared in the report of the committee of the Australasian Association for the Advancement of Science. Only 75 minerals are mentioned from New South Wales by Professor Liversidge, as he intended to give merely a supplement to his catalogue of 1888.

Mr. Cloud, basing on reports by Goyder, Professor Tate, and Professor Ulrich, enumerates exactly 100 different minerals from South Australia, and the Queensland catalogue, worked out by Messrs Jack, Lindon, Rands, and Maitand, contain 101 different ones. In this way not many more than 100 different minerals have been recorded from Australia. As our school book (Professor Kobell's tables for determination of minerals) contains on 107 pages not less than 680 different ones, it is clearly to be seen how much can still be done in this field by careful investigation and analysis.

The development of topographical knowledge, of course, preceded that of geology. Oxley, in 1817, was the author of the first topographical map of New South Wales ; whereas Dean

Buckland applied first in 1822 palæontology to the stratigraphical chronology of the Australian rocks, as he compared coal and shale with plant impressions, and stated that there was an analogy between the coal formation of the Hunter River and that of England, whilst certain fossiliferous rocks from Hobart are described as nearly related, if not identical with those of the mountain limestone of England and Ireland. In 1825 Alexander Berry gave the geology of a part of New South Wales in "Field's Geographical Memoirs." Adolphe Theodore Brogniard, Professor of Botany in Paris, published in 1828 (at the age of 27 years) the first volume of his "Histoire des Végétaux Fossiles," and describes in it the two leading ferns from the Newcastle coal measures—*Glossopteris Browniana* and *Phyllotheca australis.*

Allan Cunningham, the botanist, described, in 1823, the physiographic features and the leading rock structure of the Blue Mountains, and discovered, in 1828, the Ipswich coal formation on the Brisbane River. Sturt (1830) and Mitchell, the well-known explorers, gave valuable geological information of the territories traversed by their expeditions. Mitchell, especially, enriched the British Museum with ample palæontological collections, which were worked out by specialists. The Post Tertiary treasures from the caves of the Wellington Valley were described by Sir Richard Owen, Professor of Anatomy and Palæontology, and from him the world heard the tale of the fossil gigantic Australian marsupials, named by him Diprotodon, Nototherium, and Thylacoleo. In 1845 Count Strzelecki published the first book on geology of Australia under the title "Physical Description of New South Wales." The exiled Polish nobleman had investigated the south-eastern part of our continent and had traversed 7,000 miles at his own expense. The map, which is added to his book, is the first geological map ever worked out on Australian territory. The palæontological items have been done by the specialists, Lonsdale, Morris, and Sowerby.

Professor Dana, the renowned naturalist of New Haven, in Connecticut, was in Sydney in 1840, and he gave a geological report on Port Jackson and 60 miles around.

In 1842 Jukes, Geological Surveyor in Newfoundland, was appointed naturalist to the steamer "Fly," for investigating the

Barrier Reef. From the above-named explorers and from his own investigations he published, in 1850, a good outline of Australian geology in his "Sketch of the Physical Structure of Australia." This book, to which a coloured map is added, was for some years the best available handbook for the student of Australian geology.

Mr. Augustus Charles Gregory's expedition from the mouth of Victoria River to Brisbane in 1855 elucidated much of the geology of North Australia and Queensland.

In 1851 Hargreaves, who died in 1891, discovered near Bathurst, in New South Wales, rich alluvial deposits of gold in a place called afterwards Ophir; and soon gold in still larger quantities was found in Victoria.

The opening of universities in the chief cities of Australia gave more opportunities to geological students, but the real practical and scientific work was done during the last four decenniums by the officers of geological survey. Victoria had a geological map as early as 1863, by the exertions of Selwyn and Professor McCoy. The Rev. W. B. Clarke was commissioned to the geological survey by the New South Wales Government in 1851. Born in 1798, he came to Australia in 1839, and died in 1878. Forty years of his life were dedicated to the investigation of Australian geology. The palæozoic fossils of his collection were described by Professor De Koninck, of Liège. Clarke's book on the sedimentary formations of New South Wales (1878) has been the starting-point for all fresh research by his followers, and his geological map was the foundation stone for Wilkinson's geological map of New South Wales (under the auspices of the Department, 1880). The Rev. Tenison-Woods, the late indefatigable enthusiast, who worked on botany, zoology, palæontology, and geology, gave, since 1862, valuable additions to our knowledge of the Lepidodendron beds, and held the opinion that the Desert Sandstone was a wind-blown formation. He also described fossils from the Ipswich formation, and refers the Ipswich coal to the Jurassic.

It must not be forgotten that Baron von Mueller has been working in palæophytology, as he described the fossils from Eocene and Miocene river beds which had been covered by volcanic lavas. Not one of the now living plants was found by the renowned botanist between these fossils; whereas pine forests (*Spondylostrobus Smythii*, F. v. M.) grew in damp places, and the hillsides were covered with small-leaved shrubs—like *Plesiocapparis prisca*, F. v. M., and *Illicites astrocapa*, F. v. M.

In 1878, Dr. Ottokar Feistmantel, of the Geological Survey, Calcutta, published in German the "Palæozoic and Mesozoic Flora of Eastern Australia," and in 1880 he gave some very interesting notes on the fossil flora of Eastern Australia and Tasmania in the New South Wales Royal Society's Proceedings.

The foundation of the Adelaide University in 1875, and the appointment of Professor Tate, brought a new era also for the geology of South Australia.

Queensland's first geological map, in 1872, was by Mr. Daintree, formerly of the Victorian Geological Survey. Mr. Etheridge, sen., made the palæontological determinations. The labours of Mr. Augustus Charles Gregory, the explorer, have already been mentioned. The Ipswich coalfield has been a special ground of exploration for this renowned geologist.

Mr. Robert L. Jack, the Government Geologist of Queensland, published in 1886 a "Handbook of Queensland Geology" for the Colonial and Indian Exhibition in London. Mr. Etheridge, jun., formerly of the British Museum, determined the palæontological collection. The book, containing 107 pages, is an excellent one, and has only been superseded (in 1892) by the "Geology of Queensland," by the same author and Mr. Robert Etheridge, jun., containing 768 pages. A coloured map on a large scale and a volume of plates are added to this grand work, which—to use the words of such a competent critic as Professor Tate—"marks an event in the history of geological progress in Australia. It stands unrivalled for its rich stores of information, and for its methodical arrangement." Mr. J. H. Simmonds has, in the lapse of years, made a grand collection of fossils, especially from the Upper Trias-Jura around Ipswich. A small number of them have been determined by Etheridge, jun., including a very interesting crustaceous animal, Estheria mangaliensis, and parts of four species of fossil beetles from Denmark Hill. The Rev. Tenison-Woods described and named ten new species of (extinct) ferns from the Jurassic beds around Ipswich, one Cycadeous plant from Rockhampton, and six new species of fossil Coniferæ from the Ipswich formation.

Mr. De Vis, the excellent Australian specialist on bones and birds, has worked out the bones and teeth (partly in small fragments) from the Post Tertiary localities. He described and named two extinct species of varanus (iguanas); an alligator, from Eight-mile Plains and the Condamine; 23 extinct species of birds, including 2 emus, 1 moa-bird (*Dinornis Queenslandiæ*); and 1 extinct kiwi (*Metapteryx bifrons*) from the Darling Downs. An extinct platypus, 2 wombats, a new Nototherium, two species of the new genus Enowenia, 4 new phalangeridæ, five new species of fossil kangaroos, an extinct fresh water dugong, and a fossil peccari have been described and named also by our ever-working Curator of the Brisbane Museum.

The Geological Museum of Brisbane, created by Mr. Jack, contains a really splendid and well arranged collection of everything appertaining to theoretical and practical geology. It is a credit to Mr. Jack and his staff, and a boon to the student of geology. And it attracts students, too. Mr. Shirley, whose Lichen Flora of Queensland has been mentioned, has looked through the museum and has already described and named some new species of plants which he found in the collection. My private collection of fossils from Ipswich and Brisbane will be described as soon as knowledge and time allows.

Mr. R. L. Jack moved, and Mr. L. A. Bernays seconded, a vote of thanks to Dr. Lauterer for his Address. The motion was carried by acclamation.

The following Officers were elected for the year 1897:—*President*, C. J. Pound, F.R.M.S.; *Vice-President*, S. B. J. Skertchly; *Hon. Treasurer*, Hon. A. Norton, M.L.C.; *Hon. Secretary*, J. F. Bailey; *Hon. Librarian*, A. J. Norton; *Members of Council*, F. M. Bailey, F.L.S., R. Edwards, P. R. Gordon, J. Shirley, B.Sc., A. Jefferis Turner, M.D.; *Hon. Auditor*, A. J. Turner.

A vote of thanks was accorded to the retiring Officers, and the proceedings then terminated.

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END OF VOLUME XII.

PROCEEDINGS

OF THE

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OF

QUEENSLAND.

VOLUME XIII.

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ERRATA.

Page 33, line 11—for "imitation" read "initiation."
,, 34, line 3—after the word "are" add "a."
,, 34, line 11—for "imitation" read "initiation" (in two places).

THE ETHNOGRAPHY OF LEPROSY IN THE FAR EAST.

By **SYDNEY B. J. SKERTCHLY,**
(Vice-President).

[*Read before the Royal Society of Queensland, 6th March, 1897.*]

INTRODUCTION.

Having recently completed an investigation in collaboration with Dr. Jas. Cantlie (both of us then of Hongkong), into the distribution of Leprosy in the Far East, which occupied our attention for several years, and having arrived at some unexpected results with regard to the ethnography of the disease, we hope that a brief statement of the main facts may be interesting to the Royal Society of Queensland.

The data upon which we found our conclusions have been gathered personally, and by means of circulars addressed to medical practitioners, missionaries, consuls and others, and we have in no case relied on vague or general statements in published works, which we have found too general to be of scientific value.

Area Embraced.—The area embraced in the enquiry extends from the Malay Peninsula, through China, the whole of the East Indian Archipelago, Japan and the Philippines and the islands of the Pacific.

With the exception of the Pacific Islands much of the area has been visited by one or both of us, the most northern part of our travels being Vladivostock and Japan. Southwards we know the Archipelago to Sumatra, Java, &c., and eastward to the Moluccas.

The Pacific Islands we have not yet had an opportunity of visiting, but California, a new centre of Leprosy is well known to us. Hundreds of correspondents have assisted us in our labours, and to them we tender our best thanks. We purposely left out Australia hoping some other investigator would take up the question. The area we had to deal with was already too large, as we found to our cost.

With regard to the Pacific Islands our information is far from complete. Many of them are so isolated, communication is so scanty, trained observers are so few that it will be some years before anything like a complete answer to our enquiries can be obtained. Nevertheless, the information at hand is such that further evidence can only strengthen our argument, and paint the picture we present, in gloomier colours.

It does not seem advisable to wait for this corroborative evidence before bringing our results before the scientific public. I shall omit all purely medical questions, and deal only with the racial aspects of the question, with which I alone had to deal.

Ethnograpy of the Area.—The area dealt with is complex in its ethnography. Without entering into scientific niceties, it may be sufficient to say that the inhabitants comprise sections of the White, Yellow, Brown and Black races. The White Caucasian is represented by the Cambodians, and indistinctly by the Koreans and Ainos; the Yellow Mongoloid by the Chinese, Anamites and Siamese; the Brown by the Malays and Indonesians; and the Black by the Negritoes and Papuans.

The racial history is somewhat as follows. The black races originally held the whole of the East Indian Archipelago and the Malay Peninsula, and have extended into the Pacific as far as Fiji and New Caledonia. The Malays, who though classed with the Mongoloids, differ greatly from them in form, feature, custom and mental traits, seem to have spread from the Malay Peninsula southwards, and settling in Sumatra, attained a considerable degree of culture. Thence they have spread all over the coast regions of the Archipelago, but have not penetrated far inland. Before this pure Malay extension, however, the Indonesians, a race of mixed Malay and Caucasian blood, invaded the Archipelago, and drove back, and in many places exterminated, the black aborigines. They constitute the bulk of the Dyaks of Borneo, and the natives of the Philippines ; and it is these Indonesians, and not the true Malays, who spread over the ocean from Madagascar in the west, to Hawaii in the east, and from Formosa in the north, to New Zealand in the south. The true Polynesian is Indonesian and not Malay.

About the thirteenth century, a wave from India swept over Malaysia and the major islands of the Archipelago, bringing with it civilisation, and the Buddhistic and Brahminic faiths ; but it was not permanent, and has only left traces behind, notably in Bali and Lombok.

This was also the awakening epoch in central Asia ; and the great Kublai Khan dominated China, and Chinese emigrants found their way into the island region of the south, and have left their impress on the Dusuns of North Borneo.

Finally, in the sixteenth century, the Europeans arrived.

Leaving China out of the question for the moment, as having been Mongolian from the dawn of history, we find that the rest of our area has been swept by successive waves of different races. The story opens with a wide-spread black population, over which the Indonesians then spread, and like a flood drowned out the aborigines as far east as Moluccas, leaving only a few isolated tribes in the shelter of the interior mountains. This wave sped beyond the Negroid area, and spent itself on the shores of the eastern and southern Pacific islands. It was followed by another wave, the true Malays, still beating on the shores ; and later by others of Chinese and European origin.

We must pause to consider the Chinese flood. It is a double one. The first started in the 13th century, and has not ceased. It was originally a wave of traders, who came to deal with the natives for local produce. It was made up of fairly well-to-do people, who travelled as merchants, and often settled as masters in the new lands ; none of them came as coolies. The second wave followed, and was the result of the European invasion, and consisted of low-class Chinese who were brought as servants and plantation hands for the European and better-class Chinese. It is most essential to grasp the fact of this double Chinese wave, which is still in progress, and upon which the whole of our argument turns.

PHYSIOGRAPHY OF LEPROSY.—The area over which our enquiry extended embraced almost every variety of surface, from snow-capped mountains and elevated plateaus, to vast plains and great river-valleys and deltas. It included continental areas and peninsulas; the islands ranged from the largest in the world to tiny coral islets. There were deserts and dank marshes: open treeless tracts and dense primeval forests; in fine, no kind of country but what was represented fully, and on a large scale.

It was therefore quite easy to see whether physical configuration was a determining cause of leprosy. The conclusion we arrived at was, that leprosy is independent of physiographical conditions.

It would be tedious to give details, so we throw some of the facts into a tabular form, giving only one case under each heading, though we might produce hundreds.

MOUNTAINS.—Leprous in Kwantung; not in Borneo.

PLAINS.—Leprous in Shantung; not in Kiangsi.

MARSHES.—Leprous in Kwantung; not in Borneo.

RIVER VALLEYS.—Leprous in the Si-kiang; not in the Hwang-ho.

FORESTS.—Leprous in Tonkin; not in Borneo.

ISLANDS.—Leprous in Hawaii; not in Lesser Sundas.

COASTS.—Leprous in Fokien; not in Kiangsi.

CLIMATE AND LEPROSY.—As we had every kind of physical structure, so our area embraced every kind of climate, save the the arctic. North China and Japan, East Siberia and Saghalien, are temperate; South China and Tonkin are tropical; the Archipelago is equatorial; Central China is continental: the Pacific eminently insular. Korea has hot summers, and intensely cold winters; Borneo has no seasonal differences throughout the year. The rainfall varies from fifteen inches to a hundred and twenty in different parts of the area. The Sulu Sea has scarcely a storm, the China Sea is the home of the typhoon. Trade winds, monsoons, and variable winds are each represented; and in fact, every kind of climate except the arctic fell within our scope. In no case did we find that Leprosy was dependent upon climate.

Geology and Leprosy.—We have representatives of nearly all the geological formations, and of all the rocks ; but there is no relation between Leprosy and geological structure. Thus, the granite of Kwantung is leprous, that of Shantung is not ; the alluvium at Canton is leprous, that of Shanghai is not ; the marine loams of Shantung are leprous, those of Chihli are not ; and so one might go on enumerating rock after rock with the like result.

In one case there is an apparent relation between geological structure and Leprosy, which might be misleading if our knowledge were less extensive. South Celebes is non-volcanic and leprous, while the North of the Island is volcanic and free from the disease. Here it would seem that volcanic rocks enjoy immunity, but when we see that the ajacent volcanic Moluccas is more leprous than any part of the Archipelago, and that Hawaii, entirely volcanic, is the most leprous place on earth, it is evident that the nature of the rocks has nothing whatever to do with the distribution of Leprosy.

It is certain, then, that neither physiographic climate nor geologic conditions have any influence upon the distribution of Leprosy.

Distribution.—By putting a red dot on a map wherever we had a record of the occurence of Leprosy, and a blue one where we were assured it did not exist, a Map of the Distribution of Leprosy in the far East grew up ; accurate as far as it went, but not complete. We had discovered that the general statements in medical works could not be relied upon, as many places were entered as leprous which we knew were free from the scourge. For instance, a work on the disease of the tropics, published in 1894, states that Leprosy is rife throughout the length and breadth of China, which indeed is the common belief among Europeans even in China itself. Another work on the same subject issued by a French physician of wide tropical experience cites several of the Polynesian groups as Leprous, which we have good reason to believe are not infected. The reason for these inaccuracies is probably the habit of taking the statements of lay observers, who mistake some of the numerous forms of skin disease, to which the islanders are very prone, for Leprosy, just as did the Jews of old, and as the Chinese do to this day. We were therefore compelled to reject *en masse* all such statements, and to trust to our own information, backed of course by the writings of those who had described specific cases. Our Map is in consequence incomplete, but accurate as far as it goes. It might have been somewhat fuller had not Hongkong been so barren in medical works of reference.

Additional information may perhaps show that Leprosy is somewhat more widely spread than we declare; it cannot make the scourge appear less virulent. It will be seen that we differ from others on three points; (1). we show that the disease is not nearly so common as is currently believed at home; (2). that it has a definate centre, where it has been endemic from time immemorial, and where it is growing less virulent, but from which it is spreading, and has spread to other places with dire effects; and (3). in the ethnological distribution of the disease.

It would be impossible in a paper like this to give details of all the places we have visited, or from which we have received direct communications; these, which extend to 650 p.p. have been presented to the National Leprosy Fund. It must suffice to give short abstracts of the chief facts.

1. China.—It turns out that China is not infected as a whole; entire provinces being free from the disease. Thus, from some distance south of the Yangtse, the coast of China northwards into Manchuria and eastern Siberia, and westwards for hundreds of miles, is as free from Leprosy as Middlesex, with two exceptions. These are northern Shantung, where the disease is rarer than formerly, and southern Korea, in which country the disease dies out about the middle line of the peninsula. The Yangtse Valley, from the neighbourhood of Shanghai is clean for four hundred miles; the next two hundred miles, from Kiukiang to Hankow are leprous; the following three hundred miles are clean, and then comes another leprous patch, succeeded by a free district.

The southern coast provinces, Kwantung and Fokien, are very leprous, indeed this is the great leper centre of China, and the disease extends with diminishing intensity inland to the province of Yunan. The islands of Formosa and Hainan are leprous only on portions of the coast, in fact, only where coolies from the infected provinces have settled. The aborigines of both islands are clean.

It appears then, that so far as China is concerned, the great centre is the southern coast provinces of Kwantung and Fokien, a most important fact whose dread significance will be made clear in the sequel. Even here the disease does not appear to be so rife as formerly, and there are numerous so-called *Leper Villages* in which not a leper now exists, though the people still draw the government grant for lepers. Still the disease is very common, and scores of lepers may be seen in Canton, and in many a smaller town and village. Macao has its lepers isolated on a separate island ; there is a colony of lepers within ten miles of Hongkong, on the island of Chung-chau, and lepers are by no means so rare on Hongkong island, as is commonly believed here ; we have examined some three hundred cases in the past five years.

2. Indo-China.—Taking the blunt peninsula over which French influence prevails as coming under this heading, we find that Leprosy is endemic all along the coast ; that it is, as might be expected, most rife in Tonkin, bordering on the province of Kwantung, and that it was in old times much more frequent than at present. The French authorities, who most kindly aided us in our research, tell us that the Mission Hospital reports, dating back over two hundred years, show that hundreds of cases used to occur where now only tens are encountered. One Hospital now serves where several were needed before. There is not a particle of evidence that the wilder tribes of the interior have Leprosy among them.

3. The Malay Peninsula.—In the Malay Peninsula Leprosy is again rife ; but here also it is confined to the coast and the settled parts inland. The interior natives are not leprous, with the single doubtful exception of the Jakuns of the Muar district of Johor, bordering on the ancient Portuguese colony of Malacca. Even here its presence is only an inference, from the reported occurence of Jakuns with mutilated toes or fingers, but no European doctor has seen a Jakun leper, though at least one has spent years in the district.

4. The East Indian Archipelago.—This vast region presents many interesting features respecting the distribution of Leprosy. In the greater Sunda Islands, that is, Borneo, Sumatra and Java, Leprosy exists, but practically only among the Chinese and Malays; the aborigines are clean. In Borneo it is only found in a few populous centres in the south and south-west, and here again only among the Chinese and Malays. The whole of the interior is clean and so is North Borneo. In this last district a few Chinese lepers were introduced some few years ago, and one Portuguese leper came there. They have been deported, and the country is clean; not a single native has ever become a leper.

Java and Sumatra have Leprosy spread pretty evenly all over them, and this has lead to alarming reports of the prevalence of the disease. As a matter of fact, they are only sporadic cases, and the disease is officially declared to be rare. Formerly the government supported fourteen Asylums, but in 1868 eight were abolished, and the rest are supported by voluntary subscriptions, chiefly by the Chinese, who are the greatest sufferers; the number of Asylums has now, we understand, been reduced to three. Here again it was the Chinese and Malays who suffered chiefly, and the aborigines went scot free.

The whole of the lesser Sunda Islands, from Bali to Timor Laut are free from infection.

To the north the disease again appears, and it is said to be more rife in Moluccas than any part of this region. The south of Celebes is leprous, the northern district of Minahassa is free.

In the Philippines Leprosy is found on the main Islands, but again it is the Chinese who are the chief victims, and the interior natives are exempt. Palawan and Cagayan-Sulu, are clean.

The vast number of other Islands, chiefly inhabited by the black races are clean, and we have no proof that the disease is known in New Guinea among the natives. The Sulu Islands are also clean.

6. The Pacific—This area is so vast, communication so difficult, and observers so few, that our observations are still incomplete. We are in hopes of one of us being able to traverse

the region with this special object in view. Meanwhile, we must be content with the evidence at hand. It has been necessary to reject much that has been written in a general way on this area, for we have definite statements of experts of the the absence of Leprosy from places which have been confidently stated to be leprous.

There are three well-defined leper centres—New Caledonia, where it is not rare ; Fiji, where it seems to be spreading ; and, Hawaii, where it is rapidly destroying the native population. The New Hebrides (Leprosy seems to be introduced there quite recently), the Caroline and Solomon Groups seem to be quite clean, in spite of statements to the contrary, and so are in all probability all the rest of the innumerable islands that dot Oceania.

New Caledonia was quite free from Leprosy when annexed by the French in 1853. About 1880 a Chinaman who was a leper arrived and lived with a native tribe for several years. He does not seem to be the first leper, for three New Hebrideans, had been deported as lepers a few years previously. As these natives were certainly not lepers at that time, they must have acquired the disease, and it is a fair inference that as Chinese who are known to be lepers were in the colony, they were the introducers as in so many other cases. By 1890 lepers were said to be numbered by hundreds, and even Europeans had become affected.

We know that in these three Pacific leper-centres, the disease is of recent introduction, and hence we are justified by an examination of the facts above given in drawing the important conclusion that :—*From the Chinese provinces of Kwantung and Fokien, Leprosy spreads with diminishing intensity in all directions, and has formed a new focus in Hawaii of unparalleled virulence.*

Ethnography of Leprosy.—We will now traverse the facts above given from an anthropological point of view. Certain startling results seem naturally to accrue, and they are so opposed to prevalent opinion, that this in itself is sufficient reason for bringing them under notice.

Dr. A. Corré, in his valuable *Maladies des Pays Chauds*, (Paris, 1887, p 575) writes as follows :—" Les races noires sont partout les plus éprouvées, en Afrique comme en Océanie et en Amérique. Les races jaunes, bien qu'infectées à un haut degré, semble déjà moins accessibles à la maladie, et, chez elles, les centres endémiques tendent à se limiter, à se rétrécir. La fréquence d'ailleurs variable de la lèpre parmi les Malais, les Indochinois et les Hindous, n'est pas sans doute dépourvue de toute relation avec là nature et le degré des croisements subis par ces peuples. Les Maures et les Arabes entretiennent la maladie parmi eux, en raison de leurs unions nombreuses avec les femmes de race noire ; mais les Juifs, ne s'aillent qu'entre eux, ne sont pas moins sujets à la lépre."

Our experience is exactly the contrary of this statement. So far from the black races being the most leprous, and the yellow the least, over the great area we are dealing with, the black races are quite free from Leprosy, except where as in Fiji, it has been recently introduced ; and the yellow race, the Chinese, is the leper and the distributor of Leprosy. We proceed to demonstrate this.

A glance at the map shows that there are only two centres of intense Leprosy in the whole of the Pacific basin—the provinces of Kwantung and Fokien in China, and Hawaii in the distant Pacific. We shall see that Hawaii was infected from China. As we go south and east from what we will call, for brevity's sake the Kwantung centre, Leprosy spreads with diminished vigour, attaining a sub-focus in Moluccas. The disease is more intense in Tonkin than further south, and in Sumatra and Java it is so rare, and of so mild a type, that the Netherlands government, who having colonies both in the West and East Indies, both leprous, and who have dealt with the disease in a most enlightened manner, have from experience given up all the restrictive measures with which they started in the East Indies, while they maintain them in all their rigour in the West Indies.

Neither in Indo-China, the Straits, or in the Dutch, Spanish, or Portuguese islands have we been able to find a particle of evidence that the aboriginal tribes ever were, or are now leprous.

If we again refer to the map and consider the portion coloured blue, which shows the area from which we have evidence of the non-existence of the disease, it will strike every anthropologist that it is roughly conterminous with the division between the brown and the black race, and that the black race is the clean one.

Over all the East Indian part of our area, we have only one case of infected aborigines reported to us, and this of the most doubtful character. We refer to the Jakuns of the Muar district of Johor. The case is an interesting one, for this is the native home of the gurjun oil which has achieved such a reputation as a specific in Leprosy. It has long been a native drug, yet the natives suffer much from skin diseases, and it is significent that they alone are suspected of Leprosy. More to our point is the fact that this tribe is in close contact with the oldest European settlement in this part of the far east. To this question we shall return.

All the lesser Sunda Islands and the New Guinea group are free from Leprosy.

Turning to the Pacific we find by an analysis of the old voyages that there is proof that when first visited by Europeans the entire area was free from the disease. At the present time there are three centres. So far as European influence is concerned, we may state the case thus :—New Caledonia is French, Fiji is English, Hawaii is practically American ; but neither the French, the English, nor the Americans can have introduced the disease, for they are not leprous. Fiji is peopled by the black race, New Caledonia by a mixed black and brown people, Hawaii by a brown race. All have become lepers.

In view of this strange and unexpected distribution of Leprosy, it behoved us to look for some common factor. Climate, physical and geological conditions were clearly out of the question ; yet the disease had a definite relation to the ethnography of the area. The appended table gives the state of our present knowledge.

The Common Factor.—If we examine the ethnographical table, it will be seen *that in not a single instance are the native races attacked without there being Chinese lepers in the country.*

It is hardly realised how widely, and in what enormous numbers, the Chinese are dispersed over the Far East. Reference to Directories will show that in many places they equal, and in some outnumber the native inhabitants. They are the first immigrants to introduce trade, and may be found living where no white man's life is safe ; they are the advance guard of coming civilisation. When the European opens new land, he looks to China for labour, and it is not far from exact to say that over the whole of this vast area there is not a spot where a foreigner can earn a living without a Chinaman in it.

All the direct, and much indirect evidence, goes to show that Leprosy was not known in the Archipelago until it was brought by the Chinese. The same is true of the Pacific Islands; they certainly introduced it into Hawaii, as we will show.

This suggestion gathers force when we consider the relative intensity of the disease among the various races. The case may be thus stated :—*The intensity of Leprosy in the area under consideration is inversely as the antiquity of the race in any given spot.* The black races, the oldest, practically enjoy immunity ; and this holds good in a slightly less degree with the succeeding Indonesians. The Malays who followed are tainted in many places ; the Chinese, the last to arrive, are the most leprous, and we know Leprosy to be endemic in China. Europeans can be left out of the question for their habits prevent them from becoming lepers, save in a few isolated cases.

In the Archipelago the Negroid races have for the most part been driven inland by the Indonesian incursions ; and these latter have in many cases been similarly affected by the Malay invasions. None of these island tribes are leprous, as they must be if Leprosy were endemic among them. Leprosy is in fact practically confined to the coasts, and to the cultivated parts of the interior, or just to those places where the Chinese are most thickly settled. The Malays are in closer contact with the Chinese than the other races, being confined to the coast for the most part ; hence they suffer more than the older races. Yet ten Chinese lepers can be found for one Malay. Every Leper Hospital, save in Hawaii, tells the same story ; it is the Chinaman who suffers most. Over and over again the report came to us, "seems to have been unknown till introduced by the Chinese."

The test of language tells in the same direction. Unfortunately, we were at the outset of our inquiry so under the impression that Leprosy was endemic over the region treated of, that we omitted to make special enquiries on this point, and only chance statements and personal observation, are to hand. It is not sufficient to find a name for Leprosy given in a vocabulary; such a name may be a loan word. What is required is a knowledge of native usage. For example, the Malays of the Straits have the word *kosta*, but in North Borneo, the name was unknown to the native Malays, and when Leprosy was brought by the Chinese, they simply termed it *sakit*, sickness, accompanying the term with a gesture of disgust, or called it by the English term, *sakit lepra*. So too in Hawaii, there was no native name for the disease, though they have a copious nomenclature for other diseases. The Hawaians call it *Mai Pake*, the Chinese disease.

The necessity for thus getting hold of local usage is vividly illustrated in the case of China itself. In the north, where we have shown it is only present in a mild form the natives call it *hai lai*, or great itch; thus showing they do not recognise it as a separate disease, but only as a form of a well known and little heeded complaint. In the leprous south the case is very different. The general term for Leprsoy is *Ma Fung*: and they recognise the following varieties, *Hung Wan*, red patches; *Hak Wan*, black patches; *Hung Tun*, red rings; *Pak Tun*, white rings; *Tsz Wan*, darker than Hung Wan; *Lau Tai*, contraction of the sinews of the feet; *Tun Chai*, contraction of the sinews of the fingers; and *Kai Chau Tung* (probably), tubercular Leprosy. This wealth of terminology shows an intimate acquaintance with the disease, for no Cantonese would dream of calling Leprosy by so mild a term as "great itch." It also goes far towards establishing the point that Kwantung is one of the principal centres of the disease.

The conclusion we draw is that *Leprosy shows a strongly marked ethnographical distribution; and it is most marked in the inverse order of the date of introduction of the different races.* The order is as follows:—

Original Black races	...	Free in the Archipelago.
Indonesian race	...	Free in the Archipelago.

Malay race	... ...	Somewhat affected.
Chinese	... ...	Strongly Leprous.

The only common factor we can discover is the presence of Chinese in all leprous centres.

The Distributing Centre.—The centre from which Leprosy has chiefly spread over the area under consideration, is the two adjoining southern Chinese provinces of Kwantung and Fokien. From their shores Leprosy spreads outwards in all directions, diminishing in intensity as the distance increases, but coming to a new focus in Hawaii.

The exceptions to this rule are significant. The disease does not go northwards, nor does it spread much in China westwards ; that is, it neither goes up the coast nor inland. But it does spread in every other direction. In other words *it follows the lines of Chinese emigration.*

In North Borneo we saw with our own eyes the introduction of Leprosy by the Chinese, and happily its extinction also. From Sumatra and Java the news came that the disease was unknown until the introduction of Chinese coolie labour ; in New Caledonia and Fiji the disease has also followed the opening up of the country, and the coming in of the same class ; in South Moluccas there is no aboriginal race to nurture the disease ; Celebes is full of plantations where Chinese abound, and so we might go on, giving case after case.

The two islands of Hainan and Formosa are striking examples of our theme. Hainan is inhabited by a tribe that, keeping to the interior, give but partial submission to the Chinese, and hold scarcely any communication with them. The Chinese proper on the island, are mostly descendants of emigrants from Fokien, and they are leprous, while the natives are free.

Formosa was early settled by an Indonesian race, and the island did not become Chinese till 1661. Even now they are confined to the west of the dividing range, and the natives successfully hold the rest. The Chinese are leprous, the Formosans are not.

Hawaii is a terrible illustration of the point we are contending for. It is the most leprous place on earth, and the native race seems doomed. Their Board of Health in 1894, spent over $300,000, the greater part of which was for their lepers. The Government have issued many reports, extending over hundreds of pages, so that the history of the disease can be readily followed. It will be well to devote a little space to the consideration of this interesting country.

Discovered in 1777 by Captain Cook, it speedily became a resort for whaling ships, and the growth of vegetables for the use of ships was the first settled industry. Early in this century, missionaries settled in the islands, and we have searched in vain their reports and those of all the early voyagers for any notice of Leprosy. We state confidently that it was unknown.

By the middle of this century California had attracted large numbers of American settlers, and a regular trade was kept up with Hawaii. Contemporary writings show that about this time the Chinese were attracted to the islands for sandal wood, trepang, &c., and many settled down and took to planting and growing vegetables for the American market. Then came the great gold discovery in California, with its unparalleled influx of population, and Hawaii became of great importance as a food-producing country, its chief mart being San Francisco. Chinese now flocked to Hawaii and California, and the erstwhile savage islands became the seat of an enlightened and civilised native government.

In 1850, King Kamehameha III organised a Board of Health, and his royal mandate decrees "that everything . . . ought to be done or undone, removed or procured, for the preservation or cure of contagious, epidemic, and other diseases, and more especially of Cholera." No mention is made of Leprosy.

In April 1863, Dr. Hillebrand, Surgeon to the Queen's Hospital, called attention to "the rapid spread of that new disease, called by the natives 'Pai Make'."

In February 1864, the President of the Board reports the disease as spreading to other islands in the group. In 1865, an Act to Prevent the Spread of Leprosy was passed, which commences with the statement that "Leprosy has spread to a considerable extent among the people." From this time to the present the most strenuous efforts, and enormous outlay, have failed to check the disease, and in 1894 there were 1155 lepers in the settlement at Molokai.

Here we have a clear case of the introduction of the disease, although some have tried to show that it was prevalent in Hawaii at the time of its discovery.

Leprosy made its appearance, and began to spread, exactly at the time when Chinese coolies flocked to the islands ; and even now there are 26 Chinese lepers, and only 24 of all other nationalities except Hawaiian. The discovery of gold in California was the proximate cause of the introduction of Leprosy into Hawaii.

One cannot leave the notice of Hawaii without a mede of praise and admiration to a government that has shown such an enlightened perception of an awful crisis—one that threatens the very existence of the nation.

The facts seem to justify the following conclusion :—*Leprosy in the East Indian Archipelago and Oceania is conterminous and co-existent, in time and area, with the Chinese coolie.*

Indian and Japanese Influence.—The influence of India and Japan upon this area is almost nil. India, it is true, is leprous ; but it does not send contingents of the coolie class into our area, the chief Hindu emigrants are traders of a class far above the coolie ranks.

So too with regard to Japan, the coolie class is practically absent. It may very well be that the Leprosy of South Korea, a recent introduction, may be due to Japanese influence, but the Archipelago and Oceania have no such charge to bring against this nation.

Chinese Traders and Coolies.—We draw a broad line of distinction between the Chinese trader and the Chinese coolie. The trader belongs to a higher social level, and he goes abroad as a master, and not as a servant ; he is not of the class that supplies most of the lepers. That he is not responsible for the spread of Leprosy is shown by many facts, of which we may cite three.

First.—When in the 13th century, owing to the conquest of China by Kublai Khan, the Chinese began to invade the islands of the south, numbers of Chinese came to North Borneo, and settled on the N.W. coast. Here they intermixed with the natives, and the great tribe of Dusuns bear to this day the stamp of their Chinese blood, in feature, customs, and even language. Yet Leprosy is unknown among them.

Second.—Though Chinese traders have spread all over the Archipelago, they have not taken Leprosy with them. Thus all the islands of the lesser Sunda group, from Bali eastward, and innumerable other islands as far as New Guinea and Australia, are quite free from Leprosy.

Third.—It was not till the coolie class entered Hawaii, that the disease appeared.

Now contrast this with the effect of coolie emigration. Wherever the coolie has gone, the land has become infected. The leper map is also the map showing where plantations have been established. Java, Sumatra, South Borneo, Celebes, and Moluccas, are cases that at once strike us ; and in the Pacific, it is New Caledonia, Fiji and Hawaii—the lands of plantations—that have become infected. In the islands where planting has not yet been introduced, or where it has not attracted the Chinese coolie Leprosy is wanting, though all the physical characters may be similar to those of infected places.

The Coolie Trade.—If we are right in ascribing the spread of Leprosy to the introduction of coolie labour, we ought to be able to show that the mass of the coolies come from the infected provinces of Kwantung and Fokien.

This is almost exclusively the case. At present the ports of Hongkong and Amoy, both in Kwantung, are the source of nine tenths of the coolies, and we can speak from experience that it is a rare thing to find a plantation coolie that comes either from the northern or central provinces.

This is not the place to describe the coolie trade ; it is still, in spite of all sorts of precautions, only a modified system of slavery. Kidnapping is by no means so rare as some would have us imagine. Even the truly voluntary coolies are gathered from the poorest of the poor ; many do not know where they are going or what for, and the majority have no conception what life on a plantation is like. In former times the coolies where chiefly shipped from Macao, also in Kwantung; now those that come through Hongkong are inspected, but in Amoy they are shipped under easier conditions.

It is sufficient for our purpose to have shown that the bulk of the coolies come from the very hot-bed of the disease. Many of the coolies land in a poor state of health, and coolie ships, as we know by travelling in them, are not all they might be.

The Cause of the Intensity of the Disease in Hawaii.—On this point we can only hazard a conjecture. It is very noticeable how slightly the Malays are affected, though they are in the most direct contact with the Chinese, and are allied in blood to the Indonesian Hawaiians. That the Indonesian and Negroid races in the Archipelago are so free from Leprosy is due to the very slight intercourse they have with the Chinese coolie.

In the Pacific a different state of things obtains. In the first place the Polynesians and Micronesians are a comparatively stay-at-home people. Until this century they hardly ever saw a stranger of other than their own races. The Malay, on the other hand, is a born rover, so much so that it is hardly settled where his ancestral home is.

We know that isolated communites are prone to take new diseases in an intensified form; even the St. Kilda folk illustrate this. It is owing to this cause that Fiji lost 40,000 inhabitants in a single epidemic of measles a few years ago.

Hence it is probable that it is the susceptibility to disease born of isolation that has made the Pacific Islanders so amenable to Leprosy, and to other diseases also; while the allied Malay, a traveller for centuries, escapes more easily.

How to Check the Spread of Leprosy.—That Leprosy is spreading through Oceania is unfortunately too true. In Hawaii, New Caledonia and Fiji, we have seen how it has sprung up, and it has been pointed out how narrowly North Borneo escaped being stricken. There is further evidence in the same direction. In 1880, five natives were sent back from New Caledonia to the New Hebrides, suffering from leprous mutilation, and so forming a possible new centre of infection. In 1891, the *Samoa Times*, quoted by Mr. Tebb, reported that H.M.S. Cordelia considered that Leprosy has been recently introduced into the Penrhyn Islands from Hawaii, and that there was an undoubted case of Leprosy on Manaheke Island.

It is pretty certain, then, that Hawaii is disseminating the disease, and almost certain that New Caledonia is doing the same.

Now there is no proof that Leprosy is increasing just at present in China or the Archipelago. In the latter area, this seems to be due to a temporary lull in the Chinese coolie traffic; but this traffic has taken a fresh start to North Borneo, and as we write, coolies are being shipped from the leper hot-bed of Kwantung and Fokien by the S. S. *Memnon*, and it will be surprising if the disease is not reintroduced. It is easy to send the lepers back if they are found out. But a man may be leprous for years and not know it, and so involuntarily spread the disease. To establish a Leper Asylum in a clean country is to form a fresh centre; it makes the disease endemic, as is shown in our detailed report. The true specific is to return the lepers to their native homes.

The only way to stop the spread of Leprosy, is to put an end to the coolie traffic from the infected provinces, and this cannot be done except by concerted action of the governments holding possessions in the Far East. Already the disease has been taken by the Chinese to California and Australia.

It may be retorted that the coolies are medically inspected before leaving China, and again on arriving in an English port. But they are not inspected for Leprosy, and that lepers get through is proved by the case of North Borneo.

If estate managers could be prevailed upon only to take coolies from the clean northern provinces, the chief source of the spread of disease would be avoided. It will be pointed out the coolie will lie as to his native place, as an oriental only can lie; but in this case his speech will betray him. The Kwantung man cannot understand the man from the northern provinces: the dialects are as distinct as those of Suffolk and Yorkshire.

As regards the Pacific centres, all that can be done is to exclude the Kwantung and Fokien coolie, and to prevent the emigration of labourers from places like Hawaii and New Caledonia.

No one can look upon the splendid races of the Pacific and see how rapidly they become leprous, without feeling they are doomed, unless the Chinese coolie is prevented from infecting them, without profound regret. A race destroyed is gone for ever, and we, as civilised beings, do not desire to repeat the story of the Tasmanian and the Carib.

China would not help in the good work, of this we may be certain. The remedy lies in the hands of the European nations; and they are the chief importers of the Chinese coolie. Cheap labour, cheap tobacco, sugar and spices, are bought at too high a price if paid for by the extermination of races whose territories we have usurped.

In this paper we have not touched upon Australia, and only incidentally upon western North America, as these countries were not included in our scheme; but they too have the same story to tell. Neither have we dealt with other supposed causes of the spread of Leprosy. These questions are treated elsewhere; but we do not like to close this paper without recording the fact that we have not been able to find a trace of evidence that vaccination has played a part in the dissemination of this fell disease.

PLACE.	RACE. Mongoloid.	Caucasian.	Indonesian.	Malay.	Negroid.	REMARKS.
CHINA—						
Chihli ..	o					Certainly absent
Shantung ..	†					Rare: formerly more abundant
Shansi ..	o					Certainly absent
Honan ..	o					Certainly absent; a few perhaps on Hupeh frontier
Kiangsu ..	o					Certainly absent
Nganhwai ..	o					No case reported
Kiangsi ..	†					Not a common disease
Chekiang ..	o					A few on Fokien border perhaps
Fokien ..	‡†‡					Prevalent nearly everywhere
Hupeh ..	†					Endemic, but not common
Hunan ..	o					Could not hear of a case
Shensi ..						No information; prob. clean
Kansu ..						Do. do. do.
Szechuen ..	†					A few small centres
Kwantung ..	‡†‡					Prevalent everywhere
Kwangsi ..	††					On Kwantung frontier chiefly
Yunan ..	††					Do. do. growing rarer
Formosa ..	†		o			Among Chinese only
Hainan ..	†					Only in immigrants from Fokien
MANCHURIA ..	o					No case known
KOREA ..	†					Only in South: rare
S.E. SIBERIA ..	o	o				Unknown round Vladivostock
SACHALIEN ..	o					A few cases, prob. not endemic
JAPAN ..	†	†				Rare: Japs and Ainos both leprous—rare
INDO-CHINA—						
Tonkin ..	‡†					Commoner on Kwantung front
Cochin ..	††					Formerly much more prevalent
Cambodia ..	††	†				Not common
Siam ..	††			?†		No native lepers reported
STRAITS SETTLEMENTS						
Perak ..	††		o	†	o	Nearly all Chinese
Selangor ..	†		o	?	o	No native case reported
Sungei Vjong ..	†		o	?	o	Do. do.
Negri Sambilan ..	†		o	?	o	Do. do.
Pahang ..	†		o	?	o	Do. do.
Johor ..	†		?	?	?	A few Jakuns, doubtful lepers
Singapore ..	††		?	†		Almost exclusively Chinese
Penang ..	††			†		No native lepers; patients brought from the Peninsula
Malacca ..	††			†		No reliable information as yet
ARCHIPELAGO—						
Sumatra ..	††		o	†		Rare: almost exclusively Chinese
Java ..	††		†	†		Do. do. very few even among Malays

PLACE.	RACE. Mongoloid.	Caucasian.	Indonesian.	Malay.	Negroid.	REMARKS.
Borneo ..	††		o	†		Only in Dutch part of South; no native lepers
Celebes ..	††		o	†		Absent from North
Moluccas ..	‡†		o	†		No aborigines in South where most prevalent
Sulu ..	o		o	o		No case known
Buru ..	o		o	o		Reported clean
Ceram ..	o		o	o	o	Do. do.
Bali ..	o		o	o		Do. do.
Lombock ..	o		o	o		Do. do.
Sumbawa ..	o		o	o		Do. do.
Sumba ..	o		o	o	o	Do. do.
Flores ..	o		o	o	o	Do. do.
Timor ..	o			o	o	Do. do.
Timor Lant ..	o		o	o	o	Do. do.
Small Islands ..	o		o	o	o	Do. do.
New Guinea ..	?		?		?	Doubtful cases; no reliable information as yet
PHILLIPINES—						
Luzon ..	††			†		Not common; chiefly Chinese
Mindanao ..	††			†		Do. do. do.
Palawan ..	o		o	o		Quite clean
Cagayan ..	o		o			Do. do.
PACIFIC ISLANDS						
Ladrones ..			o			From private information
New Ireland ..			o		o	Do. do.
Solomon Is. ..			o		o	Do. do. a few doubtful cases
New Hebrides ..					†o	Do. do.
New Caledonia ..	†		†		o	Rare
Fiji ..	†				†	Natives becoming affected
Friendly Is. ..					?o	Almost certainly free
Samoa ..			?o			No reliable information as yet
Society Is. ..			o			Do. do. do.
Hawaii ..	‡†	†	‡†‡	†		The most leprous of all places
Carolines ..			o			No lepers seen (Dr. J. Rale)
Marguesas ..			†			Leprous (Dr. Rale)

PROBABLE OUTCROP OF BLYTHESDALE BRAYSTONE SOUTH OF ITS SUPPOSED BOUNDARY NEAR MT. ELLIOTT.

By F. BENNETT.

[*Read before the Royal Society of Queensland, April 10th, 1897.*]

While traversing Mt. Elliott, a peak to the south of Redford Station, and lying slightly east from the divide between the Warrego and the Maranoa Rivers, certain rocks were met with which seem to indicate that the Blythesdale Braystone crops out somewhat further south than was formerly noticed.

The rock is beautifully clear and white, hardly even coherent, and, whether the Braystone or not, is eminently suited for water absorption. It presents great similarity to a water-bearing sandstone found deep down in the celebrated "Boatman Bore."

The mountain is capped with a coarse ferruginous grit, probably of Desert Sandstone age. Underlying this is a band of exceedingly porous white sandstone, then a small and vanishing layer of shale, then the above mentioned porous white sandstone to an indefinite depth. This order, I may remark, is exactly what seems to present itself in the Morven Bore. At a depth of about 875 feet, about 10 feet of coarse ferruginous grit was pierced, followed by about 300 feet of very porous non-coherent white sandrock. But from the very nature of the sandstones here, fossils are entirely absent, and paleontological evidence as to the age of the sandstone beds is entirely wanting. The Rolling Downs Limestone, so common about here, is missing in the Mt. Elliott section. Sections are, from the nature of the western country, very rare, hence the stratigraphical evidence is not at all satisfactory. The outcrop referred to may indeed be only a member of the Desert Sandstone series, and, in the absence of stratigraphical or paleontological evidence, the assertion that such was indeed the case would be hard to contravene.

But there is such a great lithological resemblance between this outcrop and the Braystone, that their possible indentity would be worth inquiring into. The outcrop is a great addition to the already known water-absorbing areas, whatever it may be, and its course across the country parallel to the known course of the Braystone, and its position in the Mt. Elliott strata, would justify a further exploration of the outcrop with a view to establishing its indentity with the Blythesdale Braystone. I am not at present able to explore further, nor am I likely to be able to do so in the near future, but the search is worth prosecuting.

My attention was called to this deposit by Mr. Lambert, of Redford, and the deposit presents a striking appearance viewed from the side of the mountain. It resembles a local "White Terraces," and is tunnelled and eroded to a depth of forty feet. These sheer walls, seen from the mountain side, appear flat like a sea of sand. From this outcrop is probably due much of the white sand of the Maranoa channel.

The same rock, as far as one can judge from lithological resemblance (in the absence of stratigraphical or paleontological evidence), breaks out at the "Chalk Water-holes" on the Angellala Creek, also at the "Apple-tree Camp" on the same creek; also at a cave about 7½ miles N. of Mt. Maria; also, according to Mr. Connolly, of Angellala Downs, at the head of Duck-pond Creek. Hence it will be seen that this deposit runs a course parallel with the Blythesdale Braystone, but, if identical with the Braystone, widens its outcrop some 32 miles in breadth, as it appears fully that distance S. and W. of the supposed Braystone boundary. Samples of the stone referred to have been forwarded to the Geological Museum. Mt. Lonsdale, Redcap, and McManus's Gap present, I am told, outcrops of this same rock. I am awaiting an holiday long enough to visit these localities. Whether Braystone or not, this rock is remarkably fitted for water-absorption and extends in a broad belt over the country, its derived soil being covered by a vegetation very distinct from the Mulga ridges of this region. The ant-hills and the soil are greyish yellow or white, not red as further west.

The only rock found freely near Morven and for many miles around is Desert Sandstone in its many forms, and Rolling Downs Limestone. Fossil localities are mainly of the Rolling Downs Limestone and occur at Brunel Downs, opposite the head station; at the foot of the Cocked Hat, and on Burka Bourka Gully, on Angellala Downs; also on the Borer Creek, running down to the Burenda Bore. From Brunel Downs were obtained *Crioceras Australe* (Moore), many fine specimens of which were obtained here and forwarded to the Geological Museum. *Belemnites*, *Canaliculatus*, *Natica*, *Cyprina*, *Pecten*, *Corbicula* and an inflated *Modiola* were obtained from Brunel Gully; also here, as elsewhere, *Glycimeris* is very common. *Crioceras* was obtained from the spur of the Cocked Hat, and *Hamites* from Borer Creek, on Burenda. This Rolling Downs Limestone crops out freely on the plains, but is in places highly fossiliferous, in others remarkably devoid of fossils. Specimens of fossils and lithological specimens have been duly forwarded; also a rough sketch, to show the probable course of the outcrop referred to. (Specimens and sketch were exhibited at the meeting.—*Ed.*)

ON A NEW WORM DISCOVERED IN MORETON BAY OYSTERS.

By J. LAUTERER, M.D.

[*Read before the Royal Society of Queensland, April 10th, 1897.*]

ARTESIAN WATER AS ILLUSTRATED BY THE HWANG HO AND YANG TSE RIVERS.

By S. B. J. SKERTCHLY.

[*Read before the Royal Society of Queensland, May 15th, 1897.*]

A REMARKABLE REACTION OF THE TYPHOID BACILLUS.

By A. JEFFERIS TURNER, M.D., Lond.

[*Read before the Royal Society of Queensland, 12th June, 1897.*]

THE microscopical reaction which I show you to-night, may appear a very insignificant matter to most of you. Nevertheless, it represents a discovery of very great practical value. Furthermore, it is a reaction of such a strange and remarkable character, that I would not venture to describe it to you unless I were able to let you see it with your own eyes.

A few words of introduction are necessary to enable you to understand what the reaction is. It has long been known that two very fatal diseases affecting man—Asiatic Cholera and Typhoid Fever—are due to bacteria which can be readily isolated from the body after death, or the discharges during life. In the first the organism is a curved rod, in the second a straight rod, both showing very agile swimming movements. In both instances great difficulty, not to say impossibility, has been found in distinguishing these disease organisms, when found outside the human body, for instance in drinking water, from other organisms almost exactly resembling them, but quite innocent of any disease-producing qualities. Some years ago, Professor Pfeiffer, one of the best known of the pupils of the illustrious Koch, made the remarkable discovery that the blood and body fluids of an animal, which had recovered from the illness produced by an injection of cholera poison, had the power of paralysing the movements of the cholera vibrio ; but had no such effect on vibrios which were not the same as the cholera vibrio, though in most respects exactly resembling it. Here then was a new method of distinguishing the true cholera vibrio from its counterfeits. The exact method used by Pfeiffer need not concern us; it has since been much simplified. For the distinction of typhoid from other similar bacilli an identical procedure has been found of the greatest value.

But, it has been discovered by Widal and others, that our reaction has a double value. It is, so to speak, a two edged sword cleaving asunder the dark places of our ignorance. By making use of a cultivation known to consist of typhoid bacilli, we can distinguish the blood of those who have received a dose of typhoid poison from the blood of others.

Without further preamble let me describe the reaction as you may see it to-night. Under the first microscope is a "hanging drop" preparation of living typhoid bacilli to which has been added a minute fraction of a drop of the blood of a subject not suffering from typhoid. You will see it to contain immense numbers of actively swimming rods. These will continue swimming as you see them for many hours, until by their multiplication the whole drop has become filled with single rods. Under the second microscope is a similar preparation except that the blood was derived from a patient suffering from typhoid. In it the bacilli behave in a strikingly different way. They appear benumbed or paralysed, the majority exhibit no movements, others are spinning rapidly around on their own axes like whirligigs or weathercocks, expending an immense amount of energy but not getting forward. If you watch long enough you will see many of the rods gathering into little groups or clumps all over the preparation, like sheep huddling together when frightened. Finally they cease from all movement, and grow no longer as single free-swimming rods, but as long motionless filaments, which interlace to form a network, and would be taken by an inexperienced observer for some different organism altogether.

Into the explanation of this remarkable reaction I do not propose to enter. It is a difficult problem on which it would be rash to theorise. But its practical value is easy to recognise. It is possible by the examination of a single drop of blood, dried on notepaper, to distinguish whether the illness from which a person may be suffering is typhoid fever or some other disease. This is possible even when the case is so obscure as to render the results of all other methods of examination uncertain. Furthermore, specimens so taken may be sent by post and examined days afterwards by an observer hundreds of miles distant. Indeed, I have obtained the reaction with perfect distinctness from specimens eight weeks old. This is a result at which no one can be more astonished than I have been myself. For it comes to this—that an observer here should be able, were it worth while, to recognise the presence of typhoid fever in persons residing in London, Berlin, or New York, on receiving such specimens through the post.*

* Since this was written, I have obtained typical reactions from dried specimens of blood of patients suffering from typhoid fever in London, forwarded to me by letter post.

DESCRIPTION OF AN ANTIQUE PLAQUE IN REPOUSSE.

PLATE I.

By H. L. DAVIS.

[*Read before the Royal Society of Queensland, 12th June, 1897.*]

THIS interesting specimen of hammered metal only recently came into its present owner's possession. Its original owner furnished no particulars respecting its history beyond intimation "that it had been in his family's possession for two or three generations."

The Plaque is circular in form, twenty-one inches in circumference, and oxidised to a dark brown hue, its appearance indicating that it may have lain buried with hidden treasure many centuries. The oxide coating has crumbled away in places, otherwise the Plaque is in fair preservation, the design in bold relief and finely executed.

The subject depicted is evidently an incident recorded in the Old Testament (1 Saml., xvi) which must have taken place about the year 1017, B.C., and represents the prophet Samuel anointing the shepherd lad David.

The future King of Israel is seen in centre of the Plaque on his knees, with his left hand on Samuel's thigh, a position similar to that in which Abraham's servant took the oath of fealty (Gen. xxiv, v 3 & 4). The prophet is pouring the sacred oil from a ram's horn, on to David's head.

The prophet wears the priest's cap, and is arrayed in the loose flowing garments of the period, his robe reaching to his feet which are shod with sandals. David wears a loose robe, the skirt scarcely reaching to his knees, and is bare footed. On the extreme left, David's father (Jesse) is seated on a block of wood or stone, with his right hand resting on a rug, or skin of some animal. He appears to be intently regarding the prophet's operations.

Three female figures (David's mother and two sisters) are standing behind Jesse. The mother, distinguished by the wife's cap or head-covering worn by married women of the Hebrew nation, looks on with complacency, while the two daughters appear to be engaged in animated conversation.

To the right of Samuel, two of David's brothers stand looking on, and smiling contemptuously at the prophet's selection of the younger brother in preference to themselves. One of the brothers appears to be wearing a cuirasse or a coat of mail ; both are bare headed, and both wear leggings or greaves with decorations below the knees.

In centre of the background David is again depicted seated and holding a harp, an erect figure (perhaps the prophet's servant) stands before David and is holding a shepherd's crook ; sheep are represented browsing behind an altar of incense, the smoke from which is ascending in dense volumes. In the lower foreground is a harp, a sling with four or five stones, a wallet or bag, and a shepherd's crook, the head of which is of peculiar shape.

In the background on the extreme left is a Date Palm, then (prominently depicted) a view of a fortified city or castle with the sea in front and two ships sailing under its walls, a hill at the rear with a castle or fort on the summit and cedar trees on the side. The view evidently represents either Tyre or Zidon, both ancient cities of Phœnecia, about 24 Roman miles apart. The former "rock-bound Tyre," the city of which, at period of the reign of David and Solomon, Hiram was king, and became noted for his intimate commercial relations with Israel.

The British Encyclopœdia intimates respecting Zidon or Sidon "that on division of the land of Canaan, Sidon fell to the tribe of Asher, but was not conquered for a thousand years, when (B.C. 320) its king, Tennes, betrayed the city into the hands of Artaxeres Ochus, on which occasion the Sidonians, rather than fall into the hands of their conqueror, burned themselves, with their city and its rare art treasures."

Returning to the Plaque, to the right of the city is an Olive tree and a distant view perhaps intended for Bethlehem of Judœa, David's birthplace.

In the supposed view of Tyre or Sidon, the roofs of several buildings appear to be surmounted by a dome or cupola, but close examination shows the roofs to be flat with a lantern or look-out rising from the centre of what appears to be a covered verandah, and terminating in a spire.

The Plaque is surrounded by a narrow border finely wrought but partially obliterated.

One feature worthy of note as a probable indication of the great antiquity of the Plaque is the artist's delineation of Jesse with his left arm in a sling. No modern artist would have ventured on such departure from the Bible narrative. The Phœnecians may possibly have possessed some record of the life of David, that would have shown Jesse to have been thus crippled, perhaps through injury sustained during David's encounter with the Lion and Bear of which the Scriptures give but very meagre information (1 Saml. chap. xvii, v 34 to 37).

The anointing of David at Bethlehem of Judœa took place about 2,900 years ago. Tyre and Sidon continued flourishing cities a thousand years later, therefore, if the Plaque be of Phœnecian manufacture, it should be between two and three thousand years old.

Phœnecia was celebrated for its hammered work in metal, as early as the period of Hiram, king of Tyre. The view of a city so prominently represented in the background of the Plaque, would hardly have been shown without some distinct reason for its appearance, and since neither Tyre, Sidon, or other port or city of Phœnecia had any connection with the incident represented, whichever of these the city be, the only reasonable inference for the artist's delineation of it, appears to be, that the Plaque was made there.

Israelites, even to this day, have a custom of hanging on the Eastern wall of the room in which their daily prayers are re-cited, a picture representing some sacred subject to indicate the direction of the Temple towards which devout Hebrews invariably look while at prayer. This picture is termed a Mizrach or holy mark, and as the wealthy Hebrews sometimes used such things wrought in gold, silver, or brass, the Plaque may have served this purpose, and if so? it was probably mounted on a panel of cedar with Hebrew inscription, in golden legend around it ; Adoni Eloihim the Eternal, the living God" ; or Shemang yesroel adoni alohinu, adoni archod, Hear O Israel, the Eternal is our God, the Eternal is One."

Whatsoever purpose the Plaque may have served, it is a very interesting specimen of ancient art, worthy of careful examination, and if it be as ancient as its appearance would seem to indicate, it affords valuable evidence of accuracy of the Scripture narrative of that interesting historical event "the anointing by the prophet Samuel of the shepherd king of Israel."

PARTHENOGENESIS AND BISEXUAL CHARACTERISTICS.

By Hon. A. Norton, M.L.C.

[*Read before the Royal Society of Queensland, 10th July, 1897.*]

PECULIARITIES OF THE FLOWERS OF THE ORDER PROTEACEÆ.

By J. SHIRLEY and E. C. BLAKE.

[*Read before the Royal Society of Queensland, August, 7, 1897*]

ABORIGINAL CUSTOMS IN NORTH QUEENSLAND.

By R. H. MATHEWS, Licensed Surveyor.

Read before the Royal Society of Queensland, September 11, 1897.

INTRODUCTORY.—On several occasions I have contributed papers to different Societies on the customs of the aborigines, my object being to stimulate enquiry and and encourage others to embark on the same line of investigation. In some of the papers referred to, I drew special attention to the necessity for anthropological research in those parts of Queensland and the Northern Territory which abut on the Gulf of Carpentaria. Since writing the previous articles, I have gathered some further information respecting the natives scattered over the country mentioned. In the present paper it is proposed to make a few cursory remarks in regard to their class systems—their imitation ceremonies—and their practice of drawing upon rocks, upon trees and on the surface of the ground, together with other matters of ethnological interest.

CLASS SYSTEMS.‡—There are a number of tribes occupying the country on the Leichhardt, Cloncurry, Flinders, Norman, Gilbert, Mitchell and Kennedy Rivers, extending from the Gulf of Carpentaria across the Cape York Peninsula to Princess Charlotte's Bay, and reaching southerly from the Gulf to the Main Dividing Range. These tribes are divided into four sections or classes after the Kamilaroi type, the men of one section marrying the women of another, and the descent of the children is counted on the maternal side, the same as already described by me in the Kamilaroi tribes. The names of the four classes are different in different districts, owing to diversity of dialects, and in nearly all cases the names of the women are different from the men.

‡ The reader is referred to my papers on this subject in Proc. Roy. Geog. Soc. Aust., (Q)., x, 18—34; American Anthropologist, ix, 411—416; Journ. Roy. Soc. N.S. Wales, xxxi.

It has been said that some of these tribes have agnatic descent; but I now think this is very doubtful.

The following are few totems common among some of the tribes referred to:—Flying-fox, native companion, black duck, grass, eagle-hawk, plain turkey, iguana, carpet snake, whistling duck, black snake, tiger snake, pelican, crow, whip snake, emu, jackass, opossum, magpie, red kangaroo, porcupine, bandicoot, kangaroo rat. Descent being reckoned on the side of the mother, if she is, for example, a native companion, all her sons and daughters will be native companions.

Imitation Ceremonies.[†]—Among these tribes the imitation ceremonies are similar in their fundamental principles to other ceremonies I have described in New South Wales, but many of the details differ considerably. When it is found that there are a sufficient number of boys old enough to be admitted to the status of tribesmen, messengers are sent throughout the community to ascertain the wishes of the different head men, and when they all agree among themselves which tribe is to take the initiative in calling the people together, the head man of the tribe so selected sends out some of his own men as messengers to invite the neighbouring tribes. Each of these messengers is provided with a small bullroarer, and a few articles of a man's attire, perhaps he carries the club, boomerang or woomera of his chief, to serve as his credentials.

In due course, the tribes so invited start for the general meeting place, and on arriving there they are accorded a formal reception. When all the invited tribes have mustered at the main camp, a day is set apart for taking the novices away to be initiated. After a number of preliminaries similar in character to those described by me elsewhere, the boys are led away with their heads bowed, to an oval enclosure or yard, the dimensions of which are about 35 feet by 20 feet, but it varies in size according to the number of people to be accommodated. It is bounded by a row of high stakes standing nearly upright, and is open at one end; some of the stakes at the back part of the enclosure are about twice the height of a man, but they get shorter towards the

[†] See my papers on the "Bora of the Kamilaroi Tribes," Proc. Roy. Soc. Victoria, ix. N.S., 136—173. "The Burbung of the Wiradthuri Tribes," Journ. Anthrop. Inst., xxv, 295—318; xxvi, 272—285.

open end where they are about the height of one person, or not so high. These stakes are inserted in holes dug in the ground and are rammed in the same way that a white man rams the posts when erecting a fence to keep them firm. Around outside the stake yard there is an embankment composed of loose earth.

Whilst away in the bush the boys are placed sitting down and are not allowed to speak a word ; if they want anything they must whisper their wishes to their guardians. They must keep their hands shut, which is very tiring when long continued ; and in the summer time, owing to the sweat which collects in the shut hand, fly-blows are often found. The guardians therefore open the hands of the boys, and rub grease upon their palms to keep the flies off. Incisions are made in the arms of several men, and the blood flowing from the wounds is collected in a native vessel, and some of this blood is rubbed on the bodies of the novices. They are also compelled to eat human ordure in the way described by me elsewhere. During their stay in the bush the boys are placed standing in a row, and the bullroarer is shown to them. These bullroarers are about ten inches in length, with a string fastened through a hole at one end, the other end of the string being attached to a pliable rod like a whip-handle. A man catches hold of this rod in one hand and swings it round, using the bullroarer something like a whip, and it at once begins to give a loud weird sound.

Incision.—On the western side of the Leichhardt river, and extending thence across the boundary between Queensland and the Northern Territory, are a number of tribes among whom the practice of slitting the urethra is common. The custom is known by different names in districts where diverse dialects are spoken, but I think it is better to adopt the English word "incision," which at once suggests its meaning. E. J. Eyre was one of the first to record this singular mutilation,* having observed it in 1841 among the native tribes about the Great Australian Bight, and Port Lincoln. Since then it has been reported from several parts of South Australia, West Australia, and the Northern Territory, as well as in that portion of North Queensland extending from the Mulligan river to the Gulf of Carpentaria.

* Journs. Expeds. Discovery Central Australia in 1840-41. Vol. II., p. 332 and note.

In some instances the urethra is slit from the meatus to the scrotum; in other cases the cleft extends only two or three inches from the glans; and sometimes a perforation an inch or more in length is made in the canal at the base of the scrotum. The object of the rite appears to be connected with the initiation of the subject operated upon into the privileges of a man of his tribe, in the same way that the extraction of a tooth is practised in other parts of the country. Various "white men's yarns"—travellers' tales—have been told about this rite, but I want to collect exact and reliable details as to how the operation is performed, the instruments used, the stopping of the bleeding, and the subsequent treatment of the wound. The information hitherto published is very meagre in regard to these points. Sometimes the custom of circumcision is also found among those tribes who slit the urethra.

Rock Pictures.*—The rock paintings of the natives are met with in greater abundance in Northern Queensland than in any other part of Australia. They are found on most, if not all the rivers flowing into the Gulf of Carpentaria, and also on the rivers flowing towards the eastern coast. I have myself seen them in different places, and on one occasion I met an old blackfellow on the Dawson river who had seen the paintings done when he was a youth. Rock carvings are said to be found on the Batavia river,† and R. B. Smyth reports that "while Mr. Norman Taylor was exploring in Cape York Peninsula, he found on the hardened earth flats at the back of a beach some regularly drawn turtles cut out in outline."‡

Ground Drawings.*—Earthen figures formed in high relief, or engraven upon the turf, representing human beings, different animals, and other curious designs, are found chiefly at those places where the young men of the tribe are admitted into the rank of manhood. Where they have been observed in other localities the circumstances would lead us to suppose that they were connected with some tribal myth or superstition, or were used on festive occasions.

* Journ. Anthrop. Inst., XXV, 145-168, Plates XIV-XVI; Proc. Roy. Soc. Queensland, XII, 97-98; Proc. Roy. Geog. Soc. Aust. (Q.), X, 46-70; Ibid., XI, 86-105.

† Proc. Roy. Geog. Soc. Aust. (Q.), X, 60.

‡ Aborigines of Victoria, I, 292.

Marked Trees.||—The drawings on trees consist of representations of men, animals, weapons, the different heavenly bodies, lightning, and a variety of other characters. Among the Kamilaroi, Wiradjuri, and other tribes with which I am acquainted, marked trees of the character indicated, are found at those camps where the initiation ceremonies are performed. The graves of the natives, the scenes of some of their fights, and remarkable events in their daily life are likewise commemorated by curious symbols marked on the trees standing around the spot.

With the assistance of the articles I have written on these subjects, any man of ordinary intelligence could spend an hour or two now and then amongst the blacks near the town or station on which he lives, and gather all the particulars above indicated without any difficulty whatever. The scenes of their initiation ceremonies, rocks containing drawings, marked trees, &c., could be visited as opportunities offered, and full descriptions and drawings made on the spot.

|| See my paper on "Ground and Tree Drawings," American Anthropologist, IX, 33-49; Journ. Anthrop. Inst., XXV, 154-155.

THE OLDEST WORKED COAL FIELDS OF CHINA.

By S. B. J. SKERTCHLY.

[*Read before the Royal Society of Queensland, October 16, 1897.*]

ADDITIONS TO THE FOSSIL FLORA OF QUEENSLAND.

By J. SHIRLEY, B.Sc.

[*Read before the Royal Society of Queensland, November 13, 1897.*]

NOTES ON SOCIAL AND INDIVIDUAL NOMENCLATURE AMONG CERTAIN NORTH QUEENSLAND ABORIGINALS.

By **WALTER E. ROTH**
(Late Demy of Magdalen College, Oxford).

[*Read before the Royal Society of Queensland, November 13, 1897.*]

INTRODUCTORY.

During the past three and a-half years I have had opportunities of personally obtaining information on this subject in the neighbourhood of Boulia, Cloncurry and Normanton on one side of the Colony, and at Cooktown, Townsville, Marlborough, Yaamba, Rockhampton, Gladstone, etc., on the other. A total of about twenty-four (24) tribes has been enquired into. Among the aboriginals of all these districts, practically identical systems of social and individual nomenclature have been met with, and it will be my endeavour now to render them somewhat intelligible.

Every individual aboriginal is related or connected in one way or another, not only with all other members of his own tribe, but also with all those of other friendlies perhaps hundreds of miles distant, the majority of whom he has probably never heard of or seen. Unfortunately in the white man's language, there are no adequate terms to give suitable expression to such connecting ties, and hence the various English names that will be brought into requisition must be understood as having a far more extended range of signification than has hitherto been usually applied to them, even then, the introduction of some new appellatives has been forced upon me.

Every male is primarily some one's brother, father, brother-in-law, mother's brother; every female is similarly some one's sister, mother, sister-in-law, father's sister. But these terms, mother. father, brother, sister, in addition to their generally accepted meaning of relationship by blood, express a class or group-connection quite independent of it. Mother is the one and the same name used by an aboriginal to express not only the woman that gave him birth, but also the sisters (matron or virgin) connected with her by blood, as well as the dozens of women connected with her by class or group on a basis to be subsequently explained. Similarly with the terms brother, father, sister. The name of sister-in-law as here used signifies any female member of the particular group or class from among whom a man is allowed to choose a mate, it includes a man's wife, and her blood sisters, as well as the multitudinous other women belonging to the same group.

The Patronym, or tribal name. Every person belongs to the same camp or tribe as his or her blood-father; *e.g.* If a Pitta-Pitta (Boulia) male marries a Mitakoodi (Cloncurry) woman, the child irrespective of sex, is a Pitta-Pitta.

The Gamomatronym.—Every person in a tribe belongs to one or other of two main groups; a member of the one group can only marry a member of the other, and the offspring, irrespective of sex, always belongs to the same main group as its blood-mother. The term gamomatronym is intended to express the suitable marriage-union and blood-mothership implied by these two main divisions which are everywhere discoverable and generally recognised by distinct names; *e.g.*, Ootaroo and Pakoota at Boulia, Cloncurry, etc., Ootaroo and Mullara along the Leichhardt, Selwyn Ranges (Kalkadoon Tribe), Woodaroo and Yungaroo in the Rockhampton area, etc. At Normanton among the Wollangama blacks, and at Miriam Vale, a few miles south of Gladstone, among the Koreng-Koreng no special gamomatronymic terms were obtainable, although the distinctions implied by these two main groups were observable.

The Paedomatronym.—Each gamomatronymic group is divided into two, one for the offspring, and the other for the blood-mother; these secondary divisions, owing to this distinguished feature. I therefore propose naming paedomatronyms. Thus every tribe has its four paedomatronymic groups, which occasionally, owing to the presence of feminine suffix (*e.g.* in the Rockhampton area) give rise to a superficial appearance of there being eight. The Pitta-Pitta tribe at Boulia speaks of these four paedomatronyms as Koopooroo, Woongko, Koorkilla, Bunburi, the two first together constituting all the Ootaroo, the two last all the Pakoota; of course if the blood-mother is a Koopooroo, her offspring, irrespective of sex, is a Woongko; similarly, a Koorkilla blood-mother will have Bunburi children &c. Identical paedomatronymic names are in use among the blacks of the Upper Cloncurry and Upper Flinders Districts, among the Miorli and Goa people of the Middle and Upper Diamantina, at Roxburgh on the Middle Georgina, and on the Eastern Coast of the Continent certainly from Cooktown to Broadsound. The Kalkadoon (of the Leichhardt-Selwyn Ranges) speak of these four groups as Patingo, Kunggilungo, Marinungo; Toonbeungo: the Miubbi (extending from Donor's Hills to Conobie, across to the Eastern side of the Leichhardt River) call them Badingo, Jimmilingo, Youingo, Maringo; the Woolangama (at Normanton, but originally from between Spear Creek and Croydon) know them as Rara, Ranya, Awunga, Loora; the Taroombul (Rockhampton), Duppil (Gladstone), Karoonbara (Rosewood and Yaamba), Rakivira (Yeppoon), Bouwiwara (Marlborough), Koomabara (Torilla) etc., name them Koorpul, Koodala, Karalbara, Munnul for the males, and Koopulan, Koodalan, Karalbaran, Munnulan for the females; the Koreng-Koreng (of the Miriam Vale, south of Gladstone) call them Deroin, Balgoyn, Bunda, Barung.

Concerning this quartet of paedomatronymic groups, a considerable amount of information is available; it may be tabulated as follows.

(*a*) In North-West Central Queensland, every individual, as soon as he or she passes the first initiation ceremony, is forbidden to eat—not necessarily to kill—certain animals, each paedomatronymic group having its own special fauna that are prohibited. Not one, but several animals are tabooed to each paedomatronym: in no case, notwithstanding very careful search, did I find any plants, trees, fruits, shrubs, or grasses forbidden. Upon this point of avoiding certain food, the aboriginals are very particular, and should one of them wilfully partake of that which is tabooed, he is firmly convinced that it would never satisfy his hunger, and that sickness, probably of a fatal character, would overtake him. To be caught red-handed in the act by his fellow-men often means death to the delinquent. With regard to the food not permissible it has to be noted that the lists of prohibited articles, though constant for each tribe, are not identical throughout the North-West Central Queensland for the corresponding paedomatronyms in different tribes. Thus a Pitta-Pitta Koopooroo at Boulia has a prohibitory diet-scale differing from that of a neighbouring Mitakoodi Koopooroo at Cloncurry.

Along the coastal district between Gladstone and Marlborough, in reply to enquiry from the few old men who could render themselves adequately intelligible, I found that in the old days, all members of the tribe up to the time of their attaining a certain social rank (at the first initiation ceremony), were forbidden to eat iguana, carpet snake, black-face snake, emu, porcupine, young opossum, young paddymelon ; there was no record of any particular diet-scale being prohibited to each paedomatronym.

At Miriam Vale, south of Gladstone, no evidence whatsoever was obtainable concerning any dietary being forbidden to anyone at any time.

(*b*) These groups have an important bearing, in the North-West Central Districts, at the first and subsequent rites or initiation ceremonies which admit the individual to his or her respective grade or rank in the social status. Thus, the persons with whom one may converse by speech or sign, on certain of these occasions, depends upon particular paedomatronymic groups.

(*c*) They bear relation to the marriage-rule. The members of these four paedomatronymic groups can be married as follows only, no other arrangement being allowed ; the rule is constant throughout the two dozen odd tribes examined, for corresponding paedomatronyms. Among the Pitta-Pitta, etc., tribes they may be tabulated thus :-

Male	x	Female	=	Resulting Offspring.
Koopooroo		Koorkilla		Bunburi.
Woongko		Bunburi		Koorkilla.
Koorkilla		Koopooroo		Woongko.
Bunburi		Woongko		Koopooroo

(*d*) Domestic and private quarrels are generally settled or continued with the assistance of members belonging to the same or corresponding paedomatronyms, *i.e.*, by brothers and mother's brothers in the case of males, by sisters and mothers in the case of females.

(*e*) In spite of every enquiry I found no signs or passwords employed to distinguish the individuals comprising one paedomatronym from those of another; this is mutually made known by word of mouth. It will also be noted that when an aboriginal is asked what he is, he will always mention his paedomatronym; only on subsequent interrogation will he state his gamomatronym (presuming it to have a name).

The Heteronym.—The name varying with the particular paedomatronymic group into which the individual happens to be born, in his general group relationship to any other individuals. It has already been stated [Introductory Section] that every male is primarily some one's brother, father, brother-in-law, or mother's brother, while every female (virgin or matron) is some-one's sister, mother, sister-in-law, or father's sister; these terms having the extended range of signification already referred to. This comes about as follows:—The individuals belonging to the same paedomatronym call each other brothers and sisters, bearing in mind of course the reservations already laid down, *i.e.*, whether related by blood or not; the members of the corresponding paedomatronym (*i.e.*, belonging to the same gamomatronym) being their mother's brothers and mothers, whether related by blood or not. Similarly, they would call the members of the paedomatronym (belonging to the opposed gamomatronym) into which alone they are allowed to marry, their brothers-in-law and sisters-in-law, while they would speak of the individuals comprised in the fourth remaining paedomatronym, as their fathers and father's sisters, whether blood-related or not. Thus, throughout all the different districts under consideration, every person holds one or other of these eight group relationships to everybody else, the particular term of relationship varying, of course, with the paedomatronyms to which the compared parties belong. It is owing to this circumstance of such terms varying with the paedomatronym that the adoption of the name Heteronym has appeared suitable to give expression to them. To show this arrangement the more clearly, the following table has been compiled :

Gamomatronym	Ootaroo.			
Paedomatronym	Koopooroo.		Woongko.	
	male.	female.	male.	female.
Koopooroo ..	brother	sister	mother's brother	mother
Woongko ..	mother's brother	mother	brother	sister
Koorkilla ..	brother-in-law	sister-in-law	father	father's sister
Bunburi ..	father	father's sister	brother-in-law	sister-in-law

Gamomatronym	Pakoota.			
Paedomatronym	Koorkilla.		Bunburi.	
	male.	female.	male.	female.
Koopooroo ..	brother-in-law	sister-in-law	father	father's sister
Woongko ..	father	father's sister	brother-in-law	sister-in-law
Koorkilla ..	brother	sister	mother's brother	mother
Bunburi ..	mother's brother	mother	brother	sister

To learn from this, the particular heteronymic group relationship subsisting between any two people, no matter the tribe or tribes to which they belong, we have only to look along the horizontal line (paedomatronym) for the one person, and down the vertical for the other; where these intersect we get what is required. In the case of the heteronyms brother and sister, a distinction is sometimes made between those older or younger than the person speaking of them. Certain of the heteronyms may on occasion be supplanted by

THE GENEANYMS—or names serving to distinguish the individual's own true family connections (as understood among Europeans). The various terms denoting these would, *as understood among Europeans*, comprise the following :—

(*a*) In the contemporary generation—brother, sister, husband, wife, husband's brother and sister, wife's brother and sister, male cousin, female cousin. The translation of the terms brother and sister has been already dealt with. Husband's brother and sister, wife's brother and sister are known as brothers-in-law and sisters-in-law (as in a European community). Husband and wife are either called after the particular heteronymic terms of the paedomatronymic groups into which they are allowed to marrry (*i.e.* as brother-in-law and sister-in-law), or by separate geneanymic names. No special geneanyms are applied to male or female cousins ; they are simply known by the particular heteronymic groups into which they fall, *i.e.*, either as brothers and sisters (if their father's brother's, mother's sister's, children), or as brothers-in-law and sisters-in-law (if their father's sister's, mother's brother's, children). [See Genealogical Tree] .

(*b*) In the preceding generation—father ; mother ; father's brother, sister, father, and mother ; mother's brother, sister, father, and mother ; man's father-in-law, mother-in-law ; woman's father-in-law, mother-in-law.

The aboriginal equivalents for father, mother, fathers' sister and mother's brother, have already been noted in the heteronyms ; father's brother and mother's sister are called respectively by the same names as father and mother. A father's father is designated differently from a mother's father, and a father's mother differently from a mother's mother ; special geneanyms are applied to these four relationships. With regard to fathers-in-law and mothers-in-law, I have not yet had time to make sufficiently minute examination of the numerous notes collected to warrant my discussing any uniformity or otherwise in the aboriginal equivalents among all the tribes under consideration. The existence however is noteworthy, in some of the North-West Central Queensland tribes of a mutual term expressing the relationship, unknown among us Europeans, between the mother of the husband and the mother of the wife.

(*c*) In the succeeding generation—son, daughter; son's son, daughter; daughter's son, daughter; brother's son, daughter; sister's son, daughter; man's son-in-law, daughter-in-law; woman's son-in-law, daughter-in-law.

In all the tribes, son, daughter, brother's son, brother's daughter have no distinguishing names, each language having but one term (sometimes with a special suffix to express the females), a special geneanym, to express them all; similarly, sister's son, sister's daughter, pass by another special cognomen. The remaining relationships of the succeeding generation are not here discussed for reasons similar to those expressed when speaking of fathers-in-law and mothers-in-law.

While finishing with these geneanyms, it is well to draw attention to the necessity of avoiding, for reasons aforesaid, such terms as uncle, aunt, cousin, nephew, niece, grandfather, grandmother.

The accompanying genealogical tree has been drawn up to show more graphically the connection of group and blood relationship existing between one individual and all the others constituting a small tribal encampment, *e.g.*, of the Pitta-Pitta blacks. For the sake of convenience and simplicity, the number of relatives given in the minimum consistent with the proper elucidation of the different relations by which the central figure Charlie, a Koopooroo male, would personally know and speak of them. The diversity of English equivalents for identical aboriginal terms is very striking. Where special geneanyms are in use, the heteronyms are discarded.

THE AUTONYM—personal, individual name. The names applied to individuals are based for the most part upon physical peculiarities or objects of nature. Whether any connection is to be traced so far as individual names are concerned, between parents and their offspring, it is difficult to decide absolutely; in great measure this uncertainty on my part is due to the determined unwillingness of survivors to mention anything concerning their relatives deceased; their names, exploits or other particulars. In the Boulia and surrounding districts so called pet-names are applied to young males, but these are dropped at the first of the initiation rites, when, amid much ceremony, they receive their permanent individual names. In the same North-West Central country the names of women are usually given them at birth, and throughout life do not usually change ; exceptions however are met with in cases where some physical defect or unusual habit is brought into prominence. At Miriam Vale, males and females are known by their paedomatronyms, *e.g.*, Bunda, Deroin, etc., until such time (the first initiation ceremony) as they receive their permanent name ; members of the same paedomatronym (prior to this ceremony) may be distinguished by some physical peculiarity, etc., *e.g.*, Deroin Dolom, *anglice* Deroin. The left handed one.

THE CLIMANYM.—The "step-ladder" or titular name of the individual, depending upon his social degree, his status on the rung of the social ladder. To attain these titular names, the person has to pass through the ordeal of the several initiation ceremonies, in general about four of them (each with a new climanym), though, in the centres near civilisation these ceremonies are fast dying out.

THE RECAPITULATION.—Supposing we wished to give any person his complete individual and social nomenclature, it would be as follows :—

Patronym - - -	Pitta Pitta, Kalkadoon, etc.	
Gamomatronym -	Ootaroo or Pakoota	see Genealogical Tree.
Paedomatronym -	Koopooroo, Woongko, etc.	
Heteronym - -	Titi, Kako, etc.	
Geneanym - -	Jiungka, Uttana, etc.	
Autonym - - -	Moorrawilulli, (a Pitta-Pitta name).	
Climanym - - -	Yuppieri, etc. (a Pitta-Pitta name).	

PROBABLE INTERPRETATION OF THE CLASS-SYSTEMS.—It has often been suggested that these class-systems have been devised to prevent incestuous consanguinity. In opposition to this view I may state that *(a)* this alleged object is not met by the marriage-rule of Koopooroo, mating only with Koorkilla, and of Bunburi only with Woongko ; *e.g.*, a man cohabiting with his blood-cousin, his daughter's daughter, or his father's mother, would be guilty of incest although these three relatives belong to the particular paedomatronymic group from which he is otherwise allowed to choose a wife [see Genealogical Tree].

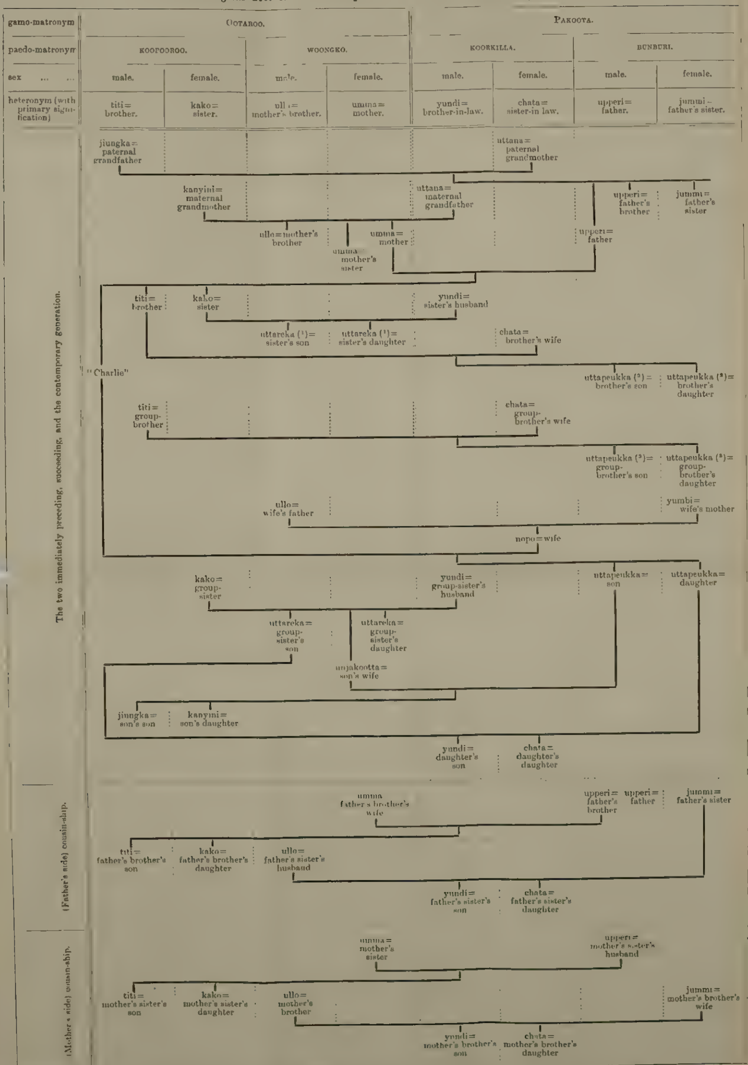
(*b*) In North-West Central Queensland what we should term incest is totally disregarded (except perhaps in the case of father and daughter, mother and son) at the sexual orgies taking place at a woman's first initation ceremony; the individuals indulging in this celebration are in no way limited by any particular grouping (paedomatronym, etc.), based on the class systems.

(*c*) The difference of group and blood relationship is not recognised in the aboriginal idea of incest, the penalties for any violation of the rights of either relationship are identical.

(*d*) The class systems do in fact prevent the union of couples whose marriage (if permissable) would certainly not constitute incestuous consanguinity. For instance, a Koopooroo Boulia native cannot marry any Banburi or Woongko woman of some friendly tribe, say a hundred and fifty miles distant, with whom he or his family have perhaps never mixed; but yet of that same tribe, he may marry a Koorkilla.

For my own part I am strongly of opinion that the whole class system has been devised, by a process of natural selection, to regulate the proper distribution of the total quantity of food available. Thus the husband, according to his paedomatronym lives on articles of diet different from those of his wife (or wives): both these diet scales again differ from those permissable to their resulting off-spring, which belong to a third paedomatronymic group. Hence, putting it shortly, whereas in a European community with a common dietary, the more children there are to feed, the less will become the share of the parents. In this North-West Central Queensland aboriginal class system, the appearance of children will make no appreciable difference in minimising the quantity of food available for those that give them birth. Any scarcity in the total quantity of all the food is met by a change of camping ground. A circumstance in favour of this view is that, although identical classes with corresponding marriage-rules, etc., are found throughout, the particular animals, birds, fish, etc., tabooed in each paedomatronymic group, vary with each ethnographical district. I look upon the Rockhampton area custom as being a still earlier development, a survival of the time when the elders, and consequently the stronger party in a camp collectively forced the younger

The Genealogical Tree of a male Koopooroo Pitta-Pitta Aboriginal, e.g., "Charlie."



(¹) and (¹), although in the suitable paedo-matronyms, cannot marry (²) and (²), being connected by blood (sect. 326): they can of course marry (³) and (³) if they want to.

members to discard those dietaries of which there might otherwise prove a scarcity.

Holding as I do the above views, I am inclined to believe that the gradual evolution of the class systems in general took place on lines somewhat as follows:—

(*a*) The food supply being inadequate to the increased population, the elders (the stronger) combine to force the younger (the weaker) to limit themselves to certain articles of diet. Remnants of this are to be found in the examples already cited from the East Central Queensland coast; others are recorded from Western Australia, etc.

(*b*) The stage when the younger (the weaker) progressively increasing in number and gradually insisting on being heard, come to terms with the elder (the stronger) and mutually agree in dividing themselves into two parties, each admitting the rights of the other to certain dietaries. To maintain this arrangement as far as possible *in statu quo*, these two divisions became exogamous. This separation of the tribes into two primary divisions and nothing more, is fairly common in Australia, *e.g.*, the doo-ar and the tar-boo of the Bloomfield River, (Q). blacks. There is every probability of this stage being both contemporary with, and subsequent to, stage (*a*); the youngest and weakest here and there being still prohibited from certain food-stuffs.

(*c*) An analogous subdivision, for similar reasons, of each primary division into two again, making the *four* (secondary) divisions met with throughout North-West Central Queensland. Further advances on these lines would be the cases recorded at Burketown (N. Queensland) of divisions into six and into eight. The exogamy of stage (*b*) is still retained; in other words, the divisions have arrived at that period where they actually regulate the marriage rules:—the sexual regulations are equalling and gradually overpowering the food regulations. During this stage the various animals, etc., tabooed by each division progressively come to have that social and religious interdependence with human beings (recorded from several parts of the Australian Continent) which may be called Totemism. So far, I have met with no examples of Totemism in Northern or North-

West Central Queensland, and for this reason, I have purposely avoided the use of the term throughout this paper.

Conclusion.—The whole question of class-systems, etc., whereby a relationship, such as it is, is established between aboriginals living miles and miles apart, yet may be mutually unknown personally, has an important practical bearing which has hitherto been apparently overlooked. In the mind of the real North-West Central Queensland savage, on a line of reasoning easily intelligible, all white men are believed to be similarily related; he looks upon any one European as being the brother, brother-in-law, father, or mother's brother, etc., of any other. I have not the slightest doubt that many a white settler (himself perfectly innocent) has thus paid the penalty of some crime committed by a predecessor.

The accompanying genealogical tree, from my work on "Ethnological Studies among the North-West Central Queensland Aborigines," has been kindly supplied by the Honourable the Home Secretary for Queensland.

NOTES ON FOWL ENTERITIS IN BRISBANE.

By C. J. POUND, F.R.M.S.,
[GOVERNMENT BACTERIOLOGIST.]

Read before the Royal Society of Queensland, 11th December, 1897.

During my investigations into the various outbreaks of chicken cholera in and around Brisbane, I succeeded in demonstrating the existence of another disease among poultry, namely, "Fowl Enteritis," which, in the two epidemics I have examined, assumed a very virulent form and resulted in a heavy mortality among the affected fowls.

HISTORICAL.

The first to discover and name this disease was Dr. E. Klein, F.R.S., of London.

In his book on the etiology and pathology of diseases affecting birds, Dr. Klein says: "During the early part of the the year 1889, I became informed of the existence of an acute and fatal epidemic disease amongst fowls on a poultry farm in Kent, in England, which was represented to me as being Chicken Cholera; but after careful microscopical examination, cultivation, and animal experiments, it very soon became evident that the disease, although similar to, was in many points different from, chicken cholera; therefore I have called it 'fowl enteritis.'"

As far as I can gather from carefully perusing various books on bacteriology and the proceedings of different scientific societies, there does not appear to have been any further recorded accounts of this disease, either in England or on the Continent, since that described by Dr. Klein in 1889; therefore it is somewhat specially interesting to have discovered the existence of Dr. Klein's disease in Queensland. There can be no doubt whatever that if all the various epidemics amongst poultry in different parts of the world were carefully studied and investigated, a certain number of the outbreaks supposed to be "chicken cholera" would turn out to be "fowl enteritis," and thus prove that the latter was more common and more widely distributed than is generally supposed.

ACCOUNT OF THE DISEASE IN QUEENSLAND.

No. 1. Epidemic.—In the beginning of October, 1896, I received information from Mr. J. Love, of Enoggera, that a neighbour of his, Mr. Simpson, was losing fowls every day from what he believed to be chicken cholera, and requested me to visit his place and enquire into the nature of the epidemic, and, if possible, suggest some practical means of mitigating or stamping out the disease. To this I accordingly consented, and on October 16th I accompanied Mr. Love to the poultry farm of Mr. Simpson. The latter gentleman informed me that during the previous week about 30 fowls had died.

Symptoms..—The description of the symptoms is as follows:

The infected birds suddenly become drowsy and sick without any apparent cause whatever ; they refuse food and water ; lose the use of their legs, and the wings droop ; the feathers become ruffled ; comb remains normal in colour ; in most cases they frequently discharge a greenish yellow mucoid excrement which soils the feathers. It is most noticeable that when the acute symptoms set in, the bird rarely lives more than 10 or 12 hours—in fact, not long enough to cause any signs of emaciation to the bird.

POST MORTEM APPEARANCES OF NO. 1 FOWL.

Heart.—Normal looking, but auricles and ventricles distended with coagulated blood.

Lungs.—Normal in colour, etc.

Liver.—Somewhat enlarged, but although not congested, was very friable.

Spleen.—Considerably enlarged, being fully three times the normal size, but no congestion.

INTESTINES.—In some parts the mucous membrane was slightly inflamed: contents of the intestine appeared greenish yellow and somewhat stringy or gelatinous.

MICROSCOPICAL EXAMINATION of the blood from the spleen, liver, and heart revealed the presence of a specific bacillus, which was very sparsely distributed. They appeared either singly or in pairs; a few were oval, while the majority were rod-shaded. With methylene blue, they stain uniformly and very dense, quite different to the bacteria of chicken cholera, which is characterised by the extreme difficulty with which it is stained. Moreover, the poles, or terminal part of the organism, are stained more deeply than the central part.

In all cases of "fowl enteritis" that I have examined, the bacilli are much thicker and longer than the chicken cholera bacteria.

CULTIVATION EXPERIMENTS.

A mere trace of blood taken from a freshly cut surface of the liver or spleen and rubbed over the slanting surface of a tube of Agar Agar always yields, after 12 hours incubation at 37 deg. C., a pure cultivation of colonies of the bacilli of "fowl enteritis." The colonies first appear as greenish translucent dots, then they spread out and become very thin and somewhat angular in shape; whereas the colonies of chicken cholera bacteria are more heaped up, and never look translucent, but a dirty yellowish white.

As pointed out by Klein, the chief difference, however, is shown in the rate of growth. The colonies of chicken cholera grow conspicuously slower and remain smaller than those of the "fowl enteritis" bacillus.

Gelatine culture media is not liquified by the "fowl enteritis" bacillus.

In faintly alkaline beef broth kept at 37deg. C, the growing bacilli cause a uniform turbidity which gradually increases, and, compared with that of chicken cholera, produces a greater amount of whitish precipitate in the broth culture. Broth cultures of "fowl enteritis" bacillus have a tendency to become clear in the superficial layer, while those of chicken cholera always remain turbid throughout.

EXPERIMENTS ON ANIMALS.

Two small black rabits, A and B, were inoculated (by means of scarifying the ear) with a mere trace from a young broth culture. Both apparently remained in perfect health until the 11th day, when one suddenly appeared exhausted and gradually sank into a drowsy condition for several hours and then died.

The other rabbit, after exhibiting the same symptoms, died the following morning.

Post-mortem in both cases was as follows:

SPLEEN.—The most noticeable feature was the enormous enlargement of the spleen, which was of a dark purple colour and firm in consistency.

HEART.—Normal in appearance, but cavities filled with coagulated blood.

LUNGS.—Normal.

LIVER.—Enlarged, friable, and slightly congested at the apices.

INTESTINES.—Appeared normal. Fæces in the rectum showing signs of diarrhœa. There was slight inflammation around the seat of inoculation.

MICROSCOPICAL EXAMINATION.

Spleen blood contained a fair number of bacilli.

Blood from the *heart* and *liver* showed only very few organisms.

Six (6) tubes of Agar-Agar were inoculated from the heart, liver, and spleen, all yielding a typical growth of the bacilli of "fowl enteritis."

On October 26th I received two more dead fowls (Nos. 2 and 3) from Mr. Simpson.

Post-mortem and microscopical examination gave positive results.

A small portion of the liver of one of the above fowls (No. 3) was mashed up with a little broth and used for inoculating the following animals :—

1 young rooster,
1 rabbit,
1 guinea pig, and
3 white rats.

Results :—

The rooster died in 9 days. P.M. positive.

The rabbit died in 17 days. P.M. positive.

The guinea pig and the rats remained alive.

A little of the mashed liver of No. 3 fowl was given as food to 2 young rabbits, 3 rats, and 1 guinea pig.

Results :—

1 rabbit died in 6 days. P.M. positive.

The other rabbit, together with the rats and the guinea pig, remained alive.

A Broth Culture inoculated from the rabbit's liver gave positive results. A little of this broth culture was injected into a pullet, a rabbit, a rat, and a guinea pig.

Results :—

The pullet sickened on the 6th day. but gradually recovered.

The rabbit appeared sick on the 4th day, became weaker on the 5th, and died on the 6th day after inoculation.

Post mortem and microscopical examination gave positive results.

The rat and the guinea pig remained alive.

INOCULATION AND FEEDING EXPERIMENTS

To Show the Difference in the Susceptibility of Rabbits to Fowl Enteritis and Fowl Cholera.

For this experiment 4 healthy and vigorous rabbits were selected. Inoculated one rabbit and fed another with a mere trace of a 24 hours old broth culture of the bacteria of chicken cholera.

Results :—

The inoculated rabbit died in 14 hours and the fed one in 17 hours. P.M. in both cases positive.

Microscopical examination of the blood from the liver showed enormous numbers of the specific bacteria.

Inoculated one rabbit and fed another with a mere trace of a 24 hours old broth culture of the bacteria of "fowl enteritis."

RESULTS :—

The inoculated rabbit sickened on the 4th day, became worse on the 5th, and on the 7th day it died in a very poor condition.

The fed rabbit sickened on the 5th morning, became worse in the afternoon, and died in good condition the same evening.

P.M. examination in both cases positive.

Microscopical examination of the blood from the liver showed only a relatively few bacilli.

INFECTION REMAINING IN CAGES USED PREVIOUSLY FOR EXPERIMENTAL PURPOSES

CASE I.—A healthy rabbit was placed in a cage which had not been used for over 6 weeks.

RESULT :—On the 7th day it was found dead.

P.M. and microscopical examination showed that it had died from "fowl enteritis," evidently contracted in this cage.

CASE II.—About a week afterwards, another rabbit was found dead in a cage which had been used for experimental purposes.

P.M. and microscopical examination proved that this rabbit had died from "fowl enteritis."

NOTES ON A RECENT OUTBREAK OF "FOWL ENTERITIS."

My friend Mr. Norton, who is ever ready to assist in the advancement of science, came to my laboratory in the latter end of last month (November), and informed me that he believed he had got chicken cholera amongst his fowls. He said that, as he had lost a good many, it might be worth while for me to examine some of the next birds that died.

On November 30th last, Mr. Norton brought to the laboratory a fowl which had only been dead a few hours.

On post mortem examination I found the usual characteristic appearances of "fowl enteritis," namely: Spleen enormously enlarged, but not congested or friable; the liver was much enlarged, but light in colour; the lungs were perfectly normal; and the heart was filled with coagulated blood; the mucous membrane of the intestine, and particularly the rectum, was slightly inflamed.

Microscopical examination showed the presence of the bacilli of "fowl enteritis."

Cultivations were made on Agar and in beef broth, and all yielded typical growths of the "fowl enteritis" baclili.

Experiments on Animals.

A little of the fowl's liver was mashed up with broth and used for inoculating the following animals :—

2 rabbits, 2 mice, and 2 pigeons.

Results :—

1 rabbit died in 7 days and the other in 8 days.

P.M. and microscopical examination gave positive results.

1 mouse got killed by accident on the 8th day, and the other remained alive.

Both pigeons remained alive, never showing any signs of sickness whatever.

Pigeons, notoriously susceptible to chicken cholera, are quite refractory to fowl enteritis. Klein says that in no single instance has he been able to produce illness in pigeons after inoculation with large doses of virulent material—that is, material which proved virulent for fowls even in small doses.

On December 3rd Mr. Norton brought me the last one of his flock of fowls, which, on post-mortem and microscopical examination, was found to have died from "fowl enteritis."

As this disease is still under investigation, the paper must only be looked upon as somewhat immature : but I think sufficient experiments have been conducted to prove that we have in Queensland two diseases of poultry which, even to the expert poultry-keeper, may appear identical; but, as I have endeavoured to show you this evening, they are totally distinct when studied from a bacteriological aspect.

No doubt owners of poultry will be anxious to know what is the most satisfactory way of dealing with an outbreak of this disease when it appears.

I do not think I can do better than quote the last sentence in Dr. Klein's book, namely :—

"Although the two diseases, fowl enteritis and fowl cholera, are different, the mode of their spread and the general behaviour of the two species of bacilli are similar, and therefore the rules that should guide us in the prevention of the spread of either should be the same. These may be summarised in saying—(1) every fowl that shows any suspicion of the disease should be at once removed, killed, and burned; (2) the remaining fowls should be at once transferred to new ground, and, if practicable, should be subdivided into separate small lots; (3) the ground from which the affected fowls have been removed should be turned, disinfected with quick-lime, and not used for fowls for a considerable time. These seem to me the best and easiest ways to prevent the healthy fowls contracting the infection by picking up food tainted with the evacuations (full of the specific bacilli) of the diseased fowls."

DESCRIPTIONS OF QUEENSLAND LEPIDOPTERA.

By THOMAS P. LUCAS, M.R.C.S.E., L.S.A., Lond.,

L.M. AND L.R.C.P., EDIN., ETC.

[*Read before the Royal Society of Queensland, 11th December, 1898.*]

FAMILY ARCTIADÆ.

SPILOSOMIA FRENCHII, SP. NOV.

♂ ♀ 58 m m. Head ochreous, mouth and two patches on forehead black. Palpi black. Antennæ grey, light on under side. Thorax reddish ochreous, band along dorsum and epaulettes black, collar narrowly scarlet. Legs black, under side of coxæ scarlet. abdomen scarlet, with a row of black dorsal narrow dots, and a row laterally extending from under side, caudal appendage scarlet, Fore wings costa rounded, hind margin obliquely rounded, creamy ochreous, covered in centre with fuscous scales, tinted with the scarlet of under surface, and marked with irregular bands of black dots and bars ; a dot at base, a finer near inner margin, an elongated blotch at base of costa, with another obliquely to a dot at one-third inner margin : this blotch subtends a curved line of spots from one-fourth costa : two spots beyond one-half costa subtend an S which is continued obliquely by three dots to just beyond one-half inner margin : a triangle of three or four short bars at three-fourth costa join a sub-apical line in a ? row of dots, splitting into two rows to just before, and to anal angle of inner margin : a line of linear dots from one-third along hind margin. Cilia ochreous banded with black. Underside ground colour scarlet, costal and hind marginal bands ochreous, with the dotted lines of upper surface continued as black bands. Hind wings scarlet, with black bands and spots ; a zigzag band from a spot at one-half costa outward to beyond half wing, thence inward and curved to near, but not touching, inner margin at five-sixth: dots from outer angle to costa at three-fifth, two large spots in a line from costa before apex and with interruption with curved band reaching to anal angle: a sub-marginal line of dart-like dots, and a marginal row of lines and dots to two-third hind margin, a faint dot at anal angle. Cilia ochreous, barred with black. Northern Queensland, Mr. French's collection.

SPILOSOMA QUEENSLANDI, NOV. SP.

♀ 65 mm. Head creamy white, with a small black dot on either side of forehead. Palpi black. Antennæ grey. Thorax creamy white, with a patch on dorsum and either epaulette black. Legs black. Under side of first and second pair of coxæ scarlet, of hind pair white. Abdomen light fuscous with segments black narrowly bordered by white, tinted with yellow, excepting sub-caudal, which is entirely black; caudal segment tipped with a triangle which contains two rows of minute black dots and bordered with dull orange. Fore wings costa straight, apical third rounded, hind margin obliquely rounded, creamy white marbled with black, costal side of median black, white from base running along veins and forming small patches near costa one-fourth and three-seventh, a white curved band three-fifth costa to two-third inner margin, an oblique white line from costa six-seventh to vein 6, an apical white band, interrupted between veins 6 and 7, thence broader to near anal angle of hind margin, angle only produced to hind margin, a broad median white band from base, meeting an oblique blotch from median, thence as a Z to middle of inner margin. Cilia grey, banded with white. Hindwings creamy white, with black spots, a round spot near costa one-half, two or three minute dots on costa immediately beyond, and a subapical bar and dot subtending a row of elongated spots to anal angle, a row of minute dots from apex along hind margin, faint and scant before anal angle, Cilia as forewings. North Queensland. Allied to S. fulvohirta.

FAMILY HYPSIDÆ.

NYCTEMERA MC-KIEANA. NOV. SP.

♀ 45 mm. Head ochreous, with a black spot on face, one across the crown, and a round dot on neck. Palpi and antennæ black. Thorax ochreous, tinted with golden yellow, narrowly bordered with black, with four rows of black dots, first row of two, second and third of three, and hind of one large blotch; second and third rows connected by narrow lines. Abdomen smoky grey, narrowly banded at junction of each segment with a line of fringy white, bordered by a fuscous line, under side white, with the grey bands widened out and becoming black, caudal segment tipped with orange. Forewings, costa rounded, hind margin rounded, smoky black, with white spots, basal dot small, tinted with orange spot above median at one-fourth, a large oblong rounded discal spot touching, or not quite touching, costa at one-half and extending to submedian vein, three submarginal spots, apical and median well defined, one opposite anal angle small, a white patch from one-sixth to three-fifth inner margin. Cilia smoky black. Hindwings as forewings, with basal two-thirds white extending to inner margin, and within a narrow border of costa; a white spot in dark border near apex of hind margin, a second at two-thirds hind margin, and one or two indefinite dots near anal angle. Cilia as forewing. Ingham Mac-Kie Collection. Allied to N. chloroplaca Meyr. and N. Separata, Walk.

GROUP BOMBYCINA—FAMILY HEPIALIDŒ.

Pielus magnificus. sp. nov.

♂ ♀ ɱɱ 125—165. Head smoky drab, antennæ ♂ pectinated, 2, attenuated at either end, ♀ denticulate. Thorax fawn colour drab, shading lighter laterally, with a black line down centre and across shoulders. Abdomen lighter drab than thorax. Forewings fawn color or drab in ♂, with markings edged with black, in ♀ drab grey thinly edged with black. Costa gently arched, hind margin obliquely rounded, straight toward apex, a broad white band, shading to creamy grey, from base close to costa, attenuated to a point four-fifths costa; a triangular white blotch at base of hind margin; an elongated triangle of white, with apex on middle of wing, at one-fifth to two-thirds extending to base, reaching from opposite two-thirds costa at one-third depth of wing to opposite one-half hind margin and nearly one-half depth of wing from inner margin; this conspicuous marking is bounded with rich deep black, excepting on inner side near base; basal margin sinuous, toothed; an outer elongated white patch obliquely opposite hind margin from close to apex to opposite anal angle at one-fifth depth of wing from border—a rich black line bands this patch gently wavy and broadly and irregularly dentate. These marks in ♀ have lighter ground colour and the black bounding line less dense, A number of hieroglyph figures around and between these larger patches cover the wing outlines in fine black line or grey dotted lines, less conspicuous on ♂ than ♀. . Cilia drab. Hind wings brownish drab. Cilia as fore wings. Melbourne. This and the next species have been confounded with P. hyalinatus (Herr Schaff). This latter is a mountain form, and its locale and resting and other habits appear to be quite distinct. If markings, colouration, and general appearances go for anything, to say nothing of size, the two are widely distinct.

PIELUS DIVERSATA. SP. NOV.

♂ ♀ mm 85—110. Head, thorax, and abdomen, fuscous grey. Antennæ ♂ fuscous, $1\frac{1}{2}$, pectinations tapering to either extremity, ♀ fuscous grey, serrate. Forewings fuscous grey, in ♂ tinged with ferrous, markings white, a long white narrow fascia through middle of wing from opposite one-fourth costa to upper angle of cell, thence obliquely to vein 7 opposite three-fifth costa, coarse dentate prolongation on inner border, divided by narrow line in ♀ to near base; a second narrow fascia nearly parallel with hind margin, borders sinuous, at one-third from anal angle to apex of hind margin, faint hieroglyphic lines round borders of wings. Hindwings as ground colour of forewings, plain. Melbourne, Victoria. In P. hyalinatus the markings are divided into blotches and spots irregularly grouped into fasciœ. In diversata each fascia is uninterrupted, and less irregular. The golden colour of the fascia is sufficient to distinguish P. hyalinatus.

EUDOXYLA (ZEUZERA) CRETOSA. SP. NOV.

♂ ♀ mm 79—115. Head white, with wool-like tuft on crown. Antennæ, ♂ stalk white, pectinations black, 4, ♀ black, thickly specked with white. Thorax blackish grey, irrorated with white and grey; a broad arrow, deeply black on borders, from immediately behind head distending laterally posteriorly. Abdomen ♂ 22 ♀ 45 mm, blackish grey, densely covered with grey and white scales, slightly tinted in ♀ with ferrous. Forewings, costa almost straight, excepting base and apex, hind margin sinuous, white profusely shaded with grey scales and black markings. Costa pencilled with regular short lines, becoming small triangles towards apex; a diffused blotch, one-fifth to two-fifth costa, gives rise to several angulated lines which form different faciœ through centre of wing, and which go to join concatenation of lines and loops extending along the whole inner and hind borders; a smudged fuscous-stained blotch of black lines at two-thirds costa; sub-marginal series of black columnar linear barred bands from apex along hind margin to one-half inner margin, where they diffuse into network on inner margin; a marginal line of small black squares on veins are connected with each other and with marginal fascia by interlacing lines. Cilia white, with bands and lines of grey and black. Hind wings grey, deeply irrorated with smoky black, becoming white towards hind margin, where it is fasciculated with network black lines to border; small squares of black on veins along whole hind margin; cilia white, barred with brown and grey. Brisbane.

Walker has described some of the Zeuzera, but appears to have grouped several species into one. His descriptions are most vague. I have endeavoured to divide the species by well marked permanent characters. E. cretosa is distinguished by its large size, its chalk-dust appearance, by the lacing network round the wing borders, by the two suffused netlace fasciæ, one through wing at one-third, and the other broadly from centre of inner margin and parallel with hind margin to apex.

EUDOXYLA (ZEUZERA) SECTA. SP. NOV.

♂ mm 52—62. Head white, densely irrorated with black and grey; face white. Thorax grey, irrorated with fuscous white and black, an elliptic black line on dorsum. Abdomen whitish grey densely irrorated with black. Forewings, costa nearly straight, hind margins obliquely straight, grey irrorated with white and black, costal border with regular short fine black lines, a deep black band from costa near base along cell to opposite three-fifths costa, thence diffused and dots to apex of hind margin; the costal area marked off by this line is richly washed with white ; the inner marginal area is deeply irrorated with grey and black lines between veins, and short black lines on entire inner margin ; there is also suffusion of white toward base and toward hind margin. Cilia white, barred with black. Hind wings fuscous grey, with whitish grey scales, and lightly smoked lines between veins. Cilia grey. Brisbane. Easily recognized by rich black line dividing off white costal area, and grey netted dark inner marginal area.

EUDOXYLA (ZEUZERA) TEMPESTUA. SP. NOV.

♂ mm 50. Head grey, irrorated with black and white. Antennæ fuscous, freely covered with white down. Thorax and abdomen greyish white, freely irrorated with black ; a black spot on dorsum on either side opposite hindwing. Abdomen mm 15 long. Forewings, costa gently wavy, apex and hind margin rounded, white, with blackish grey lines between veins ; a central dark diffused ovoid sinuous-outlined fascia at one-third, narrowing at costa, broadly diffused to inner border; this continues along inner border, is diffused in a small rhomboid blotch at two-thirds inner margin, and is gradually lost in a broad suffusion over entire hind margin. Cilia alternate bars blackish grey and white. Hindwings fuscous drab, with darker venations and a few indistinct grey lines along inner border—lighter grey toward base. Cilia as forewings. One specimen Brisbane. Allied to E. tigrina—Boisd. The dark central fascia and dark hind border, with the intermediate white area sparsely crossed by fine lines, give the appearance of a snow storm.

EUDOXYLA (ZEUZERA) COLUMBINA. SP. NOV.

♂ mm 100—110 Head fuscous. Antennæ, stalk white, pectinations 4 black, apical half plain. Thorax and abdomen fuscous, profusely speckled with grey. Forewings elongated, narrow, costa gently rounded, hind margin obliquely rounded, fuscous freely irrorated with a dove-colour grey: a sub-hind-marginal row of short fuscous bars between veins, a median row parallel from opposite half inner margin to opposite three-quarter costa, central bars faint Cilia fuscous and grey. Hindwings as forewings, uniform lighter, fuscous grey. Cilia as forewings. Brisbane. Unicolorous, only for the two rows of bar fasciœ.

EUDOXYLA (ZEUZERA) INTERLUCENS. SP. NOV.

♂ mm 57—75 Head fuscous, irrorated with woolly grey. Antennæ fuscous 1-4, apical two-fifths plain. Thorax fuscous, deeply covered with grey, a rich black-lined arrow over dorsum diverging to root of hindwings. Abdomen fuscous grey, richly barred in each segment with interrupted bands of black. Forewings very narrow, elongate; costa nearly straight, hind margin obliquely straight, fuscous deeply irrorated with grey and sprinkled with smoky grey scales. Hindwings pale grey. Brisbane.

EUDOXYLA (ZEUZERA) MINUTISCRIPTA. SP. NOV.

♂ mm 58. Head grey, densely covered with white. Antennæ black, pectinations 1.3, apical third simple. Thorax and abdomen grey irrorated with black and white. Forewings costa straight; hind margin obliquely rounded, very narrow, elongated; fuscous grey, grounded with lighter grey and closely covered with rows of minute black lines between veins; costal dots large, cilia fuscous grey and black. Hindwings light grey. One specimen, Brisbane. The whole forewing resembles a copy-book page of closely-written strokes, pot-hooks and short curves, which are independent of each other and do not net together.

EUDOXYLA (ZEUZERA) IRRETITA. SP. NOV.

♂ mm 50—62. Head black. Antennæ black, pectinations 1-3, apical third simple. Thorax black; a deeper velvety band on either side of dorsum. Abdomen black, with rich velvety black bands on segments. Forewings costa straight, apical third gently rounded; hind margin rounded, smoky black with patches of velvety black and netted lines between veins; a rich diffused velvety black along inner border from one-fifth to three-fourth, a second obliquely to this to costa at three-fourth, and a third parallel with hind border from centre of wing to apex. Cilia black. Hindwings white, with a hind-marginal row of smoky grey spots within a suffused line on either border. May Orchard, Brisbane, at light.

EUDOXYLA (ZEUZERA) PUNCTIFIMBRIA, WALK.

Two specimens, Brisbane.

EUDOXYLA (ZEUZERA) COLUMELLARIS. SP. NOV.

♂ ♀ mm 56—64. Head fuscous grey with black and white scales on crown. Antennæ black, pectinations 1-3, apical 4th plain, ♀ serrate. Thorax fuscous grey, irregularly bordered on dorsum with broken bands of black and irrorated with white. Abdomen grey mm 20 long. Forewings costa gently rounded; hind margin obliquely rounded, fuscous grey, mottled with white and looped with black lines, straight, angled, and curved, between veins; there is a darker suffusion from one-fourth inner margin and obliquely to apex of hind margin. Cilia black. Hindwings ochreous. The forewings are broader and whiter than either E. irretita or E. punctifimbria, and the markings are longer. The hindwings in E. irretita are white, in E. punctifimbria they are smoky black, and in E. collumellaris light ochreous, or ochreous grey. A pair, Brisbane.

EUDOXYLA (ZEUZERA) INSULANA. SP. NOV.

♂ mm 83—96, ♀ 108—130. Head black, grey on crown and face. Antennæ black ♂ pectinations 1-4, apical fourth plain, ♀ plain serratulate. Thorax fuscous grey, mottled with black grey, rich fuscous on shoulders of some specimens, and dark fuscous and black on dorsum—very variable. Abdomen fuscous grey, mottled with grey and bands of black, ♂ 25 ♀ 35 mm long, flat. Forewings costa gently rounded, hind margin obliquely straight, fuscous grey handsomely irrorated with black and shades of grey and scattered pencil dots of white; wings pencilled with rich black lines along the veins, multiplied between veins, and united irregularly by short connecting cross-bar lines; in ♀ this is largely hidden by the thickening of the lines into fasciæ and by a rich suffusion of black and fuscous grey; the wings, especially ♀, resemble insulated rocks or islands surrounded by mud-banks; a large patch of such, as a darkened fascia, extends from near base of costa to before one-half costa, with hind border obliquely toward anal angle as far as one-third from costa, thence to hind margin just before apex. The dark colouration includes the whole centre of wing, with the apical costal half of the wing, the hind and inner borders, and a patch from base of wing toward centre intruded ground colour; a hind-marginal row of black bars along veins arch together into dark fasciæ, and are carried midway to border by two or more irregular black lines, thus forming a series of arches or walls on border of wing. Cilia grey, or white grey, with fine black bars. Hindwings dark fuscous grey, with smoky black on veins and darker toward base, a marginal row of black column bars which form arches in a smoky outline at one-fourth distance of wing from hind margin. Cilia as forewings. Melbourne—Brisbane.

For some time I was undecided whether the ♂ from Brisbane and the ♀ from Melbourne might be different species. The specimens of each sex are so variable, yet so many characters hold good of the five specimens examined, that I have for the present grouped them as one. The rich fasciæ and the intervenal lacing lines distinguish from other species.

EUDOXYLA (ZEUZERA) TIGRINA (BOISD.)

One specimen, Brisbane.

EUDOXYLA (ZEUZERA) MIXTA. PAG.

I have a pair which Meyrich has queried this species.

FAMILY LIPARIDÆ.

DARALA TRISECTA. SP. NOV.

♂ 56 mm. Head, antennæ, and palpi ? Thorax ochreous, tinged anteriorly with light rust colour. Abdomen reddish ochreous. Forewings, costa rounded, hind margin rounded, ochreous shaded with faint fuscous, veins prominent, two red brown lines across wings, first one-fourth costa to one-third inner margin, slightly concave outwards; second, from five-sixth costa to two-third inner margin ; a slight fuscous dot at apex of cell. Cilia ochreous. Hindwings ochreous, strongly shaded with ferrous; second red line narrower than in forewings, three-quarter costa to two-third inner margin. Cilia ochreous. Ingham, Queensland. Collection McKie.

DARALA MACULOSA. SP. NOV.

♀ 80 mm. Head fuscous. Palpi ochreous, terminal joint filiform, blackish at point. Antennæ ochreous, fuscous toward base. Thorax ochreous, sparingly speckled with black. Collar dark fuscous. Abdomen fuscous. Forewings, costa gently rounded, apex acute ; hind margin bowed, ochreous freely (excepting on costa) shaded with fuscous and dusted with black scales, a darker discal shade approaching costa at one-half; an irregular blackish oblique fuscous broken line from a spot at one-half inner border to apex of wing, with a suffused blotch one.third from apex; cilia fuscous ochreous. Hindwings as forewings, with three transverse lines more or less distinct—first, one-third inner margin to two-fifth costa; second, one-half inner margin to three-fifth costa, denticulate and sinuous; third, less distinct, four-fifth inner margin to four-fifth costa, denticulate and interrupted; cilia as forewings. Ingham, Queensland. Collection McKie.

GROUP GEOMETRINA.—FAMILY GEOMETRIDÆ.

IODIS SIDERALIS. SP. NOV.

♂ mm 34—35. Head rich dark green, face dotted with white. Palpi fuscous, middle and terminal joints tipped with white. Antennæ reddish fuscous, bipectinate, terminal half simple. Legs glaucous brown, barred with white. Thorax green, with a black dorsal blotch, white in centre. Abdomen green, a white dot at end of each segment, a black patch with two white lines before apical segment, sides and under-surface white, apical tuft white. Forewings, costa arched, hind margin rounded, rich dark green irrorated with white scales; costa smoky black barred with fine white lines; a white scar like blotch at four-fifth near middle, white dots on veins, veins and terminal line a darker velvety green; cilia green, fringed with greenish white. Hindwings as forewings, white blotch larger and with a comma appending inwards, followed and closely circled by a wavy white line, and a smaller line before hind margin; cilia as forewings. Two specimens, Brisbane.

HYPOCHROMA CONSPURCATA. SP. NOV.

♀ mm 31. Head greenish grey. Antennæ light fuscous. Palpi fuscous, terminal joint elongated, smooth. Thorax grey, irrorated with green. Abdomen grey, with dorsal white tufts. Forewings, costa straight, rounded at base and apex. Hind margin straight, rounded from vein 4, grey, irrorated and shaded with green and ferrous; costa edged with smoky green, a dark green sinuous broadly dentate line from one-third costa to one-third inner margin, a discal grey line beyond half across centre of wing, a second dark green line of small round loops with free ends toward hind margin shaded with black from two-third costa to two-third inner margin and nearly parallel with hind border; a smoky green denticulate line from five-sixth costa approaches second line near middle, thence continues narrowly parallel to five-sixth inner margin; the enclosed space is ferrous fuscous on inner half, and shaded into green on costal half; beyond this again are irregular diffused line or lines of green alternating with lines of ground colour to hind border, terminal line ferrous green. Cilia grey, with ferrous band. Hindwings as forewings; first line becomes a green suffusion, a dark discal comma, and beyond a median green suffusion; second line, ferrous suffusion, green lines beyond, and marginal border lines as forewings. Cilia as forewings. Under surface of wings ochreous, with a black grey discal comma on each, and a broad black grey band covering posterior third of wing, lightly shaded with ground colour next border in forewings, but much more extensively in hindwings. One specimen, Brisbane.

FAMILY MONOCTENIIDÆ.

MONOCTENA PALLIDULA. SP. NOV.

♂♀ 39—43 mm. Head, thorax, abdomen, and wings creamy ochreous; ♀ reddish buff. Palpi ferrous fuscous. Antennæ ferrous fuscous; basal junction and apical half creamy ochreous. Forewings, costa slightly wavy, apex acute; hind margin first scooped out, then broadly bowed; costa marked by numerous transverse ferrous bands, tinted with cherry, a circular cherry ferrous line at apex of hind margin enclosing with border a ferrous patch, a few scattered black dots over all wings, a discal ring of ferrous cherry or ferrous fuscous at one-half reaching to median, a light ochreous line bordered by yellow in ♂ and ferrous yellow in ♀ from just before apex forewings to middle of hind border of hindwings, a hind-marginal border of ochreous ferrous in ♂ with five ferrous dots in forewings and lines in hindwings, in ♀ reddish buff bordered with rich ferrous. Under surface markings same as upper surface, but deeper; a broad blotch of maroon at three-fourth inner margin, continuous as a line of brown dots to four-fifth costa, *a figure of maroon divided* *into three squares by cross bars at two-third costa hindwing, and containing a light blue suffusion*, a like bar-line bordering but not touching the figure posteriorly. This figure is not seen on M. Vinaria, and readily distinguishes it from that species.

I caught three at light, Brisbane, and submitted them to Mr. Meyrick, who believed them to be a variety of M. Vinaria. Mr. Illidge has bred both species in Brisbane, and considers them distinct. The colouring of purple which leads to all shades in M. Vinaria is absent. Maroon takes its place, but is restricted to markings and lines, and does not tint the wings at all. The insect, both those caught and bred, being much smaller than M. Vinaria.

HYPOGRAPHA REFLUA. SP. NOV.

♂ ♏♏ 37. Head and thorax fuscous drab. Antennæ fuscous drab, pectinations 1-5, apical third simple. Palpi with long projecting haics on second joint, terminal joint thickened. Abdomen fuscous drab, tinted with ferrous. Forewings triangular, costa straight, apex rounded, hind margin gently rounded, fuscous drab diffused with light reddish violet and sparsely scattered gray scales. Costal fourth of wing irrorated by indistinct short smoky lines ; a dusky slate-colour line from cell at half to one-third inner margin, median portion curved, under half obliquely straight ; a second line, broader and more tinted with violet, from four-fifth costa to spot on vein 7, thence obliquely rounded to three-fifth inner margin ; a row of suffused dots on this line is continued to before apex ; hind-marginal line ferrous. Cilia fuscous drab. Hindwings as forewings, first line half costa to half inner margin, second more faint from five-eighth costa to opposite two-third inner margin at one-fourth from margin, marginal line and cilia as forewings. Under side of wings light fuscous, lightly tinted with violet, and crossed by a fuscous violet line beyond three-fourth in all wings, stopping short by one-fourth of inner margin. One specimen, Brisbane.

ONYCHODES FULGURAUS. SP. NOV.

♀ ♏♏ 27. Head fuscous ochreous, collar and face darker fuscous. Palpi fuscous. Antennæ light fuscous. Thorax lighter in front, fuscous. Abdomen fuscous. Forewings costa nearly straight, hind margin sinuate, bowed, fuscous with scattered lighter scales, costal area fuscous ochreous with minute black specks on costal line, a small darker fuscous spot at two-third costa, an irregular wavy ill-defined line opposite one-third costa to before one-fourth inner margin, and an irregular patch along bend of hind margin. Cilia fuscous. Hindwings fuscous, with conspicuous darker band lines parallel with hind margin, costal half of wing elaborately variegated with violet tinged with splashes and dots. Cilia fuscous. Mr. Turner, Mackay.

GROUP NOCTUINA.—FAMILY BRYOPHILIDÆ.

BRYOPHILA MILITATA. SP. NOV.

♂ ♀ 23—30 mm. Head bluish white, with a black dot on crown. Antennæ fuscous, becoming white at base. Palpi fuscous. Legs white, with black bands. Thorax bluish white, with four dorsal black spots. Abdomen grey white, with two rows of dorsal black spots. Forewings, costa straight, hind-margin rounded, blue white, with black dots and lines, arranged in squares and figures, as in military array; costa with a small dot near base, an irregular rhomboid at one-sixth, a small dot subtending a second immediately beyond, an S figure at half, reduplicated posteriorly, a dot at $\frac{5}{8}$ with a smaller one contiguous and two near middle of wing, a dumbbell figure seven-eight subtending, and a spot just before apex; an irregular blotch in centre of base attenuated in some specimens to thorax, a dot beyond near sub-median, three double dots or lines, or first two united into square on sub-median beyond, a diamond figure of three or four dots attenuated by narrow line to anal angle, four dots on inner margin, two middle (sometimes united), two or three dots before middle of hind margin, a row of small sub-marginal dots. Cilia white with fine white black bars. Hindwings blue white, with a broad hind-marginal blackish grey band, narrowing to two-third hind-margin, a few dots show from under surface. Under-surface with a square of four costal dots, and a fifth between on median, a row of three dots sub-median, hind-marginal band more attenuated. Cilia white, with black shading opposite the band. Brisbane Scrub. Very rare. On tree trunks.

BRYOPHILA METALLICA. SP. NOV.

♀ 25 ᵯᵯ. Head white. Antennæ and palpi black. Legs black and white annulated. Thorax white (rubbed, abdomen wanting). Forewings, costa gently rounded, hind margin apical half straight, anal half obliquely rounded, white bronzed all over in reddish coppery patches, black dot at base of costa, a sub-lunar band immediately beyond to sub-median, a dot at one-third with a bar opposite on median, and a crown half-way to inner margin, an angulated figure at half costa, with a dot close beyond, two sinuous recurved bars enclose a bronze patch half across wing at three-quarter, a sub-marginal row of dots, suffused in apical half, hind-marginal row of dots, a blotch with bars and stripes beyond crown to anal angle, a spot near quarter hind-margin. Cilia white and grey annulated. Hindwings smoky bronze, with a grey line at two-third parallel to hind margin and bounding diffused hind-marginal grey band. Cilia as forewing. One specimen. Brisbane.

FAMILY CARADRINIDÆ.

AMYNA AUREA. SP. NOV.

♂ ♀ 18—22 ᵯᵯ. Head, antennæ, and thorax light amber buff. Palpi golden red. Abdomen paler amber buff. Forewings, costa straight, apical portion rounded, apex acute, hind margin obliquely rounded, golden red or golden amber, more golden on costa, a faint oblique line shading posteriorly from three-quarter costa toward but not reaching two-third inner margin. Cilia amber fuscous. Hindwings amber, inclining to ochreous toward base. Cilia as forewing. Under surface of all wings with an oblique fuscous bar at three-fourth costa to two-third across wing, shaded anteriorly with amber fuscous. Mr. Tryon took this species at Broadwater, near Brisbane, 1892.

FAMILY NYCTEOLIDÆ.

EARIAS SUBVIRIDIS. SP. NOV.

♂ ᵯᵯ 22. Head greenish ochreous. Palpi ochreous fuscous, terminal joint short. Antennæ fuscous. Thorax ochreous green. Abdomen light green. Forewings, costa gently rounded, hind margin nearly straight, light bright green, with scattered darker green scales with a tendency to indistinct lines, an oblique dark green line with an ochreous border shade from four-fifth costa to two-third inner margin, and a slightly sinuous line of the same colour and shading from half costa to before half inner margin, curved along inner margin to join first line, and thus forming a letter V in the wing ; a hind-marginal faint ochreous line. Cilia green. Hindwings light greenish ochreous, hind-marginal line darker. Cilia light green. Brisbane.

EARIAS PARALELLA. SP. NOV.

♀ ㎜ 20. Head, thorax, and abdomen echreous, tinted with green. Palpi and antennæ light fuscous. Forewings, costa gently rounded, hind margin nearly straight, ochreous tinted with green and crossed by green bands ; first green band before half costa to two-fifth inner margin, second band three-fourth costa to three-fifth inner margin, third band four-fifth inner margin fading toward costa before apex, fourth band hind-marginal. Cilia ochreous green. Hindwings light buff, with veins darker, and a hind-marginal fuscous suffusion gradually shading to ground colour. Cillia buff. Brisbane.

EARIAS CHROMATARIA. WALKER.

One specimen at light. Brisbane.

FAMILY DYSGONIIDÆ.

THYAS NOVENARIA. NOV. SP.

♀ 78 ㎜. Head, palpi, and thorax violet fuscus. Antennæ violet ochreous. Abdomen orange-red. Forewings costa nearly straight, apex pointed, hind margin obliquely rounded, violet fuscous with darker scales, with darker mouse colour fuscous diffused over two-fifth of width of wing from five-eight to fifteen-sixteen costa ; a short blackish red costa bar near base, an oblique marone bar suffused in ferrous one-fifth costa to one-third inner margin ; a discal figure in shape of a nine composed of nine rich black spots on median at half ; a deep velvety marone band shaded with fuscous from two-third costa to two-third inner margin ; a shading from costal suffusion, curved concavely to just before anal hind margin with an indistinct black spot one-fourth from costa, hind-marginal row of black points. Cilia fuscous. Hindwings orange-red suffused with fuscous, with an irregular smoky black suffused band over basal half wing except on inner margin, and a broad black sub-marginal band, nearly touching basal band at apex, narrowing to nearly one-third near anal angle. Cilia reddish ochreous. Cooktown. Mr. Relton.

Closely allied to T. Coronata, Fab., but abdomen lacks black at base of segments, the transverse bars are very much closer, the discal figure is composed of nine distinct spots, and the smoky black of hind wings extends over basal half instead of a narrow bar.

THYAS CORONATA, FAB.

Townsville and Brisbane.

FAMILY ANTHOPHILIDÆ.

THALPOCHARES VEHEMENS. SP. NOV.

♀ mm. 18. Head and palpi rich chocolate fuscous. Antennæ basal half fuscous, thence passing into ochreous fuscous. Thorax ochreous, neck and collar rich chocolate fuscous. Abdomen, base, and sides ochreous, posterior dorsal two-third chocolate fuscous. Forewings costa slightly wavy, hind margin obliquely outwards to vein four, thence rounded inwards, ground coloured costal portion ochreous as far as a line from quarter inner margin to apex of costa, thence rich chocolate fuscous; costa narrowly bordered at base with chocolate fuscous, which then diffuses with scattered dots along whole border; a transverse row of these dots at half, and a subtending blotch on costa at seven-eight; darker wave lines cross the deeper fuscous shading; a deep coloured hind margin line. Cilia chocolate fuscous barred with darker fuscous. Hindwings with only the basal fourth ochreous, the outer three-quarter of wing rich chocolate fuscous shaded with deeper fuscous. Cilia as forewings. The rich fuscous of the hinder two-third of both wings with the contrasting ochreous anterior one-third readily distinguishes this moth. Brisbane. Rare.

FAMILY EROSIADÆ.

EROSIA EXCELLENS. SP. NOV.

♂♀ 20—22 mm. Head light grey. Palpi fuscous, terminal joint grey, tipped with fuscous. Antennæ ochreous grey. Thorax light grey. Abdomen light grey, freely banded with lines of fuscous dots. Forewings, costa gently rounded, apex prolonged, hind margin extended at vein 4, light grey freely dusted with fine fuscous dots, costa bordered with fine fuscous dots, three transverse rounded lines of fuscous drab—first from two-fifth costa to one-third inner margin, suffused in angular projections at one-third, two-third, and before inner border; second line from three-fifth costa to two-third inner margin, with angular suffusions near costa and before inner margin, a loop line connects these suffusions posteriorly; third line from before apex costa to before anal angle, inner margin suffused toward hind margin and before inner margin; in some specimens, a dark purple suffusion extends from a patch on one-half inner margin to apical half of costa and great part of hind border; cilia chocolate, interspersed with grey. Hindwings as forewings, first line from median to half inner margin, second from three-fifth costa to three-fourth inner margin, third from before apex costa to before anal angle inner margin, more or less lost in suffusion; hind-marginal row of black dots; cilia as forewings. Allied to E. diversa, Lucas. Geraldton, Northern Queensland.

EROSIA RADIATA. SP. NOV.

♂ ♀ mm 20—22. Head and antennæ fuscous. Palpi fuscous. Thorax fuscous, marked on dorsum with darker fuscous. Abdomen light fuscous. Forewings, costa gently rounded, hind margin obliquely rounded, fuscous drab, with smoky scales and darker longitudinal bands along the folds; a similar narrow band along costa, narrowing to three-fourth costa, and another along basal half of inner margin, a black spot opposite costa at two-third, and a fainter one immediately beyond. Cilia fuscous. Hindwings as forewings. Hind margin extended to a point at vein 4, costal half scooped out. When spread out, the lighter and darker colours in all the wings alternate and radiate as the spokes of a wheel. Brisbane.

EROSIA QUADRATA. SP. NOV.

♂ ♀ mm 18—21. Head and antennæ creamy grey, Palpi fuscous. Thorax fuscous, speckled with grey. Abdomen fuscous, grey. Forewings, costa nearly straight, hind margin rounded, drab, freely covered with fuscous, lighter along folds, markings darker, indistinct; a brown discal spot at two-third, a suffused blotch beyond, before hind margin, an indistinct line of dots from two-third costa obliquely to suffusion before anal angle of hind margin, a hind-marginal row of arched minute velvety fuscous dots, shading toward anal angle—hind-marginal line dark. Cilia fuscous. Hind wings almost square, drab, covered with fuscous scales, and marked with darker lines and shadings ; two black lines form half-squares broadly parallel with hind margin, and with diffused shade in posterior angle, these fill the basal half of wing ; a dark wavy suffusion is spread out beyond the square at half distance to hind margin, becoming lighter towards anal angle ; a sub-marginal line of broken black curves. Cilia fuscous. Brisbane.

EROSIA THECLATA GN.

Brisbane.

EROSIA STOLIDA BUTL.

Brisbane.

EROSIA (?) REGALIS. SP. NOV.

♂ ♀ mm. 41. Head, palpi, antennæ stone drab. Thorax stone drab with narrow lighter band on collar and lighter scales posteriorly on dorsum. Abdomen grey with blackish scales posteriorly and laterally. Forewings costa straight, apex rounded, hind margin apical third dentate, sinuous, thence obliquely rounded, inner margin bowed inwards, stone drab with numerous scattered black scales and shading of fuscous ; a dark fuscous transverse line parallel with hind margin from two-fifth costa to two-fifth inner margin, a second line from two-third costa to half inner margin, the space enclosed and lines on inner half are covered with rich ferrous fuscous shading along second line toward costa and enclosing a broad white bar shaded with ferrous on inner half of first line, and a similar bar bordering middle third of second line ; a rich ferrous blotch at five-sixth costa ; a shading fuscous line bordered by slaty grey, but neither colour definite from seven-eight inner margin and shading from median fold with second line before costa. Cilia ferrous fuscous. Hind-wings costa scolloped, apex acute, hind margin scooped one-third thence gently rounded, as forewings, with first transverse ferrous fuscous line two-fifth costa to two-fifth inner margin, with a white dot in a black ring in disc, second line two-third costa to two-third inner margin, not well defined, but with a short white bar or chain of dots in centre, shaded on either side and along middle third of wing toward base with chocolate fuscous. Cilia as forewings. Brisbane. Rare. This large and handsome species may have to be included in a new genus, but it folds its wings and rests as the smaller Erosia species.

BRITHA LENIS. SP. NOV.

♂ ♀ mm. 16-17. Head greyish drab. Palpi fuscous, terminal joint clubbed. Antennæ drab, ♂ pectinations 4, attenuated to apex, ♀ simple. Thorax creamy grey with drab scales. Abdomen creamy grey, base of segments reddish fuscous. Forewings costa slightly rounded, hind margin gently rounded, creamy grey with scattered drab scales and brownish fuscous bands or shadings; costal edge speckled with drab, a brown fuscous line one-third costa to one-third inner margin, a second line from half costa, at first obliquely backwards to opposite three-fifth costa, then sinuous and roughly parallel with first line to three-fifth inner margin, there is a small discal spot in this space opposite the bend, a second just beyond, and a median shading of drab or brownish fuscous, there is a third conspicuous inward curved dark fascous line from before apex of costa to seven-eight inner margin, this deep colour is diffused in gradually lighter lines of shade along space toward second line ; a sub-terminal drab line, and drab scales freely scattered over enclosed space. Cilia drab, basal half lighter grey. Hindwings as forewings creamy grey freely irrorated with drab scales, and crossed by three lines, outer line the most conspicious is concurrent with forewing line. Cilia as forewings. Allied to B. pactalis. Brisbane. Rare.

MADOPA LEUCOCROSSA MSS. MEYR.

♂ ♀ 20—22 mm Head, palpi, and antennæ light cinereous fuscous. Thorax reddish fuscous, collar light cinereous. Abdomen fuscous, with a lighter fringe on each segment. Forewings, costa straight, hind margin obliquely rounded past vein 4, alternate very fine reddish ferruginous and light cinereous transverse lines ; costa broadly ochreous, with ferruginous dots before apex ; three transverse ochreous lines—first, one-third costa rounded to one-fourth inner margin ; second, almost straight two-third costa to two-third inner margin, with a ferruginous discal dot in interim near costa ; third line, seven-eighth costa wavy and dentate to anal angle inner margin, sub-marginal row of black dots, hind marginal alternate ochreous ferruginous and reddish fuscous lines. Cilia reddish fuscous. Hindwings exactly as forewings, three lines of similar character extending in line with those of forewings; (veins beyond third line like colour dividing wings into helmeted cells). Cilia as forewings.

Brisbane to Northern Queensland.

MADOPE CONSTELLANS. SP. NOV.

♂ ♀ mm 18-21. Head, palpi, and antennæ fuscous. Thorax ochreous, collar fuscous. Abdomen ochreous. Forewings costa straight, hind margin gently rounded, ochreous with scattered dots and markings blackish fuscous; a blotch at base of costa, a semi-circle of three dots at one-third, two dots beyond half obliquely outwards, a twice sinuous fascia band from two-third costa to three-fifth inner margin, inner third nearly straight, two or three dots close to costa from three-quarter to apex, a hind marginal line of dots and several minute indistinct dots scattered over wing. Cilia ochreous. Hindwings ochreous, indistinct line of hind-marginal dots. Cilia ochreous. Brisbane. During a hot N.W. wind.

MADOPE AUFERENS. SP. NOV.

♀ mm. 22. Head, palpi, antennæ ochreous fuscous. Thorax and abdomen ochreous with scattered fuscous scales. Forewings costa straight, hind margin gently rounded, ochreous with fuscous scales tending to form transverse lines; a row of eight or nine dark fuscous dots evenly distributed along median vein, a transverse broad fuscous fascia from four-fifth costa to three-fourth hind margin, outer half of wing crossed at intervals by four lines of dots or veins, a fine subterminal line immediately beyond last row. Cilia ochreous. Hindwings ochreous with a few fuscous scales, hind two-fifth crossed by three diffused fuecous bands and dots. Cilia ochreous. One specimen. Brisbane.

MADOPE VULPINA. SP. NOV.

♀ mm. 16. Head, palpi, and thorax ochreous grey. Antennæ ochreous fuscous. Abdomen creamy ochreous. Forewings, costa straight, hind margin wavy, reddish ochreous, with scattered fuscous scales and fascia and lines of ferrous fuscous, a median fascia from half inner margin to four-fifth costa composed of two lines and diffused shading, two minute black discal dots opposite half costa, a transverse scolloped sinuous line at quarter, a sub-terminal chain of dots, and immediately beyond a similar hind-marginal line, with a suffusion of ferrous ochreous in inclosed space. Cilia ferrous fuscous. Hindwings ochreous, with a light median transverse and hind-marginal line and suffused border of ferrous fuscous. Cilia ochreous red.

Brisbane.

FAMILY GALLERIADÆ.

APHONIA ERUMPENS. SP. NOV.

♀ 24 mm. Head creamy ochreous, face fuscous ochreous. Antennæ and thorax creamy silky ochreous. Abdomen fuscous ochreous. Forewings elongate, costa nearly straight, apex squared with straight hind margin, anal angle squared, creamy ochreous, freely irrorated with light chocolate ochreous darker on either border, a dark chocolate sinuous line one-third costa to near centre of wing, thence re-curved to one-third inner margin, a second similar line two-third costa for a third straight, thence obliquely to four-fifth inner margin, darker chocolate diffusion on hind and inner margins. Cilia chocolate ochreous. Hindwings reddish ochreous, hind-marginal chocolate fuscous line. Cilia as forewings.

Brisbane, rare.

GROUP PYRALIDINÆ.—FAMILY CRAMBIDÆ.

DIPTYCHOPHORA TORVA. SP. NOV.

♀ 9 mm. Head, palpi, antennæ, and thorax fuscous. Abdomen grey fuscous. Forewings triangular, costa straight, hind margin obliquely straight, ochreous grey, freely dusted with fuscous and chocolate marks and lines; a chocolate band from base along costa to beyond one-half; a conspicuous square, with three anterior angles wanting, formed by dark chocolate lines bounded by ochreous or fuscous and containing a bright ochreous spot in centre, and small diffusions of same on anterior and costal angles (resembling a sparkling eye); an indistinct ochreous dot at half inner margin, and another at apex of costa, preceded by a short chocolate costal line; two other chocolate lines, parallel to but not touching sides of square portion off apical and anal triangles; a fine chocolate hind-marginal line; cilia fuscous. Hindwings fuscous grey, with hind-marginal dot or line of darker fuscous; cilia as forewings. One specimen, Brisbane. Readily recognized by large eye patterns on forewing.

DIPTICOPHORA (?) KUPHITINCTA. SP. NOV.

♀ 28 ㎜. Head, palpi and antennæ fuscous. Thorax fuscous with a violet tint. Abdomen violet grey irrorated with fuscous. Forewings, costa gently rounded, hind margin bowed round vein four, violet grey, with transverse bands and lines of violet fuscous and fuscous drab; a suffused band from base to quarter, a second band at one-third, anterior border denticulate, posterior deeply angled at one and two thirds, with a darker discal blotch near costa, a broad suffused sinuous dentate band immediately beyond, a short like band beyond three-quarter costa uniting with another from apex at two-third from costa to seven-eight inner margin, a lighter suffused and broken submarginal band tinted with violet, a dark hind-marginal line. Cilia fuscous. Hindwings violet grey, with six or seven fine violet fuscous transverse lines in basal half, a broad darker fuscous band immediately beyond separated from a like colour border by a narrow line and a broad patch of ground colour before half hind margin. Cilia as forewings.

Brisbane.

FAMILY EPIPASCHIADÆ.

CATAMOLA INUNCTA. SP. NOV.

♂ ♀ ㎜ 24—32. Head and antennæ rich black. Palpi black, terminal joint ferrous black at tip. Thorax rich velvety black, with iridescent violet flush. Abdomen fuscous grey. Forewings elongated, costa gently rounded, hind margin rounded, rich velvety black, with numerous blue-grey scales, a light violet iridescence in certain lights; a faint white dot in costa at one-fourth subtends a zig-zag sinuous line to one-fourth inner margin, with difficulty traced; a second more conspicuous semi-circular dentated line, but also largely shaded with black scales from a spot at three-fifth costa to three-fourth hind margin, hind-marginal line pale grey; cilia black, with bands of black grey. Hind wings light grey, with a transverse band of darker grey at three-fifth, and a hind-marginal darker grey suffusion bordered by a definite grey line ; cilia smoky grey and black alternate bands.

May Orchard, Brisbane.

FAMILY SICULODIDÆ.

STRIGLINA PYRRHATA. WALK.

Brisbane and Melbourne.

STRIGLINA CENTIGINOSA. SP. NOV.

♂ ♀ ♏♏. 20-24. Head, antennæ, thorax, and abdomen varying from fuscous ochreous to fuscous red. Forewings costa straight, apex acute, hind margin obliquely waved to vein four, thence hollowed obliquely and abruptly to hind margin, fuscous ochreous to fuscous red, and crossed transversely with faint darker lines, in some specimens studded with fine conspicuous black dots over whole wing, but in the majority simply forming a dark smoky median band or fascia. Cilia as wing. Hindwings as forewings. Cilia as forewings.

Meyrick at first believed this to be S. pyrrhata. It is a smaller insect, the sexes are more nearly of a size, there is never the redness, and the habits are quite distinct. The two species sometimes occur on the same hill, oftener they are apart.

Brisbane, in scrubs.

STRIGLINA STRAMENTARIA. SP. NOV.

♂ ♀ ♏♏. 22-28. Head light ochreous to deep fulvous ochreous. Antennæ fuscous ochreous. Thorax and abdomen light to deep fulvous ochreous. Forewings costa first bowed thence gently sinuous, hind margin strongly rounded ; light to deep fulvous ochreous, the veins are marked lightly ferrous and form a fine network all over wing through being crossed with light ferrous transverse bowed wavy irregular lines ; a very dark ferrous line from two-third costa to three-fifth inner margin ; cilia, hindwings and cilia as forewings, ochreous

Three specimens. Brisbane and Caboolture, Queensland.

FAMILY HYDROCAMPIDÆ.

MARGAROSTICHA DISTRIBUTA. SP. NOV.

♀ ♏♏ 23. Head, palpi, antennæ, thorax, and abdomen creamy grey. Forewings elongate, costa gently rounded, hind margin rounded, creamy grey, with scattered grey scales and ferrous markings ; a long ferrous line close to costal margin from base to half costa, a slightly arched bar from base to just before anal angle of inner margin, a second nearer inner margin approaching base, and a narrow one from base along inner margin and enclosing the second ; an oblique ribbon band with borders deeper coloured, from costal band at half to opposite anal angle ; a line from inner border encloses an oval whitish patch in disc ; an obovate elongate band close to the hind margin, with darker build outline ; a hind-marginal ferrous line, bordered by a yellowish band ; cilia fuscous, with browner base. Hindwings white, with a transverse ferrous band, darker borders at two-third not touching costa or hind margin, angled broadly in centre ; a hind-marginal band of same colour, with a dentated brown shading along centre, and containing opposite this four black spots with a purple blue centre ; cilia grey white. One specimen, Brisbane. Allied to M. Sphenotis, Meyr.

MARGAROSTICHA SPHENOTIS. MEYR.

Brisbane.

FAMILY BOTYDIDÆ.

ANTHÆRETIS LIMATA. SP. NOV.

♂ mm. 27. Head antennæ ferrous fuscous. Palpi ferrous fuscous, terminal joint tipped with black. Thorax ferrous fuscous anteriorly and laterally with black hairs. Abdomen ferrous fuscous interspersed with black scales, caudal joint ferrous. Forewings costa first straight, thence gently rounded, hind margin rounded, ferrous fuscous with a rich covering of scales and markings of deep black fuscous. An S shaped ferrous mark extends over outer half of wing inverted in left wing, a large ferrous blotch at base, a ferrous dot at one-thind one-fourth depth from costa, a second similar dot immediately beyond, and a like colour blotch opposite these two and shading to inner border, a row of like colour dots on veins at base of cilia ; cilia deep black with ferrous fuscous dots at base. Hindwings as forewings, base of wing shaded with ferrous fuscous, an interrupted chain of ferrous fuscous two-fifth costa rounding to four-fifth inner margin, a second parallel line of like colour spots, the costal one the larger, two-third costa toward junction inner and hind margins; cilia black with ferrous fuscous shadings at base. The larger size and richer markings appear to distinguish this species from A. Eridora, Meyr.

Brisbane.

NOTARCHA OBLIQUALIS. SP. NOV.

♂ ♀ mm. 25-28. Head creamy grey. Palpi creamy grey *with base of second and base of terminal joint and a connecting line between fuscous.* Antennæ grey annulated with fuscous. Thorax creamy yellow, with a narrow collar two dots immediately behind and three semi-circular rows posteriorly fuscous. Abdomen creamy white, with base line of segments fuscous and fringed with ochreous brown hairs, a fuscous band across centre of second last segment and a fuscous shading laterally on apical segment. Forewings costa straight, apex rounded, hind margin gently rounded, creamy yellow with markings and veins fuscous; three dots at base of wing to one-eight inner margin, a prominent dot on costa opposite the centre of the first three, from which an arched line bends round from costa, arches along middle of wing and is shortly and sharply bent back on itself to outer dot on inner margin. A dot at one-fifth costa subtends an oblique line to one-third inner margin, a small discal ring at one-third costa, and another obliquely behind; a discoidal ring at half costa concave posteriorly; a line runs behind this between veins two and three bends at a right angle to vein one, and then forming an arrow runs along inner border to first transverse line; a strong dot at two-third costa subtends a line to vein five, thence one-third distance to inner margin it turns on itself and runs in a series of loops parallel with hind margin to vein two; an outer line or broken dots from five-sixth costa to five-sixths inner margin, the inner two-third shades in diffused fuscous to hind margin, a broad band from one-third inner margin becomes conspicuous, terminal band on hind margin; cilia ochreous shaded with fuscous. Hindwings as forewings, a rich *fuscous band from two-third costa obliquely to one-third inner margin*, three arched Denticulate lines beyond, first diverges widely from the transverse oblique band at half to anal angle, second only extends along middle third of wing and sends a line to join first where it diverges, third line forms a series of loops against the conspicuous terminal line ; cilia as forewings. Meyrick considered this the N. multilinea, but the marks on the palpi, the colouationr of the veins, the oblique band across hind wings, and the wide divergence of the first of the three lines of the hind wing to anal angle distinguish the species. The general appearance of the two insects, habits, habitat, &c., are distinct.

Scrub, Brisbane.

FAMILY SCOPARIADÆ.

SCOPARIA DELINIENS. SP. NOV.

♂ ♀ 19—20 ՊՊ. Head, palpi, thorax, and abdomen light fuscous. Antennæ smoky fuscous. Forewings, costa straight, hind margin gently rounded, light fuscous, with a few indistinct black dots near base and costa, a navicular figure, ochreous as if washed out or rubbed, from base to half inner margin and reaching half across wing to a point opposite one-eighth costa, a reversed line of same colour from four-fifth costa to just before anal angle of inner margin, an indistinct smoky discoidal dot and one or two dots near apex of costa, a hind-marginal row of small black dots. Cilia light fuscous. Hindwings ochreous fuscous diffused with light fuscous, a light ochreous sinuous line from four-fifth costa, margined with a light fuscous line half across wing and then almost imperceptible to three-fourth hind margin : cilia ochreous, tinted with light fuscous. The navicular figure only partly ochreous, with irregular patches of ground colour, as if washed out or rubbed, readily distinguishes this species.

Two specimens, Brisbane.

SCOPARIA ARCTA. NOV. SP.

♂ 16 ՊՊ. Head, palpi, and antennæ dark fuscous. Thorax dark fuscous, with ochreous at base of wings. Abdomen ochreous fuscous, with ochreous and fuscous lines across each segment, and chocolate fuscous short dorsal bars, caudal segment tipped with ochreous. Forewings triangular, costa straight, hind margin gently rounded, light ochreous freely speckled and spotted with fuscous scales and chocolate spots and markings ; series of dots, more or less definite, at base, bearing to costa ; median, submedian, and inner marginal in ill-defined lines : two lines of dots diffused into a band from beyond half costa to before anal angle of inner margin; a fine denticulate line three-fourth costa meeting a broad band of diffused chocolate and spots from apex of costa, running along hind margin and broadly suffused at anal angle with median band; a hind-marginal row of dots; cilia ochreous, barred and banded with chocolate. Hindwings ochreous, freely speckled with fuscous, with a diffused darker broad chocolate hind-marginal band; cilia as forewings. One specimen, Brisbane.

GROUP TORTRICINA.

MELISSO BLAPTESPARASITICUS. SP. NOV.

♂♀ ᵯᵯ 35—37. Head light ochreous fuscous. Antennæ fuscous, with white annulations, lighter towards base. Palpi ferrous fuscous, sub-ascending. Thorax light purple fuscous, irrorated with ochreous and black scales. Abdomen ferrous fuscous. Forewings elongate, moderately broad, costa rounded; hind margin obliquely rounded, ferrous fuscous, freely irrorated with black scales, a ligh ochreous dash or dot close to median at one-fifth, a rhomboid discal blotch of same colour before half, two minute dots of same immediately beyond, and two or three in some specimens beyond and toward apex; cilia fuscous, with smoky band at base crossed by nine minute ochreous dots, and bounded by a fine ochreous line. Hindwings ochreous at base and shading into smoky fuscous toward margins; cilia ferrous fuscous. Feeds on the larvæ of Cryptophaga.

Allied to M. bipunctatus, Z., concerning which Meyrick says little of their habits is known. This appears to be a true parasite, feeding within the larva, but whether it feeds on the digesting food in the stomach of the caterpillar, or whether it attacks the caterpillar later on, as in the pupa state, I cannot be certain, but am inclined to believe the latter. It kills its host, and is thus unlike the honey and wax feeders. Meyrick classifies this with the Pyralidina Family Galleriadæ.

Brisbane.

GROUP TINEINA.—FAMILY XYLORICTIDÆ.

XYLORICTA AUSTERA. SP. NOV.

♂ ᵯᵯ 26. Head and thorax creamy white. Antennæ, stalk creamy white, pectinations fuscous. Palpi, creamy fuscous.

Abdomen creamy white, third segment ferrous fuscous on dorsum. Forewings elongate, costa gently rounded; hind margin oblique, almost straight, creamy white, with light fuscous lines and markings; fuscous line on costa, attenuated at base; a medium fuscous line from base of wing near costa to anal angle of hind margin, suffused toward inner margin; a broader band branches from this median line at one-sixth to one-third hind margin, and a second branch at one-half extends to apex, attenuated at origin, but diffused toward costa; fuscous lines on veins in hinder half of wings; an ochreous fuscous suffusion along inner margin. Cilia creamy white, with a fuscous basal line and a median fuscous band. Hindwings creamy straw colour. Cilia white, with a straw-colour band near base. One specimen at light, Brisbane.

NOTE ON A QUEENSLAND ABORIGINAL DRILL.

By WALTER E. ROTH.

Read before the Royal Society of Queensland, December 11, 1897.

In view of the fact that considerable doubt has been expressed among English anthropologists as to the employment of drilling among the Australian aboriginals, it may be of interest to draw attention to a form of drill which I met with on a recent visit to the Keppel Islands. It is composed of a piece of white quartz fixed with fibre wedged into the split extremity of a piece of grass-tree peduncle, about 24 inches long. The Big Keppel (*Wapabara*) Islanders speak of the quartz as *boo-ran*, the fibre as *ran*, and the portion of peduncle which gives the name to the whole implement, *ral-la*. The quartz is ground more or less on a hard stone to obtain the necessary pointed shape. When in use, the implement is held vertically down, and twirled backwards and forward between the flats of the two hands, just like the common variety of fire-stick. It is employed for piercing shell, etc., in the making of fore-head circlets, and for piercing cocoa-nut or turtle-shell in the manufacture of fish-hooks.

I have already referred, in "Ethnological Studies among the North-West-Central Queensland Aborigines," p. 149, to the employment of "drilling" by means of an emu, or kangarco-bone, in the manufacture of "roarers," certain forms of wommera, and in the piercing of the *melo*, etc., shell ornaments.

TABLE SHOWING RAINFALL AT BULIMBA, NEAR BRISBANE, DURING 1897.

By Mrs. Charles Coxen, M.R.M.S.

[*Presented at the Annual Meeting of the Society, 31st Jan., 1898.*]

Month, 1897.	Total rainfall in each month.	Aggregate rainfall from 1st Jan. to end of each month.	Heaviest rainfall in 24 hours.	Number of days on which not less than ·01 of rain fell.	Total number of such days from 1st January up to the end of each month.
January ..	2 95	2·95	·71	11	11
February ..	1·78	4·73	·60	8	19
March	3·99	8·72	2·86	8	27
April	·06	8·78	·06	1	28
May	·10	8·88	·10	1	29
June	2·38	11·26	·55	11	40
July	4·07	15·33	2·45	9	49
August	1·19	16·52	·78	6	55
September ..	4·52	21·04	1·80*	11	66
October	4·48	25·52	·96	11	77
November ..	4·01	29·53	1·40	7	84
December ..	11·59	41·12	3·75	14	98

* In less than an hour.

LIST OF BUTTERFLIES OF THE BRISBANE DISTRICT.

By ROWLAND ILLIDGE.

Read before the Royal Society of Queensland, January 31, 1898.

The following List of the Butterflies of the Brisbane District has been compiled mostly from species in my own cabinet and which I know to have been taken here, or from other well-authenticated sources.

The classification of these insects is not perhaps that of most entomologists outside Australia, but as it is that adopted by W. H. Miskin in his excellent "Synonymical Catalogue of the Lepidoptera Rhopalocera of Australia," published in "Annals of the Queensland Museum, No. 1," and as this catalogue is now extensively used by Australian collectors, it would be only confusing to make use of any other arrangement.

Probably other species may yet be added as we become able to travel into the more remote parts of this portion of the colony, and possibly new species also. The higher parts of the adjacent ranges to the west, like the Little Liverpool, are well worth the attention of collectors, likewise the Blackall Range to the north.

A LIST OF THE RHOPALOCERA OF THE BRISBANE DISTRICT, WITH REMARKS ON LOCALITIES, FOOD PLANTS WHERE KNOWN, Etc.

FAM. PAPILIONIDÆ. SUB-FAM. PAPILIONINÆ.

Ornithoptera Richmondia, Gray.—Scarce in the immediate vicinity of Brisbane, but fairly abundant at Coomera, Nerang Creek, and Blackall Range. Food plant said to be Aristolochia pervenosa. W. H. Miskin gives range of this insect as from Richmond River to Maroochy. I have taken it at Gympie, and had specimens sent from Maryborough.

Papilio Anactus, Macl.—Fairly common; larva feeds on the orange and other citrus plants; original food plant, the wild lime.

Papilio Erectheus, Don.—Very common; food plants as in preceding.

Papilio Capaneus, Westw.—Now very rare about the town; have not seen specimens for several years. Formerly not uncommon at Kelvin Grove. May be taken on the islands in the Bay.

Papilio Leosthenes, Doubl.—Not uncommon in the scrubs about November. Have taken it in my garden at Bulimba, on Duranta. Sankey's Scrub is a good locality. Difficult to obtain in perfect condition.

Papilio Lycaon, Westw.—A common species; larva abundant on the custard apple, though its original food plant is certainly not this tree, but probably Diploglottis Cunninghami (on which I once took several larvæ) and other scrub trees.

Papilio Macleayanus, Leach.—Not uncommon about the scrubs, and occasionally in gardens. Larva now frequently found on the camphor laurel.

Papilio Sarpedon, Linn.—A most common butterfly everywhere; larva on the camphor laurel and other trees. Reared specimens do not attain the brilliant colours of those captured on the wing.

Papilio Sthenelus, Macl.—Common, but somewhat local; it is a species which prefers the open grassy spaces, never flying far from the ground.

Eurycus Cressida, Fabr.—Fairly abundant in many places such as Taylor's Range, especially on the summit; may, however, be taken almost everywhere.

SUB-FAM. PIERINÆ.

Elodina angulipennis, Luc.—Usually very common; occasionally so abundant as to make the scrubs seem alive with their satiny white forms. The Eagle Farm scrubs were formerly favourite haunts of this butterfly. Larva on Capparis.

Elodina Parthia, Hew.—Almost as common, in fact sometimes greatly in the majority, this insect is found in the same localities and along with the preceding.

Terias Drona, Horsf.—Fairly plentiful in the open forest and about the borders of scrubs.

Terias Herla, Macl.—A rather scarce species, also affecting the same localities as T. Drona.

Terias Smilax, Don.—The smallest and neatest of the genus here ; the males in perfect condition distinguished by the almost iridescent sheen of the upper surface. T. varius, Misk., and T. casta, T. P. Lucas, are only varieties of this species.

Terias Hecabe, Linn.—A species almost cosmopolitan in distribution. Have taken larvæ on a small dwarf species of Cassia ; the pupæ produced perfect insects greatly variegated on under side.

Pieris Teutonia, Fab.—This is the butterfly of which such vast flights are occasionally seen. The various species of Capparis constitute its food, no other plants being apparently attacked by it.

Pieris Scyllara, Macl.—Also a common butterfly, chiefly about the borders of scrubs. Donovan's name, Perimale, should take precedence here, and not be rejected because it was given to a varietal form, for a gradual transition can be traced from clear bright yellow into this dark variety in a series of specimens.

Tachyris Ega., Boisd.—During some seasons this insect is abundant enough, and at others but few will be seen. It has a quick flight, but comes to the flowers of Duranta, Lantana, etc., and is then readily taken.

Delias Argenthona, Fab.—The caterpillar of this species feeds on Loranthus, and I once reared a large number upon a species of this plant parasitic on an apple tree in an old garden.

Delias Aganippe, Don.—This must be regarded as the rarest of the genus around Brisbane, and is very seldom seen, much less captured. I took a very fine one in September, 1895, hovering over the blossoms of a wild goose plum in the garden. Probably the scarcity is occasioned by its food plant (said to be Exocarpus) being rare, for in the southern colonies and many parts of Queensland it is common enough.

Delias Nigrina, Fab.—The commonest of the genus, caterpillar also found on various species of Loranthus. Almost equally at home in the scrubs as in the forest.

Delias Nysa, Fab.—This pretty species was rather plentiful last season, and towards the coast is quite common.

Callidryas Crocale, Cram.—The larvæ of these rapid-flying insects are at times abundant on Cassia fistula, and wherever this plant is growing the species is sure to be plentiful. This Cassia is not its only food plant, however, for there is a tree growing on or near the margins of scrubs which it also affects.

Callidryas Pomona, Fabr.—Another beautiful species affecting same plant and equally common. Though the larva is almost identical with that of the preceding, I am convinced it is a distinct species, for the caterpillars of these insects are all very much alike.

Callidryas Gorgophone, Boisd.—This is the most beautiful of our species and is somewhat rarer than the preceding. The caterpillar is to be found on Cassia, especially Cassia glauca.

Callidryas Pyranthe, Linn.—An abundant species, and likewise found on Cassia.

Callidryas Lactea, Butl.—Not uncommon in our gardens and on the borders of scrubs.

Callidryas Hinda, Butl.—A very rare species about Brisbane, as I have only taken two in five years. Formerly much more common ; it is probably the destruction of its food plant which now renders it so scarce.

FAM. NYMPHALIDÆ. SUB-FAM. DANAINÆ.

Danais Affinis, Fabr.—Fairly common, especially towards the coast and on the islands.

Danais Hamata, Macl.—For some years this species has been an uncommon insect about Brisbane, but in past years it has appeared in countless numbers, and no doubt will again. On the islands it is usually common enough.

Danais Petilia, Stoll.—This insect appears to be far more common in our vicinity than formerly ; the larva affects Asclepias.

Danais Erippus, Cram.—This is so well known that little more need be said about it than that it appears to be smaller in size and much less common than during the first few years of its initial existence here.

Euplœa Corinna, Macl.—A most common insect everywhere, especially where the Oleander, various species of Ficus, and such like plants grow; it will also attack Stephanotis and occasionally Rhynchospermum.

Euplœa Tulliolus, Fabr.—Though a very rare species, I have captured it here several times, notably at Sankey's Scrub, Wolston Scrub, and once at the Gap.

SUB-FAM. SATYRINÆ.

Melanitis Leda, Linn—Found commonly on the borders of scrubs, creeks, and swamps; it is an evening flier, and seldom appear on the wing until after sunset. Have taken it up to as late as 10 p.m. on ripe fruits. Larva on a kind of swamp grass.

Xenica Achanta, Don.—This pretty species is sometimes very abundant in the gullies amongst the hills, and also on creek sides. October and November are the usual months, and a second brood in March and April.

Epinephile Joanna, Butl.—Southport is the locality where I have taken this insect, but out of nine captured only one was perfect, so that December (Christmas) is too late for it.

Epinephile Rawnsleyi, Misk.—This species may be taken from Maroochy northward to Cooran; between the latter place and Eumundi they are, I am credibly informed, by no means rare.

Heteronympha Merope, Fabr.—Occasionally a most abundant species; the males greatly preponderating, and appearing two or three weeks before the females.

Heteronympha Mirifica, Butl.—Must be sought in the dense scrubs, for it is a shade loving insect. In the scrub-shaded mountain gullies it is by no means uncommon. The H. Digglesi Misk., is only the male of this species.

Heteronympha Banksii, Leach.—Has been found in the Macpherson Ranges.

Hypocysta Adiante, Hubn.—Found most commonly in the Casuarina forest.

Hypocysta Metirius, Butl.—A frequenter of the open glades and borders of the scrubs; is very partial to the flowers of the wild Raspberry.

Hypocysta Antirius, Butl.—This species is found in the gullies and damper wooded parts of the forests, and is sufficiently distinct from the foregoing.

Hypocysta Epirius, Butl.—Appears only to differ from Antirius in the number of ocelli on the hindwings, otherwise in form and colour it is the exact counterpart of that insect.

Hypocysta Irius, Fabr.—Is at once distinguishable from all the above by its greater size, and from the tawny bands also appearing in the fore-wings. Its haunts are the gullies amongst the hills, but occasionally it may be taken on the borders of scrubs and banks of creeks.

Ypthima Arctous, Fabr.—Especially common in the Casuarina forests and on the banks of shady forest creeks, also borders of scrubs.

SUB-FAM.: ACRAEINÆ.

Acraea Andromacha, Fabr.—Abundant almost everywhere especially where the food plants—Passifloræ—grow.

SUB-FAM.: NYMPHALINÆ.

Messaras Prosope, Fabr.—Formerly not uncommon, it must now be classed amongst our rarities. Have taken it several times in my garden at Bulimba, on each occasion settling on Flacourtia cataphracta.

Argynnis Inconstans, Butl. An insect of extreme rarity about Brisbane, and I only know of one or two specimens having been taken.

Pyrameis Itea, Fabr.—Wherever the common stinging nettle (its food plant) abounds, there at seasons favourable to its appearance, will we find this butterfly. One year, perhaps, in great abundance; then for several years somewhat rare, scarcely one being obtainable.

Pyrameis Kershawi, McCoy,—The remarks as to appearance of Itea are equally applicable to this insect. Its larva may be found on Galinsoga parviflora and other common garden weeds.

Junonia Albicincta, Butl.—Another of our rare insects, I know of but few taken here. Have seen it at Kelvin Grove, but did not succeed in effecting its capture, for it is an exceedingly active butterfly.

Junonia Vellida, Fabr.—Usually abundant throughout the season; found sometimes throughout the year, larva feeds on Verbena bonariensis.

Precis Zelima, Fabr.—Must also be regarded as a rarity.

Doleschallia Australis, Feld.—The larva of this fine insect is found on a small scrub vine; it is a handsome caterpillar and not uncommon in favourable seasons.

Diadema Misippus, Linn.—Have several times noticed the female of this species, and know of captures, but have not seen the male, though I may have passed it for *D. Bolina.*

Diadema Bolina, Linn.—This grand butterfly is one of our commonest insects; the food plant is Sida.

Diadema Alimena, Linn.—Have seen specimens from Eumundi, and have one from Gympie.

Neptis Shepherdi, Moore.—Though usually a scrub insect, this species occasionally comes to our gardens.

Charaxes Sempronius, Fabr. — This fine butterfly is not uncommon, but is rarely perfect when captured. It is undoubtedly the strongest in its flight of all our rhopalocera, and sails along at a great rate. The easiest way to take them is by hanging out rotten fruit in some place they frequent. The larva feeds on many plants, and has a partiality for Sterculia, Cassia fistula, Poinciana, Acacia, etc. It is not easy to rear in captivity, and attaches itself to its food plant by a strong web, the shining white threads of which are readily seen from a considerable distance.

Mynes Geoffroyi, Guer.—Is another scarce species which may be taken at Sankey's Scrub and others to the south. Said to feed on Urtica.

FAM.: LYCAENIDAE.

Lucia Lucanus, Fab.—Most open grassy places will yield this species in fair abundance.

Chrysophanus Ænea, Misk.—The Ithaca Creek gullies, now mostly cleared, were formerly haunts of this insect. The last locality at which captures were effected was Sankey's Scrub, but it is very rare now, whereas twenty years back at the former place one might take a dozen or more specimens in an hour.

Danis Taygetus, Feld.—This is at times a common butterfly both in the scrubs, forest, and gardens around the town.

Lampides Pseudocassius, Murray.— Wherever Plumbago grows this insect is sure to be abundant ; the larva feeds on the flowers.

Lampides Perusia, Feld.—A scrub butterfly not uncommon; comes to flowers in gardens occasionally and is partial to loquat blossoms.

Lampides Lineata, Murray.—Another scrub insect of similar habits to preceding.

Lampides Strabo, Fabr.—This pretty light blue is partial to the flowers of the wild raspberry on the borders of creeks and scrubs, but may also be taken on flowers far from both ; it is by no means common round Brisbane.

Lampides Ancyra, Feld.—Also found on the borders of scrubs, but is far from common.

Lampides Scintillata, Lucas. — This well-marked species which is not uncommon appears to have been overlooked until 1889, when it was described by Dr. Lucas. The larva feeds upon flowers of Acacia, and when these trees are in bloom they may be observed in company with others flitting rapidly about. Have taken the perfect insect on flowers of loquat at Bulimba.

Lampides Nora, Feld.—Also fairly common on the blossoms of the Acacia, and likewise partial to those of the loquat, the flowers of which are attractive to many fine insects.

Lampides Boeticus, Linn.—This almost cosmopolitan insect is an abundant species wherever its food plants, various species of leguminious plants grow, especially Crotalaria alata.

Lampides Bochus, Cram.—A scarce species round Brisbane ; it may be taken in gardens occasionally, especially whére Duranta grows.

Lampides Oranigra, Lucas.—W. H. Miskin considers this identical with Bochus, but as it appears to me to be distinct I include it here, though it may prove the other sex of Bochus.

Lampides Parana, Horsf.—A not uncommon species in our scrubs, but comes to various garden flowers, loquat, Duranta, etc.

Lampides Cnejus, Fabr.—This pretty butterfly seems to prefer open grassy glades adjoining casuarina forest, though it sometimes is attracted to garden flowers.

Lampides Miskini, Lucas.—A rather scarce species found on the edges of scrub and along scrubby creeks.

Lampides Argiades, Pall.—Though not uncommon in many other places this insect is most abundant on the grass-tree ridges.

Lycæna Biocellata, Feld.—This little butterfly I once saw in countless numbers in the Botanical Gardens, near the Curator's house. It may be taken in the forest at flowers of Acacia, and in gardens on loquat blossoms.

Lycæna Lulu, Math.—Appears to have been confounded with Lampides Nora until 1889. It is rare about Brisbane, and Cubberley Creek is the only locality where I have captured it.

Lycæna Gracilis, Misk.—Seems to be confined to the dry hilly districts, and is not common. Bulimba Hill is one of the places where it may be taken.

Lycæna Trochilus, Frey.—The official collection of Department of Agriculture contains examples from Deception Bay.

Lycæna Gaika, Trim.—Also in the official collection of the Department of Agriculture, from neighbourhood of Toowong. The species appears to be very close to Lysimon, Hubn., but is a very much smaller insect.

Lycæna Lysimon, Hubn.—This insect affects the borders of swamps, where it may occasionally be seen in abundance

Lycæna Labradus, Godt.—Especially plentiful wherever lucerne grows, upon the flowers of which the larva feeds, though it also attacks the seed pods and leaves.

Lycæna Serpentata, Herr Schff.—This little butterfly principally affects mesembryanthemum upon the borders of salt swamps along the coast, where it is fairly abundant.

Lycæna Agricola, D. H. & W.—I have taken this species on Taylor's Range, and once saw many of them flying about and settling upon Jacksonia. It is also found on Stradbroke Island.

Holochila Absimilis, Feld.—This butterfly is tolerably abundant where the Moreton Bay chesnut (Castanospermum) grows, whether in the scrubs or the gardens about the town. The buds and young leaves are attacked by the caterpillars, the buds especially being eaten right out. The chrysalis is an exact imitation of the knob left by a leaf which has fallen off. The caterpillar also affects Sterculia and other trees.

Holochila Cyprotus, Oll.—A very rare species, the larvæ of which feed upon Jacksonia, from which I was fortunate enough to rear specimens of both sexes. It is a hill species, and may be looked for either in September or October, or from March to May. Taylor's Range is a likely locality, though my reared specimens were obtained on Sankey's Hill.

Holochila Heathii, Cox.—Another rare local species found upon the hills.

Holochila Xanthospilos, Hubn.—A common insect along the creeks and on the borders of swamps, also in the forest.

Holochila Allosericea, Misk.—Expedition Range is the only locality given by W. H. Miskin for this species, but as I know it to have been taken abundantly on Stradbroke Island, near Dunwich, I include it amongst those within our range. There is something remarkable about this species as to locality so far as our present knowledge goes.

Hypochrysops Ignita, Leach.—This is usually found about the margins of the scrubs, but is also to be met with in the forest undergrowth, for I saw it in considerable plenty at Manly, and have also noted it on Stradbroke Island; it is rare about Brisbane.

Hypochrysops Narcissus, Fabr.—To my knowledge, this was an uncommon species at Enoggera in former years, but it now appears to have almost disappeared from amongst us. Occurs, however, at Stradbroke Island still.

Hypochrysops Epicurus, Misk.—Appears to me but the other sex, or a slight variety of Narcissus, from an examination of the types.

Hypochrysops Delicia, Hew.—Appears to be attached to Acacia. Have taken it in the park near the Hospital, on various low hills, and also at flowers of the Leptospermum flavescens.

Pseudodipsas Brisbanensis, Misk.—The only known specimen of this appears to be that in the Miskin collection in the Queensland Museum.

Pseudodipsas Fumidus, Misk.—Sankey's Scrub and Pine River, but very rare. Probably identical with P. Brisbanensis, Misk.

Pseudodipsas Ilius, Feld.—Not uncommon about the scrubby creeks and about the scrubs.

Pseudodipsas Digglesi, Hew.—Comes to the flowers of Duranta, loquat, Angophora, Leptospermum, etc., but is a rare species.

Ialmenus Evagoras, Don.—Very common, attached to Acacia; larva readily discovered from its being an attraction to ants of several species, which come to some matter secreted by it.

Ialmenus Dameli, Semp.—This is the species named Illidgei by Dr. T. P. Lucas and which was treated by W. H. Miskin as a variety of Ictinus. It is attached to Acacia and fairly common.

Ialmenus Ictinus, Hew.—Also common, the larva likewise on Acacia. Both this and Dameli have larvæ which also secrete some matter attractive to ants and probably analogous to that secreted by Aphides.

Deudorix Dioris, Hew.—This pretty insect is rather rarer now than formerly; the scrubby creeks are its usual haunts. It comes to various flowers in gardens, such as Duranta, loquat, etc. The blossoms of Sabal Blackburniana are a special attraction to this and several other butterflies.

Deudorix Simsoni, Misk.—W. H. Miskin cites Brisbane as a locality, though I do not remember to have seen or taken it. There is no doubt he is correct, for many of our North Queensland insects come far south on favourable occasions.

Ogyris Genoveva, Hew.—Some years ago I took specimens of this fine insect at Kelvin Grove sucking at a wounded gum tree, and have seen them several times since about Loranthus high up on these trees.

Ogyris Abrota, D.W. & Hew.—Has lately been taken on Ithaca Creek. The official collection of the Department of Agriculture also contains examples procured on flowers of Callistemon in October.

HESPERIDÆ.

Casyapa Beata, Hew.—The larva of this we have taken on Tristania, Eugenia, and the camphor laurel. It draws two leaves together, one over the other in canopy-like form, with silken threads, and remains quiescent during the day, only issuing out at night. Some specimens I had in the garden on a camphor laurel, and which were protected by mosquito netting bound round the twigs, lived through the winter, changing in September and emerging in October. A second brood will change in February or March and be on the wing in from a fortnight to three weeks later. It is most active at dusk.

Casyapa Denitza, Hew.—Have only captured this species; it is also crepuscular in habits. The flowers of Buddleia Neemdha in September and of the loquat in March and April are a great attraction. In the scrubs it may occasionally be seen perched on or under a leaf. I am inclined to believe, from the partiality of this insect to Tristania, that the larva will be found thereon.

Casyapa Critomedia, Guer.—In the Miskin collection at the Queensland Museum as a Brisbane insect.

Netrocoryne Repanda, Feld.—Seems to prefer the creek sides where the Eugenia grows; it is a scarce species.

Ismene Chromus, Cram.—A rather uncommon species, but have taken it several times in the garden on Duranta. The scrubs at Sankey's, Eagle Farm, Kelvin Grove, etc., are localties where it can be captured.

Ismene Discolor, Feld.—The haunts of this insect are the borders of scrubs; it is abundant at Eagle Farm and other scrubs along the coast. A rare visitor to our gardens.

Ismene Exclamationis, Fabr.—Taken by me at Kelvin Grove about twenty years ago; still have one specimen out of several captured: hitherto only recorded from the north; the official collection, Department of Agriculture, contains specimens also procured in vicinity of Brisbane since Spring of last year.

Pamphila Augiades, Feld.—One of the commonest of our skippers; larva feeds on various palms.

Pamphila Autoleon, Misk.—Have twice taken this species, both females.

Pamphila Augias, Linn.—Formerly much more abundant than of late years.

Pamphila Mathias, Fabr.—Not uncommon; captured several last season at flowers of Bougainvillea and Duranta. It is stated that its food plant is the grass Ischæmum pretinctum.

Pamphila Bambusæ, Moore.—Several caught on Duranta at Bulimba.

Apaustus Agraulia, Hew.—A most common little species.

Apaustus Lascivia, Rosen.—Taken on orange blossoms at Cooper's Plains and flowers of Leptospermum flavescens on the borders of a swamp at Bulimba.

Trapezites Eliena, Hew.—A rare species round Brisbane; more abundant at Stradbroke Island.

Trapezites Iacchus, Fabr.—Not uncommon at Leptospermum flowers.

Trapezites Petalia, Hew.— Also occasionally captured on Leptospermum.

Trapezites Symmomus, Hubn.—The largest species; larva on Cladium.

Trapezites Phillyra, Misk.—Hitherto only recorded as Victorian; one specimen from Ithaca Creek early in September.

Hesperilla Argina, Plotz.—The Miskin Catalogue with an asterisk as unknown.

Hesperilla Doubledayi, Feld.—Not common; usually in the sunny glades in scrubs.

Hesperilla Croceus, Misk.

Hesperilla Fulgidus, Misk.—Have taken the larva of this spun up for pupation on millet; the imagines are not uncommon at Bulimba, and come to flowers of Bougainvillea, Duranta, globe amaranth, etc.

Hesperilla Humilis, Misk.—A common forest species affecting the driest and most arid looking places, settling mostly on the ground.

Hesperilla Ismene, Newm.—Not uncommon in the same localties, and strangely enough appears to have been quite unknown to Miskin, who has marked it in his catalogue with an asterisk. It is not identical with "humilis," as supposed by Spry and Anderson in "Victorian Butterflies," humilis being more like Doubledayi.

Hesperilla Ornata, Leach.—Somewhat rare, but Leptospermum blossoms and those of the orange usually attract it. Bulimba Swamps and Eight-mile Plains.

Hesperilla Peronii, Latr.—The commonest of the genus round Brisbane.

Euschemon Rafflesia, Macl. — Now commonly known as "Regent Skipper." Its haunts are the scrubs only, where it flits about in the sunny glades, usually retiring directly the sun gets hidden by passing clouds.

ADDENDUM.

Since compiling above list, during a visit on the 23rd April last to Wellington Point, I captured some specimens of a Holochila similar to Holochila mœrens from Victoria, but much lighter on under side, which has been identified as Holochila subpallida (Polyommatus Subpallidus) of Dr. Lucas. It may be a varietal form of H. mœrens, which latter again Miskin considers synonymous with Holochila Erinus also noted by him as a Brisbane species.

PROCEEDINGS

OF THE

Annual Meeting of Members,

HELD ON MONDAY, 31st JANUARY, 1898.

The Annual Meeting of the Society was held on Monday 31st January. There was a good attendance of members and visitors.

The President (Mr. C. J. Pound, F.R.M.S.), occupied the chair.

The Minutes of previous Annual Meeting were read and confirmed.

The Hon. Secretary (Mr. J. F. Bailey) read the following report of the Council for the 1897 Session.

To the Members of The Royal Society of Queensland.

YOUR Council have pleasure in submitting their Report for the year, 1897 :—

Eleven Ordinary Meetings have been held. A list of the papers read will be found in Appendix A. The attendance of Officers at the Council Meetings held during the year is shown in Appendix B.

The popular lectures on Scientific Subjects which were commenced in 1896, were continued during the past year. Two were delivered, and were largely attended. The first took place in February when the subject was "Rabbits in Queensland," and the second in June, on "Ticks and Tick fever in Queensland." The President, Mr. C. J. Pound was the lecturer on each occasion, and the lectures were profusely illustrated by lantern photographs. It is proposed to carry on these lectures during the ensuing session.

It is with regret that the Council have to record the death of two of its oldest Members, viz :—Sir Charles Lilley and Mr. W. D. Nisbet.

In March last, Volume XII. of the Proceedings of the Society was published and distributed to members, kindred societies, &c. This contained the papers read during 1896 Session. Owing to the demand for these publications, it has been found necessary to have a greater number printed.

A very large number of publications have been received for the library since last report.

In July last, Dr. J. Thomson delivered before the Microscopical Section of the Society a most able address on Photomicrography.

Owing to his removal to Childers, Mr. A. J. Norton, resigned the Hon. Libiarianship in May, and in June, Dr. A. J. Turner resigned his seat on the Council, owing to his inability to attend the Meetings. Mr. W. J. Byram was appointed to fill the latter vacancy.

During the year four (4) new members have been elected, viz:—W. E. Cameron, M.A.; B. Dunstan, F.G.S.; H. L. Davis, and G. A. K. Darbyshire.

A Commitee consisting of, S. B. J. Skertchly, Hon. A. Norton and J. Shirley, B. Sc. was appoinied during the year, to consider papers for printing in the Society's Proceedings.

The condition of the finances will be seen by reference to the Treasurer's Statement, Appendix C.

C. J. Pound,
President.

J. F. Bailey,
Hon. Secretary.

Brisbane, 19th January, 1898.

APPENDIX A.

Papers Read during 1897 Session.

No.	Date.	Title.	Author.
1	March 6 ..	Ethnography of Leprosy in the Far East	S. B. J. Skertchly
2	April 10 ..	Probable Outcrop of Blythedale Braystone South of its Supposed Border.. ..	F. Bennett
3	,,	Notes on Worm discovered in Moreton Bay Oysters ..	J. Lauterer, M.D.
4	May 15 ..	Artesian Water as illustrated by the Hwang Ho and Yang Tse Rivers	S. B. J. Skertchly
5	June 12 ..	Remarkable Property of the Typhoid Bacillus ..	A. Jefferis Turner, M.D.
6	,,	Description of an Antique Plaque	H. L. Davis
7	July 10 ..	Parthenogenesis and Bisexual haracteristics	Hon. A. Norton, M.L.C
8	August 7 ..	Peculiarities of the Flowers of the Order Proteaceæ ..	J. Shirley, B. Sc., and E. C. Blake
9	Sept. 11 ..	Aboriginal Customs in North Queensland	R. H. Mathews
10	October 16	On the Oldest-worked Coalfields of China	S. B. J. Skertchly
11	Nov. 13 ..	Additions to the Fossil-flora of Queensland	J. Shirley, B. Sc.
12	,,	Social and Individual Nomenclature of the North-West-Central Queensland Aborigines	W. E. Roth, M.R.C.S., Eng.
13	Dec. 11 ..	Fowl-enteritis in Brisbane ..	C. J. Pound
14	,,	New Species of Lepidoptera ..	T. P. Lucas, L.R.C.P.
15	,,	Description of an Aboriginal Drill	W. E. Roth, M.R.C.S., Eng.

APPENDIX B.

Attendance of Officers at the Thirteen Council Meetings Held During 1897.

Office.	Name.	Number attended.
President	C. J. Pound, F.R.M.S.	5
Vice-President ..	S. B. J. Skertchly, ...	6
Hon. Treasurer ..	Hon. A. Norton, M.L.C.	10
Hon. Secretary ..	J. F. Bailey	13
Hon. Librarian ..	† A. J. Norton	1
Members of Council	F. M. Bailey	10
	‡ W. J. Byram	1
	R. Edwards	5
	P. R. Gordon	1
	J. Shirley, B.Sc.	5
	* A. Jefferis Turner, M.D.	0

† Resigned May, 1897. ‡ Appointed August, 1897. * Resigned June, 1897.

APPENDIX C.

THE ROYAL SOCIETY OF QUEENSLAND.

Financial Statement for 1897.

Dr. **Cr.**

RECEIPTS.	£	s.	d.	PAYMENTS.	£	s.	d.
To Balance from last Report	14	15	3	By Printing and Stationery	38	15	6
,, Subscriptions	69	5	6	,, Advertising	3	9	6
,, Rent (Letting of Room)	4	16	0	,, Rent	26	0	0
				,, Postage and Petty Cash	12	10	0
				,, Cheque Book	0	2	6
				,, Balance per Bank Pass Book	7	19	3
	£88	16	9		£88	16	9

Examined and found correct.—Alex. J. Turner, *Hon. Auditor.* A. Norton, *Hon. Treasurer.*

Brisbane, 19th January, 1898. Liabilities: Printing, £6 9s. 6d.

The adoption of the Report was moved by Mr. L. A. Bernays, C.M.G., seconded by the Hon. A. Norton, M.L.C., and carried.

The President then delivered an address entitled:—"The Stockowners' Indebtedness to the Microscope."

PRESIDENTIAL ADDRESS, JANUARY, 1898.

LADIES AND GENTLEMEN,—

My year of office having terminated, it devolves upon me as a duty in accordance with a time-honored custom, to deliver this evening my Presidential Address.

First of all let me here express my obligations to the worthy officers of this Society who have made my position an easy one and have thus earned my best thanks, I am particularly indebted to the Vice-President, Mr. S. J. B. Skertchley, who has taken the chair on many occasions, when, in consequence of my official duties my absence was quite unavoidable.

On the present occasion I have thought it advisable, after due consideration, to depart from the usual custom of reviewing the past year's work of this or any other scientific society, by addressing you on a subject which immediately concerns the most important industry this Colony possesses, viz.: —The Stockowners' indebtedness to the microscope, and in order to make the subject more interesting to those engaged in pastoral pursuits I have introduced some notes on my own personal recollections of the invaluable benefit that some stockowners have derived by means of the microscope since I arrived in Australia some six (6) years ago.

Up till within recent years the microscope was looked upon by most people merely as a scientific toy, and they believed that little or no benefit could be derived even from its very close acquaintance.

During my travels through the various pastoral districts of this Colony, I am frequently asked if I have brought my microscope with me, on my replying in the affirmative I am at once met with a volley of questions, of which the following may be taken as typical examples :—(*a*) Will you show us all the snakes and insects in a drop of our tank-water ? (*b*) If I catch a beetle I suppose you will show it to us under your microscope ? I reckon it looks like one of those devils that eats our peaches. You know what I mean—flying-foxes. (*c*) I suppose a mosquito would be as large as a goanna under your microscope ? and so on. It is a very remarkable fact that what held good fifty (50) years ago in regard to the popular idea of the nature of the microscope practically speaking holds good at the present time. In the year 1847 the late Dr. C. R. Goring, in an essay on the microscope, remarks that "The great mass of mankind will almost invariably be more delighted by an exhibition where they can see the whole object at once, though only moderately magnified, than by a display with a perfect high-power instrument, which shows only small detached parts prodigiously amplified. Occasionally I meet with people who are so unreasonable as to expect that opticians ought to make a microscope which would exhibit the whole of a laughing-jackass or a bullock magnified at least a million times, not being aware, I suppose, that the more we magnify any object the less we must be content to see of it, according to the law of nature and optics, whatever may be the construction of the glasses we employ. "Once," says Dr. Goring, who by the way was a most humorous microscopist, "I met with a virtuoso in Hyde Park who seemed to have effected a sort of approximation in his own way as to the kind of microscope the general public wanted, and was making a considerably handsome collection of half-pence upon the strength of it. He was exhibiting a variety of large objects with a compound microscope of the old fashion, which might perhaps magnify six times, and requesting the observers to look through the instrument (which was placed horizontally) with one eye, while they viewed Apsley House (which was three-quarters of a mile off) with the other, in order that that they might form an idea of the stupendous powers of the splendid microscope submitted to their examination for one half-penny. 'Ladies and gen'lmun, just clap your hies to this ere vonderful and most stupendous hinsterment, it magnifies nearly one million of times or I'm a liar, and any of you may be kenwicted of the truth of what I says by looking at the diamond-beedle with one hi, while you sees Aspley House with the hother. I'll be blowed if the beedle bint bigger nor that, and all of you knows Apsley House is a million times bigger nor the beedle.' The audience seemed perfectly satisfied with the demonstration ; for mankind are always much obliged to anybody who will be at the trouble of humbugging them in their own way, and fortunately there will never be a lack of persons to do them this kindly office, putting profit of course entirely out of the question.

From these remarks I do not wish to infer that every stock-owner I meet is ignorant of the nature and uses of the microscope ; far from it. I have met with some who, I am pleased to say, are able to give a number of extremely useful tips and dodges in general microscopy, and in fact are quite familiar with some of the recent discoveries in practical bacteriology ; on the other hand, there are hundreds who, if they had the aptitude, are unable to meet with the opportunity of acquiring even a rudimentary knowledge of the microscope or its revelations in connection with animal diseases.

I intended when I commenced writing this address to briefly describe all animal diseases the study of which is known to be associated with the microscope ; but I find that by dealing with the more important details of only four or five of the more common or every-day diseases, I shall be doing all justice to my subject. First of all I will take Anthrax, as it was the first communicable disease discovered that was proved (by means of the microscope) to be caused by a specific organism, and it would be no exaggeration to say that the study of Anthrax has been the ground-work for much of our recent bacteriological knowledge.

ANTHRAX.

Anthrax, sometimes called Splenic Fever or Cumberland Disease, is a disease which is largely seen in cattle and sheep, and sometimes in the pig, horse, dog, and other domesticated animals ; in fact, very few animals are proof against inoculation contagion. It is the most deadly disease to which the animal body is heir, and it runs its course with greater rapidity than does any other disease with which we are acquainted, death frequently resulting in cattle and sheep within the space of one (1) or two (2) hours after animals have been observed to be to all outward appearance in a perfect state of health. Its rapid course is only equalled by its malignity, few animals, especially cattle and sheep, recovering from its destructive influence. In the year 1850 Davaine and Rayer made the very important discovery of the bacillus Anthracis, which is the immediate cause of Anthrax; and although they describe its relative size to the red corpuscles, and the fact that it is not possessed of any definite movement, as occurring in the blood of animals having died from splenic fever, they failed to recognise its real importance. In 1863, however, Davaine resumed his investigations, which he had discontinued thirteen (13) years before, respecting the influence of the filamentous bodies which he had at that time noticed in the blood of animals which had died from splenic fever. These researches were carried on for many years, till, in 1873, he asserted positively that these rods, which he called "Bacteridie du Charbon," were the essential cause of this malignant disease, they were constant in the blood of animals that died from Anthrax, and that such blood when filtered and inoculated in animals had no effect.

Since that time our acquaintance with these bacilli has been greatly extended by Robert Koch and others, and our knowledge of their life history confirmed by the most exhaustive and careful investigation. These researches, which can only be carried out by the aid of the microscope, are still continuing, and we shall see later on to what wonderful results in combating the symptoms to which their presence gives rise; but we must briefly examine a little more in detail how the disease is communicable from animal to animal. If the blood of a diseased animal be examined a little before or immediately after death, the vegetative rods of Bacillus Anthracis are easily found by means of a suitable microscope. Now if the smallest quantity of such blood is introduced into the tissues of another animal capable of taking the disease, the inoculated animal becomes infected and almost certainly succumbs; and if the blood of the second animal be similarly examined this also will be found densely populated with the same bacilli. We thus see that the disease is accompanied by the enormous multiplication of the micro-organisms within the system of the infected animal, and that the disease may be indefinitely communicated from one animal to another; but we may also cause this bacillus to grow and multiply outside the animal system altogether, or, as we term it, cultivate the organism in an artificial medium. Thus, if we take on the point of a sterilised platinum needle the merest trace of blood of an animal just dead of Anthrax, and then introduce the point of the needle into any of the ordinary cultivating media, such as broth, gelatine, agaragar, and blood-serum, or even the surface of a boiled potato, we shall obtain in the course of a few days an abundant growth of the Anthrax bacillus, readily visible to the naked eye and presenting a most characteristic growth. On microscopical examination we find that this peculiar wool-like growth is made up of bacilli held end to end in a delicate filamentous sheath. By continual microscopical examination of these filaments we shall notice that a number of extraordinary changes are brought about; the contents of each individual segment or bacillus in the filament sooner or later become granular; at a later stage a very minute speck appears in the centre of each rod. These bright, highly refractile bodies are the so-called spores, which, in consequence of the greater power of resisting destruction, are of such importance in the propagation of this dreaded disease. In the blood of the subject affected, these Anthrax bacilli are not able to form spores, but outside the body they give rise abundantly to these indestructible forms, and it is this power of producing spores which renders this organism so dangerous and persistent. Thus, if the carcasses of animals dead of Anthrax are lightly buried or allowed to decay on the surface of the earth, the bacilli form spores in the soil, and healthy animals may thus become infected by taking the spores with their food when grazing. Again, the skin of animals which have died of Anthrax in some countries, especially Russia, not infrequently pass into commerce, and often prove fatal to the tanners and wool-sorters who handle them even long afterwards. To give you some idea how tenacious of life and resistant these minute spores are, and how they retain their virulent properties, I have with me this evening a little bottle containing some silk threads which I impregnated with Anthrax spores in May, 1886, nearly twelve years ago. In the first three successive winters in London they stood in a cupboard where the temperature was considerably below freezing point for several days, but since that time they have been kept in a moderately temperate atmosphere, but always in a desiccated condition. From time to time I test the virulence of these spores by placing a little piece of thread under the skin of a guinea-pig, which results in the death of the animal (without any exception whatever), within twenty-four hours, of virulent Anthrax. Moreover, on microscopical examination of a merest trace of blood taken from the spleen, the Anthrax bacilli are readily demonstrated in large numbers. This experiment illustrates very clearly how the spores of the Anthrax bacilli may get into the soil, and may remain there in a dormant state for many years. Anthrax has been known to break out among cattle grazing on a field where several years previously some Russian hides from infected animals had been buried. By some means or other the spores may contaminate the grass and hay imported from an Anthrax-infected district, and may start the disease on a farm on which it had never been known to occur. The spores may in a similar way with blood manure and bone manure, or with refuse used for manure; the skin, hair, wool, hoofs and horns of infected animals, if soiled with blood, are contaminated by the bacillus. Bearing all these facts in mind, it will be seen how necessary it is that the strictest supervision should be exercised whenever an outbreak of splenic fever or Anthrax takes place, and that the disposal by cremation of the carcasses of the affected animals should be most vigorously enforced. Unfortunately those most closely connected with this disease are only too often quite ignorant of its dangers. Thus, during an outbreak of this disease a few years ago in England, I recollect quite well the case of a butcher who was called in by the farmer to skin and dress some animals that had died from Anthrax. Very naturally, like most butchers, he became bespattered with blood, and when the work was complete he went down to the other end of the paddock and washed his face and hands with water from a running stream, afterwards wiping them with some coarse sedgy grass, which produced several slight cuts through the skin. No notice whatever was taken of the cuts for several days, when suddenly on a considerable area around each cut there appeared an intense inflammation; on the following morning they became so painful that he decided to seek the advice of a medical man, who, after making full enquiries into the history of the case, came to the conclusion that the sores were true malignant pustules, undoubtedly caused by the Anthrax bacilli gaining access to the sub-cutaneous tissues through the cuts produced by the coarse grass. Although several of the pustules were excised and others treated with strong antiseptics, it was too late to save the patient's life, for the Anthrax bacilli had got into his general circulation, and his death resulted in a few hours from splenic fever. In England and on the Continent, when bacteriology was in its infancy, and microscopical science was scarcely considered necessary in veterinary schools, it was by no means an uncommon occurrence to hear of a veterinary surgeon being attacked with Anthrax, which in some instances proved fatal. Happily these days are past, for now in every veterinary teaching institution in England, Continental countries, and America, the science of Bacteriology is recognised in the highest possible degree; consequently students of the present day are in a position to acquire an all-round knowledge of practical bacteriology, even probably more so than medical students, which is accounted for by the fact that so many of the diseases peculiar to the lower animals have been proved to be entirely due to microbic origin.

We all know that early recognition and prompt action are essential to prevent the spread of any communicable diseases. By means of Koch's discovery we are able to give a definite opinion in less than three minutes whether an animal has died of Anthrax or not. Unfortunately, in the case of Anthrax, only too often the first indication of the existence of the disease is the sudden death of an apparently healthy animal. Nevertheless, the importance of being able to recognize the bacillus in the first animal that dies cannot be overestimated, and this is where the microscope scores, for it proves at once that it is quite unnecessary to perform the dangerous task of making an elaborate post-mortem examination in order to satisfy oneself that the disease is really Anthrax. All bacteriologists are deeply indebted to Robert Koch as the first to point out in the year 1876 that the Anthrax bacillus, as seen in the blood of infected animals was morphologically different from any other known bacillus; and although twenty years have elapsed, during which period a considerable number of new (pathogenic and non-pathogenic) organisms have been brought to light, it is a remarkable fact that this discovery of Koch still holds the same unique position, for not a single new bacillus has been found with the characteristic square-cut ends of the Anthrax bacillus.

IMMUNITY AND PROTECTIVE INOCULATION.

During his investigations Pasteur discovered that cattle and sheep, after recovering from one attack of Anthrax, were protected from a second attack, and in 1882 he elaborated a method by which a mild form of the disease could be given to animals, which rendered them perfectly harmless against a subsequent inoculation with virulent bacilli. He found that the continued growth of Anthrax bacilli at an abnormally high temperature (42 to 43 degrees Centigrade) caused them to lose their power of developing endospores, and also to gradually lose their virulence. In fact this virulence can be gradually attenuated till it ceases to be dangerous even to that most susceptible of all experimental animals, the domestic mouse. Prompted by the result of these discoveries, Pasteur then attempted with success to use the attenuated bacillus of Anthrax for protective inoculation against the virulent bacillus. He was able to show that if an animal is inoculated with the bacillus attenuated to the degree requisite for it—that is, for that species of animal—it either does not sicken, or it sickens slightly and recovers from the disease. It resists then the infection with less attenuated bacilli, and after the next inoculation it resists the bacilli which possesses the highest degree of virulence. Pasteur did not delay in making this brilliant laboratory achievement available for practical application. The first great experiment with this attenuated virus outside the laboratory is particularly noteworthy, and of such historical interest that I cannot refrain from giving a brief account of it.

On the 5th of May, 1881, Pasteur obtained 24 sheep, 1 goat, and 6 cows (all of which are peculiarly susceptible to Anthrax), and inoculated them with the fully attenuated virus, and 12 days later they were again inoculated with a rathei less attenuated, or rather stronger virus. On the 31st of May all these inoculated animals, as well as 24 sheep, 1 goat, and 4 cows not previously inoculated, received severally an injection of virulent blood from an animal recently dead of Anthrax. On the 2nd of June, 3 days later, 21 sheep and the goat which had not been protectively inoculated were dead, 2 other sheep were dying, and the last one was attacked later in the day, whilst not one of the previously inoculated animals was affected.

It is difficult for anyone not engaged in scientific pursuits to fully realize how the triumph of that moment must have rewarded the years of patient and persevering labour of the seeker after truth. The value of Pasteur's system of protective inoculation for Anthrax was not long in being recognised, and in a few years gained a foothold in different countries throughout the world where the disease is endemic.

In 1889 Pasteur's representatives, Dr. Germont and M. Loir, gave a practical demonstration of the efficacy of Pasteur's perfected system before a specially appointed committee at Junee in New South Wales. On the 3rd of September 20 sheep and 4 cattle were inoculated with the first vaccine, and on the 18th they were all inoculated with the second vaccine. On the 2nd of October all these vaccinated animals and 19 sheep and 2 cattle (not previously inoculated) were inoculated with blood obtained from a sheep just dead of virulent Anthrax, with the result that all of the 19 sheep and 1 of the 2 cows died, while not one of the 20 sheep and 4 cattle showed even the slightest signs of sickness. So successful was this demonstration considered by the committee that they recommended its general adoption to stock-owners throughout the colony. Since that time hundreds of thousands of sheep have been vaccinated annually.

In concluding these remarks on Anthrax, I must ask you to bear in mind that this marvellous discovery of M. Pasteur, from which stock-owners throughout the world have so much benefit, was originally the outcome of microscopical investigation; in fact, even at the present time the preparation of Anthrax vaccine cannot be conducted on a reliable scientific basis without the assistance of the microscope.

TETANUS.

Tetanus has long been known as a communicable disease of man, and especially the lower animals, characterised by spasmodic contraction of the muscles, commencing near the seat of inoculation and gradually extending to all parts of the body. It is more commonly the result of some abrasion of the skin, especially after wounds produced by old rusty nails or splinters of wood contaminated with earth or dust, and before the days of antiseptic surgery frequently followed surgical operations. Carle and Rattone, in 1884, were the first to prove that the disease could be communicated from man to animals by inoculating twelve (12) rabbits with pus, of which eleven (11) died from Tetanus. In the following year another observer found that mice and guinea-pigs inoculated with garden earth invariably contracted tetanus, and, moreover, in the pus which he found at the seat of inoculation he always found a characteristic bacillus; but it was not until 1889 that the celebrated Japanese bacteriologist Kitasato obtained pure cultures of this bacillus and worked out its life history, and further proved that it belonged to the anaerobic group of organisms—viz., those that live and reproduce their species without free access to oxygen. A very remarkable feature about the Tetanus organism is that spore formation takes place at the end of the bacillus, which when complete has the appearance of a drumstick.

Kitasato, in the course of his experiments on the poisonous properties of the Tetanus bacillus, succeeded in making animals immune to Tetanus, and subsequently made the discovery that the blood of immune animals will produce immunity when injected into other animals; which resulted in a number of eminent investigators taking up this important subject, and thanks to the combined researches of Tizzoni, Cattani, Breiger, Faber, Vallaird, Vincent, Kitasato, Roux, and Nocard, we have at the present day an antitoxic serum whose therapeutic value and as a preventive of Tetanus has been firmly established. It is, however, only fair to point out that there have been a number of reported failures when the antitoxic serum has been used as a means of curing Tetanus: but it is equally fair to state that almost without exception the treatment was unavoidably commenced when the tetanic symptoms had become extremely well pronounced, at which stage, according to our present knowledge, there is very little hope of saving life. To veterinary practitioners it is a well-known fact that the owner of a horse which is suffering from Tetanus rarely ever seeks professional advice until he thinks there is no possible chance whatever of the animal recovering.

In a recent communication to the Paris Academy of Medicine M. Nocard says that from experimental as well as from the clinical point of view the antitoxic serum employed as a preventive of Tetanus in the horse has had wonderful success, but when applied to the treatment of declared Tetanus was (for reasons previously given) almost always a failure. However, in the presence of reliable information collected by practitioners who have treated Tetanus with antitoxine, M. Nocard considers this mode of treatment still the best ; for, if it does not increase the number of cures, it gives on the contrary remarkable results from a preventive point of view. In 2707 animals which had recently received two injections each of the antitoxic serum, not a single case of Tetanus was observed in districts where the malady had made many victims some days or weeks previously. On the other hand, during the time this experiment lasted M. Nocard and his colleagues observed 259 cases of Tetanus in animals not treated preventively. M. Nocard accordingly recommends the serum treatment of Tetanus in regions where this malady is observed, and particularly after surgical operations which most predispose to it. He terminates his last communication by repeating, with M. Warnesson of Versailles, that, "employed preventively, the efficacy of anti-tetanic serum is absolute." It is worthy of note that this last statement of so distinguished a scientist as M. Nocard could never have been made but for the microscopical discoveries of previous observers.

I may say that at the present time this method of preventive treatment for Tetanus is largely used by veterinary surgeons in England, on the continent of Europe, and in America, and I see no reason why its use should not be extended to these colonies.

ACTINOMYCOSIS.

Actinomycosis is a disease the accurate diagnosis of which calls for the aid of the microscope. Until the year 1876 the true nature of this disease had, with few exceptions, been overlooked. Cases in cattle were known under a variety of names, such as wens, scirrhous, scrofulous and tuberculous tumours, osteo-sarcoma, wooden tongue, polyphus or lymphoma and clyers of the throat, bone cancer, spina ventosa, chronic abscess, caries of the bone, etc. Although these various names were each supposed to represent a distinct form of disease, recent researches with the aid of the microscope have shown that they are one and all the same, and consequently are now classed under one head—viz., Actinomycosis. From the early part of the present century till 1875 numerous well-known observers, including Dick, Langenbeck, Lebert, Rivolta, Johne, Robin, and Perroncito, wrote most elaborate essays on this disease. None of these observers, however, proved conclusively the true nature of the cases which they described. In 1876 Bollinger threw an entirely new light on the subject by the accurate description and identification of the characteristic micro-organism which has given the name to this disease. His investigations applied only to cattle; but in the following year J. Israel described a similar affection in man, and in 1879 Ponfick brought strong evidence to prove the identity of the disease in man with that which occurs in cattle. Since this time the identity of the two diseases has been generally recognised, though no definite casual relation has yet been traced between them.

In advanced stages of the disease the fungus may be detected with the naked eye in the muco-purulent discharge or in a scraping from the cut surface of a growth. The tufts of the fungus vary in size under different circumstances from a grain of sand to that of a pin's head, and appear to be yellowish white in colour. On examination under the microscope these little tufts appear to be made up of a mass of club-shaped bodies resembling, to a certain extent, soda-water bottles with the narrow ends attached to the centre, thus forming a delicate-rayed rosette; in fact, they will call to mind, on focusing in turn the centre and the periphery, the appearance of a composite flower.

In some cases, especially in the early stage, the fungus is made up almost entirely of a mass of delicate filaments or mycelium, which have been proved by numerous observers to be the active or vegetable stage of the organisms. My friend Prof. Crookshank, of King's College, London, has shown that the club-shaped end is in reality the the terminal part of the filaments; moreover, he is of opinion that the clubs are mucilaginous expansions of the sheath of filaments which become highly developed when the organism is growing in the animal tissues. In some cases of Actinomycosis that I have examined lately I find neither clubs nor definite mycelium, but a mass of what appears to be micrococci and apparently short broken up filaments. That I was dealing with Actinomycosis was subsequently proved by placing a little of the growth on several tubes of agar-agar, when, after several weeks' incubation at 37 degrees centigrade, I obtained a series of the most luxuriant cultures of the Actinomyces fungus. The naked-eye appearance of a cultivation of the Actinomyces fungus is very striking and absolutely characteristic; in fact I know of no other organism that bears even the slightest resemblance to it. The growth after a few days on the surface of agar-agar or blood-serum at the temperature of the blood forms little white, shining, moist colonies, which may remain stationary or increase and coalesce. In a week or ten days, sometimes earlier and sometimes after several weeks, the culture turns a bright yellow or yellowish-brown. After a time a powdery sulphur efflorescence makes its appearance on the surface of the culture, which at this time begins to develop a peculiar sour smell. The stage of efflorescence corresponds with the breaking up of the filaments into masses of cocci and chains closely resembling streptococci. Preparation of the fungus, either from cultivation or from the animal tissues, can be stained readily in a variety of ways, Gram's and Plaut's being the principal methods used; moreover, it is interesting to know that in sections of an actinomycotic growth the tissues can be contrasted with some differential stain, which greatly facilitates the detection of the fungus with the microscope.

From this brief sketch it would appear that the detection of Actinomycosis was an easy matter. So it is in the majority of cases; sometimes an accurate diagnosis by means of the microscope, without even the aid of anilyne dye, can be made in three minutes; on the other hand, I have met cases which baffled several of us working closely together for several days, and the positive result of the diagnosis was obtained solely by persistent work with the microscope. Several of the cases of more than passing interest are here well worthy of recording :—

Mr. E. Stanley, Chief Veterinary Surgeon to the Board of Health, Sydney, during his usual inspection of the saleyards in and around Sydney on one occasion, informed me that he had a splendid case of tuberculosis in the udder of a cow which had been recently consigned for sale from a ladies' college on account of the gradual diminution of the supply of milk. A physical examination revealed the fact that only the right anterior quarter of the mammary gland was sound, while the other three quarters were more or less indurated. The animal was condemned and killed for tuberculosis, and on P.M. examination the original opinion was maintained. The next step was to confirm or otherwise this diagnosis by microscopical examination of the diseased parts of the udder, which work the Board of Health entrusted to me. I worked away cutting sections and examining specimens with the microscope for three days, but although I could find all the necessary histological elements of tubercle, I failed to discover a single tubercle bacillus. Mr. Stanley suggesting that the staining reagents might have deteriorated, I therefore made up another fresh lot of stains, and then prepared another series of specimens, which we, independently, carefully examined, but with the same negative result as before. After this somewhat lengthy and tedious microscopical examination it was resolved as a last resource to cut up into slices that portion of the gland which was intended to be preserved as a museum specimen, with the hope of throwing a little extra light on the nature of what now appeared to be a mysterious disease. My efforts were at last rewarded by the fact that I discovered on the cut surface of two of the slices several little hard, dark-brown coloured grains, each about the size of a pin's head. These grains were placed on a micro-slide, and on adding a little drop of hydrochloric acid they immediately began to effervesce, thus demonstrating their calcarious nature. When the effervescence had ceased a little glycerine was added, and the specimen examined under the microscope, when to my astonishment what was supposed to be a case of tuberculosis now proved to be one of Actinomycosis, for I readily detected the presence of characteristic clubs of the Actinomyces fungus, while the calcarious condition of the little fungus-tufts at once explained that the micro-organisms were undergoing degenerative changes which would readily account for their scarcity in the indurated tissues.

The second case I wish to bring under notice is that of a high-class pedigree bull belonging to a well-known breeder in this colony. The owner came to me and stated he believed that this valuable animal, which he had only recently imported, was affected with tubercular tumours in the lower region of the throat, which if it should be true would mean the immediate destruction of the animal and perhaps a claim for compensation against the original owner of the animal in England. During the cold weather the animal, which was extremely quiet and good-tempered, was kept in a stable, with a halter round its neck. Apparently by continual friction of the rope, the skin of the neck got rubbed so much immediately above one of the tumours as to cause an open sore, which gradually increased in size. In the course of a few weeks one of the tumours commenced to disconnect itself from the surrounding subcutaneous tissues, and eventually sloughed out. The tumour, which was about the size of an orange and very firm in consistency, was forwarded to me for microscopical examination, which proved as difficult a task as in the previous case. However, after repeated examinations I was again successful in demonstrating that the tumour was one of actinomycotic origin, and, as in the case of the mammary gland, the fungus was undergoing calcareous degeneration. The second tumour was subsequently removed by operation, and on microscopical examination turned out to be, as was anticipated, of the same character as the first tumour. Although this event took place two years ago, the animal has never exhibited any further manifestation of this disease; in fact at the present time, I am informed, he is a perfect picture of health. Needless to say the owner was more than gratified at the result of these examinations, and even now frequently sings praises of the valuable assistance which the microscope rendered in saving the life of what is at the present time a champion animal of his class in Australia.

TUBERCULOSIS.

There is no known disease which has a wider distribution than tuberculosis. The study of this disease in all its manifestations has claimed the attention of the greatest scientific minds throughout the world ; the original manuscripts alone of these investigators would more than fill this room, and yet, although, so much information has been elucidated in connection with this disease, there still remains practically an inexhaustive field for experimental research work for the most persevering and painstaking of investigators. Not only is tuberculosis the most common disease in mankind, but there is no other disease in existence which attacks so many different kinds of animals. Not one of our domesticated animals is completely refractory to it ; they simply vary in their degree of susceptibility. The first person to claim the honor of having demonstrated the contagiousness of the disease was Villemin in 1865, whose experiments were subsequently confirmed by Cohnheim. In the year 1882 that celebrated bacteriologist Robert Koch, as a result of his masterly and extremely delicate researches with the microscope, announced the discovery of the tubercle bacillus, which he succeeded in isolating and cultivating outside the animal body on artificial nutrient media ; further, by inoculating guinea-pigs with small portions of the cultivations, he invariably produced tuberculosis, which caused the death of the animal ; and last but not least, he again found unmistakable evidence of the presence of tubercle bacilli in all the lesions of the disease. These investigations justified Koch in expressing the opinion that "without the tubercle bacilus there could be no tuberculosis—a fact which has been maintained up to the present day. For many years it was generally believed that the blood-serum media as used by Koch was the only one on which the tubercle bacilli could be cultivated, but Roux, of the Pasteur Institute, found that a more favourable medium could be found in nutrient agar-agar with the addition of about 6 per cent. of glycerine, On this the bacillus grows abundantly and rapidly ; the growth stands out from the surface of the solid medium and takes the form of small yellowish-white lichenoid grains, which are dry, dense, and difficult to crush, each grain containing hundreds of thousands of bacilli. In the case of liquid media, the growth takes place either at the bottom of the vessel in the form of extremely small yellowish-white grains, development being retarded owing to the limited supply of oxygen, or at the surface, where it has free access to oxygen in the form of a delicate crinkled yellowish-white film, which rapidly develops in a felted mass. All cultures when they arrive at a certain stage of development give off a peculiar, somewhat unpleasant, flowery odour. Although the most favourable temperature for the cultivation of the tubercle bacillus is about blood heat (37 per cent. centigrade or 98·6 per cent. Fahrenheit), recent experiments have shown that it will grow quite readily at the ordinary temperature of the room even on sterilised potatoes or beetroot, and in honey, milk, and urine. Koch showed by his discoveries, which have been slightly modified by other observers, that the tubercle bacillus behaves in a characteristic manner to some of the aniline dyes, if fact, to demonstrate it a special method of staining is necessary, which enables us at once to distinguish it by means of the microscope from all other micro-organisms. The most reliable and simple method for staining tubercle bacilli is a modification by Ziehl-Neelsen. The preparation, cover-glass, or section, is placed in a watch-glass full of carbolised Fuchsin for about five minutes, then washed in water to remove the surplus stain, afterwards plunged into a 33 per cent. solution of sulphuric acid, or as some people prefer a 10 per cent. solution of nitric acid, until perfectly decolorised, the staining process is then completed by immersion in an aqueous solution of Methylene blue, afterwards the preparation is again washed in water, dried, and finally mounted in Canada balsam dissolved in xylol. When such a preparation is examined under a suitable microscope, it will be found that the bacilli of tuberculosis alone have retained the primary red coloration (Fuchsin), while all other micro-organisms and any histological elements which may be present are decolorised by the acid, but have taken on the contrast or background stain methylene blue. This invaluable method (which is practiced all over the world), is almost in daily use in our Stock Institute at Brisbane, being principally employed for detecting tubercle bacilli in sputum from phthisical patients, milk of cows suffering from tubercular mammittis, and various morbid specimens; but its chief use is in connection with providing stockowners in this and the neighbouring colonies with pure pleuro-pneumonia virus, guaranteed to be as free as modern bacteriological examination will allow, from all traces of tubercular taint. Last year over 100,000 head of cattle in Queensland and New South Wales were inoculated with virus supplied by this Institute. Just think for a moment what this means. The mass of overwhelming evidence, experimental and otherwise, has proved beyond all doubt that the prevalence of tuberculosis among cattle in these colonies is mainly due to the evil effects of the indiscriminate method of inoculation for pleuro-pneumonia with virus obtained from an animal also affected with tuberculosis, although not necessarily showing naked-eye lesions of this disease; and further as an example, I found tubercle bacilli in three out of five animals killed for pleuro-pneumonia virus and supplied by one individual alone, and that if this virus had not been examined microscopically, it would have been used for inoculating upwards of 3000 head of cattle. Therefore, stockowners should cheerfully appreciate the invaluable work that is being executed for their benefit by means of the microscope in the crusade against tuberculosis. It does not follow that every animal inoculated with virus containing tubercle bacilli will be affected with tuberculosis; there is always a percentage of animals in every herd that are practically insusceptible to the disease even by inoculation; on the other hand, an exhaustive series of experiments conducted at the Indooroopilly Experimental Station proved that the disease can be induced in some animals quite readily. Therefore, as tuberculosis has been clearly shown to be a preventable disease, why not prevent it in the direction of using pleuro lymph that has withstood the bacteriological test. There is no objection whatever to stockowners declining to use the departmental lymph, although it is highly desirable that the virus collected by themselves should subsequently pass through the Stock Institute, otherwise it cannot be recommended with safety for inoculation purposes. In a report recently issued by the Sydney Board of Health, Dr. Ashburton Thompson ventures to remark that, "It should be made illegal to inoculate for pleuro-pneumonia except with virus taken from animals ascertained to be free from tuberculosis.

On the prevalence of tuberculosis in cattle in various countries Nocard says the power which tuberculosis possesses of spreading among cattle is not sufficiently known. There are some countries among the most advanced in breeding, rearing, and animal hygiene, where the number of tuberculous cattle is more than 20 per cent. of the total bovine population. In Saxony, for instance, the official statistics of the abattoirs under inspection show that the number of animals recognised as tuberculous was in 1891, 17·4 per cent.; in 1892. 17·79 per cent.; in 1893, 18·26 per cent.; while in some towns the proportion reached 30 per cent. At the Copenhagen abattoir the proportion of tuberculous animals in 1891 reached 30 per cent. Out of 125,000 cattle slaughtered in Berlin in 1891 almost 15,000, or 12 per cent., were tuberculous. At the abattoir of Toulouse in 1889, 1,254 animals out of 13,507 were found to be tuberculous. As the terms of inspection did not meet with the wishes of the owners, the number of tuberculous animals fell in 1890 to 340 out of 12,694 slaughtered, about a quarter of the number of the preceding year. The surplus had been turned on to private slaughter.houses not under inspection.

Although legislation with regard to tuberculosis and the inspection of abattoirs in England is still in a rudimentary state, we get from that country very valuable statistics. It is well-known what admirable energy, and the amount of money the English have expended in order to stamp out contagious pleuro-pneumonia. Their Act of 1890 orders the slaughter, not only of the sick and suspected, but also of all animals that have been in contact with the sick. In 1891 there were thus slaughtered, in different parts of England and Scotland, nearly 10,000 animals (of which only 800 were sick); post-mortems were made on these 10,000 animals, and 1,260 were tuberculous, or $12\frac{1}{2}$ per cent. In 1892 the operation was continued, but was brought to bear on much smaller numbers, pleura-pneumonia being on the decrease. However, there were slaughtered 3,600 animals (of which 134 were sick), and of this number nearly 800 were tuberculous or 22 per cent. This high proportion is due to the fact that the slaughtering operations were brought to bear on some of the most crowded and anciently infected cow-houses in London, some of which had as many as 50, 60, and 70 per cent. of their cows affected with tuberculosis.

Causes of Tuberculosis.—Up to quite recently medical men, veterinary surgeons and the public generally looked upon tuberculosis as a true type of hereditary diseases. Even at the present day stockbreeders will endeavour to bring forward, apparently, the most convincing evidence from their point of view to support this supposition; but the statistics obtained from the various continental abattoirs disagree with this theory almost entirely; in fact all the inspectors are of the one opinion that there is nothing more rare than tuberculosis of the calf. Here are some figures demonstrating this point:—At the Munich abattoir 160,000 calves are slaughtered yearly on an average, and out of this number there have been found tuberculous— two in 1878, one in 1879, none in 1880, none in 1881, and two in 1882. At Lyons, M. Leclerc, who has taken a particular interest in this question, has only found five tuberculous calves out of 400,000 slaughtered at the public abbattoir. At Rouen, Veysierre has found three out of 60,000. At Berlin, Johne has found four out of more than 150,000. In Prussia, from April 1, 1892, to March 31, 1893, there were slaughtered in the public abattoirs 600,501 adult cattle, of which 52,136 were tuberculous, or 8·68 per cent; and 914,216 calves, of which only 446 were tuberculous, or a little less than ·04 per cent. To thoroughly appreciate these figures, it must not be forgotten, as Nocard points out, that everywhere the number of tuberculous cows is infinitely greater than that of other cattle.

Among the various hereditary and predisposing causes which may be regarded as factors to diminish the resisting properties of the animal tissues to the action of the tubercle bacillus, are unhealthy surroundings, close and ill-ventilated buildings, dark stables, insufficient or unwholesome food, breeding too young or too frequently, or late breeding, overfeeding to secure an abnormal production of milk—in fact, any treatment of cattle that tends to debilitate or over-stimulate—may be considered as a predisposing cause. These conditions, some of which are too often imposed, require the very serious consideration of the breeder of stud cattle, those engaged in raising store cattle, the producer of fat stock, the dairy farmer, and even the bullock driver, all of whom are anxious to possess sound and healthy animals with vigorous constitutions. Stock-breeders should bear in mind that the predisposing cause can under no circumstaces result in tuberculosis without action of the essential cause; and the tubercle bacillus is certain to produce its specific pathogenic effect in tissues that are impaired by hereditary or acquired causes. As for Koch, whose authority in the matter is undeniable, he declares that although he has conducted hundreds of most crucial experiments, he has never seen any of his female guinea-pigs, when tuberculous, transmit the disease to their offspring. According to him, hereditary tuberculosis finds its most natural explanation; for what the mother does transmit to its offspring is not the disease itself, but the predisposition or proneness to contract the disease. In other words, the offspring is born tuberculizable not tuberculous.

These well-established facts tend to prove that heredity plays a very small part, and contagion a great part, in the propagation of bovine tuberculosis, and that if the young born of tuberculous parents were protected from cohabitation, and the ingestion of tubercular milk, the importance of heredity as a cause of the disease or even the predisposition to it would gradually dwindle away into insignificance. In Denmark, Prof. Bang has shown that by exercising a little care, and the free application of tuberculin, how comparatively easy it is to protect cattle from infection, and how a healthy herd may be bred from a severely infected one.

As evidence of this, Nocard says: "I had occasion to test with tuberculin all the animals on a large and fine farm in the north of France; 55 out of 105 were tuberculous—46 out of 57 adults; 9 out of 42 aged from four months to two years. Twenty months later I repeated the test on 30 of the young animals which had escaped infection, and on 14 more which had been born since the first trial. Of this number 25 were born of tuberculous mothers. Not one of these animals gave the slightest reaction—not one had become tuberculous; and most of them are now two, two and a-half, three, and more years old."

After the first trial all the healthy animals were strictly isolated from the affected ones.

Methods of Detecting Tuberculosis.—Comparative pathologists are agreed that there are several diseases which may simulate and be mistaken for bovine tuberculosis. Therefore on all occasions, when possible, the clinical diagnosis ought to be controlled by bacteriological examination of the suspected products—pus, discharge from the nostrils, expectoration, glandular pulp, milk, etc. If Koch's bacillus is found, with all its well-defined and peculiar histo-chemical characters, the existence of tuberculosis may be affirmed. If the search for tubercle bacilli does not give positive results, as is often the case in cattle, experimental diagnosis is proceeded with. This is done by injecting some of the suspected products directly into the peritoneal cavity of one or more guinea pigs, which are extremely susceptible to tuberculosis. Should the inoculated material be tuberculous, its virulence will be proven by the progress of the disease, the first symptoms usually appearing in from 25 to 30 days, when the animal may be killed and examined. On post mortem, the lymphatic glands and spleen will be seen to be considerably enlarged and crowded with tubercular nodules, while the liver and lungs will be less severely attacked. If these appearances are confirmed by microscopical examination, the diagnosis is thus made complete.

The two methods just described are of course inapplicable when tuberculosis in the suspected animal is confined to the abdominal organs, to serous membranes, or to glands of cavities; consequently they are impracticable for general use. But, thanks to the researches of Koch, we have in the agent known as tuberculin a most perfect test for tuberculosis. Experiments made by thousands in all countries have shown that Koch's tuberculin, injected in small doses under the skin of suspected cattle, sets up in tuberculous animals alone an intense febrile reaction, permitting one to assert the existence of lesions so minute that all other methods of diagnosis, bacteriological and clinical, would be powerless to reveal their presence, or even to make one suspect their existence; in fact, it becomes so near being an infallible test that the errors of diagnosis, based on its constant use are practically nil.

It may be asked, What is tuberculin, and how is it applied? Tuberculin is a simple glycerine extract of the toxic products of a broth culture of the tubercle bacillus; but its preparation, although not at all difficult, requires very special care.

A culture of tubercle bacilli in glycerine nutrient medium of special formula, after five or six weeks in the incubator at a uniform temperature of 37 degrees centigrade, is sterilized in an autoclave at 110 degrees centigrade; it is then concentrated in vacuo in the presence of sulphuric acid till the bulk of the culture is reduced to a tenth part of the original quantity, then passed through a specially designed Pasteur-Chamberland porcelain filter under an air pressure of about 400 pounds on the square inch, which strains all the remains of the dead bacilli from the liquid, and afterwards kept in well stoppered bottles and protected from light and heat. As the original culture contained 5 per cent. of glycerine, the evaporated product contains about 50 per cent., which explains why it retains its activity for so long. During the inoculation of a large number of flasks of nutrient media on different occasions, the number of tubercle bacilli introduced cannot possibly be the same in quantity for every flask; it therefore naturally follows that there must be a corresponding difference in the quantity and quality of the tuberculin produced. This difficulty can only be overcome by the delicate operation of "standardising," which is carried out by injection of the tuberculin into healthy guinea-pigs.

On the Use of Tuberculin.—The injection of tuberculin in recognized standard quantities is always inocuous; performed on milking cows, it in no way affects either the quantity or quality of the milk produced, and it in no way interferes with gestation, even in animals about to calve. The usual practice in applying tuberculin as a means of diagnosing tubercolosis in cattle is first of all to determine the normal temperature of the animal, which is done by the use of the clinical thermometer. For ordinary purposes tuberculin is employed diluted to the extent of one-tenth in carbolized water, 5 per 1000. The best plan is to inject at one time beneath the skin behind the shoulder 3 to 4 cubic centimetres of the dilution (3 cubic centimetres for cows of medium size, $3\frac{1}{2}$ for large cows, and 4 for bulls and high-class animals). The temperature of the animal must be taken before the injection, which in general practice it is usually desirable to make about 6 p.m. The temperature of the suspected animal is taken again next morning at 6 o'clock, then at 9 a.m., 12 noon, 3 p.m., and the last one at 6 p.m. The diagnostic reaction is measured by the difference between the initial normal temperature, which is about 101·5 Farenheit, and the highest temperature recorded after injection. If this difference exceeds 1·5 Cent., equal to 2·7 degrees Fahr., it may be affirmed that the animal is tuberculous. It may happen that the animal at the time of the proposed injection is feverish. This is caused often enough by hot weather, excitement, or by some passing irregularity of the digestive functions, and other physiological changes. It is better in such cases to defer the operation. It is important also to remember that in very tuberculous animals, those especially which are phthisical in the proper sense of the word, the injection of tuberculin may produce no rise of temperature whatsoever; but there is no difficulty in these cases, as the clinical diagnosis is always very easy.

As an example of the certainty of Tuberculin as a means of diagnosing tubercolosis in cattle, I will refer to the testing of the historical *Althorp Park* herd of high-class pedigree Jerseys, belonging to Lord Spencer. In September, 1893. Prof. M'Fadyean, of the Royal Veterinary College, London, paid a visit to Althorp Park in order to inspect the herd, as two (2) of the animals were reported to have died a short time previously from tuberculosis. The herd comprised 18 cows, 1 bull, and 4 yearling heifers. On clinical examination only one of the animals was suspected, viz., a cow in which there was a distinct enlargement of one of the pharyngeal-lymphatic glands. In none of the animals were the respiratory movements notably disturbed. The man in charge reported that all the animals fed well, and that he had not observed that any of them had a cough. With one exception, the general condition of every animal in the herd was excellent, and this exception was the cow referred to, which was 13 years old. The result of Prof. M'Fadyean's examination may be summed up by saying that certainly in not more than one of the 23 animals could he, with any degree of confidence, have diagnosed tuberculosis. But, since two members of the herd had recently died from tuberculosis, there was a very strong presumption that more than one or two of the survivors must have become infected, and the only hope of saving the yet healthy individuals lay in being able to "weed out" these infected animals. Ordinary clinical examination being then of little service, the case appeared to be one eminently suitable for the employment of the tuberculin test, which Lord Spencer promptly consented to have carried out. The general result of the injection of tuberculin was truly startling, for it appeared that not a single animal was free from the disease. As a preliminary test of the accuracy of the indication afforded by the tuberculin, two (2) of the animals, although in excellent condition, but showing a more pronounced reaction in temperature, were killed, and on post-mortem examination a number of tuberculous lesions were found. This discovery of tuberculosis in two (2) of the healthiest looking animals indicated a most serious degree of contamination of the herd, and Lord Spencer accordingly decided to have the remaining animals slaughtered. This was carried out, and a careful post-mortem examination of each animal revealed the fact that every animal was affected with some manifestation of tuberculosis, thus proving the absolute certainty of tuberculin as an aid in the diagnosis of tuberculosis in cattle.

Another exceedingly interesting experiment is that carried out on the herd at the *Agricultural Experimental Station* in Vermont, U.S.A., by F. A. Rich, State Veterinarian. The herd consisted of 21 Jerseys, 6 Ayrshires, and 6 Holsteins—33 head head altogether, including 3 bulls, 24 cows, and 5 calves. In January, 1894, Mr. Rich made a physical examination of the herd, and found in two (2) cows symptoms which might be taken for tuberculosis, and as it was suspected that some af the other animals might be affected, it was decided to test the entire herd with tuberculin, which was accordingly carried out, with the result that the 3 bulls, 16 cows, and 2 calves, a total of 21 animals, being nearly 64 per cent. of the entire herd, reacted to the tuberculin, and it is still more interesting to know that, although most of the animals which reacted were in splendid condition and giving a large supply of milk, they were ordered to be slaughtered, and the post-mortem examination confirmed the tuberculin test without exception. The remaining healthy animals were at once removed to another shed, while the infected one was thoroughly washed with hot water. Following this, every square inch of wood-work was sprayed with a solution of corrosive sublimate (1 to 1000), and then 125 pounds of sulphur was burned in the tightly-closed shed and cellar beneath. This being done, all the wood-work of the mangers and in front of the stanchions was torn out and replaced with new, after which the double sterilization with corrosive sublimate and sulphur was repeated, and the shed once again used for housing cattle. Six (6) months later 18 grade Jersey cattle were purchased from various herds and subjected to the tuberculin tests. All of these animals were found to be free from tuberculosis, but it was definitely decided to test these and the remaining healthy animals of the original herd every six months. It was the aim of the station to make its former herd of moderate priced animals produce from 350 to 400 pounds per cow per annum by such methods as any dairyman might use. The Board of Control of the station state it is again their intention to seek the same end, and at the same time to keep the herd healthy by the free application of the tuberculin test. Here is an object lesson and an example which dairy farmers in Queensland should follow, but I say unhesitatingly that the matter should be first initiated and placed on a firm basis by our Agricultural College at Gatton.

The insidious nature of tuberculosis, Prof. Walley says, has much to do with the comparative slowness with which public attention has been directed to it, but the strides which it has made and the hold it has gained on our stock renders it one of the most important questions affecting the future well-being of the bovine species. Looking at an individual tubercle bacillus, we might be led to despise its comparative insignificance, and to ignore its deadly meaning; but when we know that thousands upon thousands of these micro-organisms exist in the body of a single animal, a truth is forced upon our minds, which we cannot refuse to recognise—viz., that we have to deal with an insidious, implacable, and deadly foe, and independently of its ultimate fatality it may be said with safety that there is no disease known to the pathologist which gives rise to so many functional derangements. Contagious pleuro-pneumonia, foot and mouth disease, rinderpest, and tick fever are each in their turns terrible scourges. Are they greater scourges than tuberculosis? I think not, for although they sweep their victims off in a manner which is seen by all there is not that vast deterioration and slow but certain decimation of many of our best herds, the wholesale destruction of human food, and the danger, as is now proved, to human life and human comfort, and the insidious progress of that fell destroyer, tuberculosis, the ravages of which are only realised by those whose duties are connected with public abattoirs and meat works, or are called upon to act as arbiters on the nature of the disease. It is an extremely sad commentary on these remarks that Prof. Walley himself has died from tuberculosis, acquired several years ago by inoculation in connection with his profession.

The more we know about tuberculosis, the more alarmed we become at the appalling extent of this disease among cattle. In Denmark alone, during the last five years, Bang has tested with tuberculin upwards of 75,000 head of cattle, and of this number no less than 29,775 (39·7 per cent.) were found to be affected with tuberculosis, which will give a fair idea of what hold the disease has on the cattle of Europe.

Although Australia and New Zealand are not so seriously affected as the older countries of Europe, the returns from the abattoirs and meat works under Government veterinary inspection, an the results of occasional examinations with tuberculin on stud and dairy cattle, show that the disease has obtained a foothold in these colonies and is now causing considerable loss. When we consider what marvellous results Bang has achieved during the last five (5) years by means of the free application of tuberculin test, in gradually eradicating tuberculosis from the dairy herds of Denmark, and the decisive action taken in France, Germany and America, and recently in Great Britain, in their endeavours to stamp out tuberculosis, it is not unreasonable to ask the stock-owners of Australia to work in harmony and co-operate in making a desperate crusade against what is universally acknowledged to be the most serious of all diseases in cattle—viz., tuberculosis—in the first place by the free and constant use of tuberculin, and secondly by using only that pleuro virus which has withstood the bacteriological test. It is extremely gratifying to know that the demand for pure pleuro virus from the Stock Institute is considerably on the increase, and that the tuberculin test is gradually being taken up by the breeders of stud cattle and some of our dairy farmers, but, in order to make both systems perfect, we necessarily require some legislative action.

The study of bacteriology is so interesting and important, and opens up such a wide field for speculation and research, that I must be pardoned for having dealt with it in more detail than perhaps the compass of this address would warrant; but I trust that I have proved to you the stockowners' indebtedness to the microscope, and that all those marvellous and brilliant discoveries relating to the origin, nature, prevention, and treatment of bacterial diseases of our domesticated animals have been mainly brought about by the investigations of such brilliant epoch-making men as Pasteur, Koch, and Lister, whose names will ever be associated with the microscope and remain as lasting monuments to the science of Preventive Medicine.

A vote of thanks was accorded the retiring President for his address, which it was decided should be printed in the Society's Proceedings.

The Election of Officers for the ensuing year 1898, then took place with the following result:—*Hon. Treasurer*, Hon. A. Norton, M.L.C.; *Hon. Secretary*, J. F. Bailey; *Members of Council*, F. M. Bailey, F.L.S,, W. J. Byram, R. Edwards, C. J. Pound, F.R.M.S., and J. Shirley, B.Sc., *Hon. Auditor*, A. J. Turner.

(Owing to informalities occurring in the nominations for President and Vice-President the election for these offices was postponed for one month, when S. B. J. Skertchly and J. W. Sutton were elected respectively.)

A vote of thanks was accorded to the retiring officers, and the proceedings then terminated.

END OF VOLUME XIII.

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NOTE ON BEES AND WAX SCALES.

[*Meeting of the Royal Society of Queensland, 19th March, 1898.*]

Mr. J. Shirley, B.Sc., stated that while waiting outside the Beenleigh Post Office recently he noticed a loud humming of bees from two shade trees in front of the building, and looking at the trees observed that they were neither in flower nor fruit. The leaves of both trees were covered with the common pink wax scale, and he found that the bees were passing from scale to scale and working at them just as they work in collecting pollen from the anthers of flowers. Plucking some of the leaves he found the scales scraped quite thin, and the bees were flying away with balls of wax carried as the pollen masses are usually carried.

During a short discussion Mr. Illidge said that a caterpillar of a moth feeds on these scales; but he had never heard of bees making use of them, and considered Mr. Shirley's discovery of great importance.

In connection with this matter Dr. T. L. Bancroft writes:— "I saw the notice in the *Courier* of your discovery regarding honey bees devouring wax scale. I had myself made the same discovery in a garden near Redcliffe in June, 1896, and communicated the fact to Mr. H. Tryon. With a dozen or so hives of bees, I believe any garden might be rid to a great extent, if not wholly, of the wax scale."

In acknowledging advice as to Dr. Bancroft's discovery, Mr. H. Tryon, on 19th June, 1896, remarks:—"With regard to the information contained in your letter of 11th June, I may say that I was very much interested in your discovery *re* the relation subsisting between *Ceroplastes* and bees. The fact mentioned is quite new to me, though I have seen the waxen tests torn open as you describe. I am dubious, however, as to bees destroying *Ceroplastes* to any extent."

but this is not the case. The wood-cells produced in spring are larger and have thinner walls than those produced in autumn, and this makes visible the line of junction of the woods of different seasons when viewed in a transverse section.

Although the wood of Coniferæ is devoid of vessels, it may contain resin canals, each surrounded by a layer of thin-walled secreting cells.

It is not possible to determine to what genus of plants a fossil coniferous wood belongs. For palæontological purposes all fossil woods of this family are divided into five sections. The first includes the allies of the bunya and Norfolk pine; the second the allies of the cypress and the common pine; the third the firs, larches, and their relations; the fourth the cedars; the fifth the yews. The first are distinguished by the arrangement of the bordered pits, which form oblique lines on each cell. In the other classes, except the fifth, the pits form horizontal rows. The second class is distinguished by its resin cells, the third by the possession of resin cells and resin canals, and the fifth by the spiral strengthening fibres in each cell.

The New Guinea fossil shows the presence of numerous resin canals, and therefore belongs to the third class, known to geologists as the Pityoxylon or pine-wood family. From its resemblance to a fossil larch figured by Renault in plate 18, fig. 10, Quatriéme Année, it has been called Pityoxylon Palæolarix, *Shirley*.

For the photographs in illustration of the description I am indebted to Dr. John Thomson, of Brisbane. The drawings on stone were made by Mr. F. J. Elliot.

Pityoxylon Palæolarix (n. sp.).—Annual zones indistinct; tracheides thick-walled; marked by 1-4 rows of round bordered pits, in parallel, horizontal rows: resin canals numerous, large, with special cellular lining tissue, in transverse section oval or circular, when oval with line joining the poles parallel to the medullary rays.

Habitat: Mount Astrolabe, New Guinea; Sir W. Macgregor, M.D., K.C.M.G.

NEW INVESTIGATIONS ON RICKETS AND MACROZAMIA.

By JOSEPH LAUTERER, M.D., J.P.

[*Read before the Royal Society of Queensland, 20th August, 1898.*]

GREAT difficulties have been and are still met with in investigating the nature of disorders of the human body. During the last two decenniums a vast and altogether astonishing progress has been made in recognizing the true cause of many diseases for which the science of former times could not account at all. When I was attending the medical schools nobody believed in the possibility of transmitting tuberculosis from one individual to another, and when I was travelling in Norway in 1879 the highest authorities there would not believe that leprosy was a contagious disease. The presence of microbes, revealed by new methods of investigation, that is to say by staining and oil immersion has put the question in an altogether different light, the wonderfully quick propagation of the Schizomycetes and especially of the Bacteria by longitudinal section having been known from the researches of Tulasne and of my renowned teacher De Bary. New ways were looked for in conquering the diseases and they were found. The anti-toxic treatment, started in France and Germany, gave results acknowledged especially in diphtheria. Mistakes occurred of course here and there like in all human investigations. A special virtue for instance was supposed to be contained in the serum of the glandula thyreoidea, as it was found most effective in the treatment of Struma, Myxoedema, and even in secondary Syphilis, and only two years ago it was discovered by Prof. Baumann of Freiburg, my native town, that the active principle is nothing else but Iodine contained in the serum of the gland combined with an albuminoid as Thyreoiodine, easily accessible to the system by this combination.

Besides the Schizomycetes another sway of organisms representing amoeboid bodies, and classed before Haeckel's times in the animal kingdom, intrude the human body causing disease. Laveran, a French military surgeon in Algeria, discovered in 1880 the true cause of malarial fever in the shape of an amoeboid organism, very inadequately named "Plasmodium" (a term already given by De Bary to the Myxomycetes). The most different symptoms are produced by the intrusion of these amoeboids in the human body from simple intermittent neuralgies of the forehead to the Perniciosas, which are apt to stop our earthly career by one single attack of fever.

The occurrence of Malaria is not restricted to swampy places or to low-lying marsh ground. The dry mountain plains of the Andes are infested with Malaria, and at my old home, the western slopes of the Black Forest, with their highly cultivated ground stretching away towards the banks of the Rhine, claim still now human sacrificies by malarial Anaemia.

The glorious knowledge of human diseases alluded to here has been obtained only in the lapse of the last twenty years by the combined efforts of all civilized nations, and by a tremendous amount of work done by the higher and lower order of investigators.

Still greater difficulties await the scientist who undertakes the task of elucidating the nature of those dumb creatures, the animals, which cannot tell us where and how they suffer, which only can complain in a rude manner and which, if not understood, can only lie down and die. Many diseases are common to the animals and to the human beings. Tuberculosis propagated by Koch's Bacillus is one of these widely spread scourges of the mammals. Influenza and Typhoid have a wide range too. Ruminants are highly disposed to Anthrax or Splenic fever, the bacillus of which disease is apt to intrude human beings and to kill them. Horses are specially subjected to the "Glanders" or Malleus, transferable to human beings too.

Other diseases like pleuro pneumonia attack only animals, and are not intruding the human body at all, whereas some animals are gifted with great immunity against human diseases as for instance the horse enjoys immunity against Löffler's bacillus of diphtheria.

Like in the human beings the fungi as generators of disease have the amoeboids as their competitors in diseases of the animals. The tick disease of Eastern Australia which has given so much work to our renowned investigators, Mr. Pound and Dr. Hunt, is the best known instance of a disorder caused by an amoeboid, discovered in 1889 by Th. Smith, in Texas, and very inappropriately named by him Pyrosoma bigeminum (as the name Pyrosoma has already been taken by Savigny for a genus of the Coelenteratae).

Like the malaria of human beings it is not restricted to swampy plains, or low-lying countries. According to the newest informations obtained from my old home the cattle disease called red-water occurring in the Black Forest, and seen by me many times is caused by the Pyrosoma, just in the same way as the tick disease in Queensland. In many countries the disease is complicated by the interference of an insect which acts as a kind of inoculator, or commission agent of the sickness. In Germany there are no ticks connected with it, but in the summer innumerable hosts of large stinging flies come out of their haunts at eleven o'clock in the forenoon to suck the blood from cattle and horses, so that nobody is able to keep them out of the stables at that hour. With high elated tails they jump away from their tormentors to seek the shadow, where only a few of the insects follow them. Very likely these flies take the role of the Queensland and Texas ticks, and harbour the amoebae in their body to transfer them or their sporules on new hosts.

With all this knowledge on hand every thinking observer is apt to refer an epidemic of any disease to the action of a contagium animatum, of a living contagion or infection. Now, there exists in Australia, in epidemics, a cattle disease called by stock people the Rickets or Wobbles, a disease manifesting itself first by a staggering gait, arched back and elevated tail, then showing its progress by paresis or incomplete paralysis of the hind legs, and the sphincters of anus and bladder ending sometimes in recovery, but more often in death by exhaustion, loss of appetite and inability to get nourishment.

In fact, the disease called by the misnomer "Rickets" has nothing to do with the bone disorder known as "Rachitis," but presents exactly the symptoms of spinal Meningitis, or progressive paralysis. This diagnosis is confirmed by the presence of an effusion inside of the Pia Mater of the spinal marrow. Now, sporadic or truly idiopathic spinal Meningitis is a disease for which cattle show a very pronounced disposition in all countries, and which has been seen by me in Europe many times, but never in an epidemic form. On the contrary the wobbles in Australia have mostly been observed as epidemics attacking many individuals on one run.

The Australian disease called Wobbles, therefore, can only be :—

(1) Either idiopathic spinal Meningitis induced by the same cause in a number of cattle living under the same circumstances.

(2) Or, it is symptomatic spinal Meningitis caused by some microbic infection without being contagious by ordinary means similar to Malaria in man.

(3) Or, it is symptomatic spinal Meningitis caused by some contagium animatum spreading from one individual to another.

Already, many years ago, Dr. T. L. Bancroft, now of Burpengary, a very skilled bacteriologist, has worked on the disease searching for a micro-organism, but in every case he got a negative result. It seems likely, therefore, that the wobbles have nothing to do with infection or contagion, still negative results are not strictly and definitely proving. How long was for instance the microbe of tuberculosis looked after till it was really found? Did not Schuler in 1877 publish a book, where he is of the *bonâ fide* opinion to have discovered a Micrococcus as the true cause of Tuberculosis?; and how that discovery ran through the periodicals of that time!

Still we have no evidence of a microbe in wobbles, and so the only possibility is to look at them as idiopathic spinal Meningitis caused by the circumstances in which the cattle live. Bad food, or poisonous food could deteriorate the constitution of the animal, and its high disposition for Meningitis spinalis might then bring the disease on. As the wobbles are very prevalent in Western Australia the first investigations have been undertaken there. A very able series of experiments has been conducted by Mr. H. H. Edwards, Government Veterinary Surgeon, and the results published in the Agricultural Journal of Western Australia in 1894.

Nothing else is put down there as the cause of the Wobbles than the poisonous effect of Macrozamia leaves eaten by the cattle. Edwards could produce the Wobbles at any time by feeding the penned cattle with chaffed Macrozamia leaves and the degree of the disease was in straight proportion to the amount of Macrozamia given and to the time taken by the experiment.

There are only two objections to Mr. Edwards' skillful investigations.

(1) That no poisonous body was found in Macrozamia leaves up to the date of his experiments.

(2) That in my opinion there exists no organic poison which is likely to produce spinal Meningitis with serous infusion.

To elucidate these two points I started my investigations three years ago with the following results :—

The Macrozamia leaves, especially those of Macrozamia spiralis, contain at certain times of the year a considerable amount of a poisonous resin, insoluble in cold water, slightly soluble in hot water and alcohol, and very soluble in ether, by means of which it can be shaken out of a warm watery infusion. All efforts to obtain this resinous principle in a crystallized form have been hitherto unsuccessful, and microsublimation gave only the products of dry distillation. Therefore, no elementary analysis was tried, as all available poison has been used for experiments on small animals and cattle, to be mentioned later on. The time when the poisonous resin is found in the leaves coincides with the period of flowering and fructification. The nuts contain a much larger quantity of it than the leaves, and it has been known long ago that people eating them have been seized with violent vomiting and purging, the symtoms of Gastroenteritis, which, in the worst cases, was even followed by death. The thick half-subterranean stem contains, like the nuts, a large amount of starch besides the poisonous resin, and it is a very noteworthy fact that the aboriginals have never used for food the starch hoarded in the Macrozamia stems, whereas they eat everywhere the flour prepared from the poisonous Colocasia root.

The poisonous Macrozamia resin must not be confounded with the inert gum exuded by the peduncle of Macrozamia cones when freshly cut, which gum also collects in the cavity of the stem when the head of the plant is cut off. The gum has already been analysed by Mr. Maiden. It consists of colourless pearly, tough and hard, tears, and swells very much in water, but nothing is dissolved of it, not even if the water is boiled. Diluted caustic potash solution and diluted hydrochloric acid dissolve the gum on boiling. Ferric chloride does not coagulate or gelatinize this solution of metarabin.

At some times of the year the Macrozamia leaves are altogether free from poison. This fact is not astonishing at all, as there are similar instances in this country. Some time ago the author proved that many wattles, like Acacia Cunninghamii and Acacia penninervis, at the period of fructification are highly poisonous owing to a large amount of Saponin contained in the unripe pods and in the leaves, whereas, at other times, the saponin is practically absent, its place being taken up by catechutannic acid. Another instance is given by the amount of alkaloids contained in Duboisia leaves. This was so small in samples collected and examined by me in July, 1895, that a strong infusion did not give a precipitate with tannin although it was able to produce mydriasis in a cat's eye.

Another fact in connection with principles obtained from plants has to be mentioned here, the dependence of the plant from the soil on which it grows and from the climate under the influence of which it lives. Professor Rennie, of Adelaide, has published in one of the proceedings of the Advancement of Science a short paper stating the occurrence of a large amount of Aesculin in the leaves of Bursaria spinosa, a tiny shrub also common in the Moreton Bay district. He states this beautiful fluorescent body to be so plentiful in the leaves, that one could be induced to believe the lovely coloration of the blue crater lake on Mount Gambier was caused by the Aesculin derived from the leaves fallen in the lake from Bursaria spinosa growing abundantly on the slopes of the old volcano. Now, Bursaria spinosa from the Moreton Bay district does not contain the slightest trace of Aesculin at any time of the year, as I am positively certain by the examination of a large quantity of Bursaria leaves identified by our renowned Colonial Botanist, F. M. Bailey.

In a similar way Mr. Umney, in the Pharmaceutical Journal, England, has stated that essential oils obtained from plants grown in America are for instance dextrogyrate, whereas the oil derived from exactly the same variety cultivated in Europe may be laevogyrate. All this must be taken into consideration when the results of scientific workers in different countries are compared together, and judged respecting their positive value.

As to the toxicological action of the poisonous Macrozamia resin it did, in all guinea pigs and cats experimented upon, only produce the symptoms of Gastroenteritis followed by death when administered internally and of local irritation, phlegmone and suppuration when locally injected.

As the Government allowed me to extend my experiments on young cattle in good condition I tried to elucidate the second point which can be objected to Mr. Edwards' experiments, namely, that it is not likely for any organic poison to produce spinal Meningitis with effusion directly.

Mr. Pound had the kindness to watch the experiments with me.

On the Quarantine Station, in Indooroopilly, of three calves the first one was fed with good lucerne chaff to which about eight pounds per day of finely cut leaves of partly flowering specimens of Macrozamia spiralis were added. At first it ate its rations well and showed no difficulty at all in chewing and swallowing the rough material. After the third day it lost the appetite completely and would not eat any more Macrozamia. It ate the pure lucerne for another day and then stopped eating altogether. It died on the fifth day and the post-mortem examination conducted by me and the very obliging and able caretaker, Mr. Beck, revealed only the symptoms of Gastroenteritis. During the lifetime of the calf no distinctly pronounced symptoms of the wobbles were observed.

The second calf declined to eat Macrozamia on the fifth day, and lived on lucerne the next two days. Then it would not eat more and staggered, but perhaps only from weaknees as it died on the tenth day. The post-mortem showed the whole stomach inflamed, red and softened inside.

The third calf got only six pounds of Macrozamia per day which it ate for six days. Then it was turned out in the yard as it would eat no longer. It eat then of the green pasturage, walked slowly but with no pronounced symptoms of the wobbles and was found dead in the yard on the tenth day, showing the gastroenteritic alterations in the alimentary canal like the other two calves, but no signs of spinal Meningitis.

The chief results of the the work done by me can be summarised as follows:—

1. There is no doubt of the Macrozamia being highly poisonous, at least at certain times of the year.

2. The wobbles are not produced directly by the Macrozamia poison as no spinal Meningitis with effusion was produced by my experiments.

3. Taking into consideration the high disposition of cattle for idiopathic spinal Meningitis, the lesions of the alimentary canal produced by the irritant Macrozamia poison might through inanition lead to the form of spinal meningitis known as wobbles.

Two cardinal points have still to be elucidated, namely the questions:—

1. Do cattle in the open bush really eat Macrozamia leaves? In my experiments they seem to be disgusted with it on the second day.

2. Do wobbles occur only in places where Macrozamias are plentiful?

As the well-known enthusiast, Dr. Hunt, has givem me to understand that he will start a new series of investigations, I lay this paper in his hands not being willing for additional research on the object.

My thanks are due to Mr. P. R. Gordon, Chief Inspector of Stock, to Mr. C. J. Pound, Director of Stock Institute, and to Mr. Beck, the Quarantine keeper.

NOTES ON THE VEGETATION OF NEW GUINEA.

By F. MANSON BAILEY, F.L.S.

[*Read before the Royal Society of Queensland, 20th August, 1898.*]

In the hope that it may be of interest to the botanical portion of the Society's members I have sketched out a few stray notes on the plant life of British New Guinea, observed during a recent visit with his Excellency Lord Lamington's party to that place. First, it struck me that the plants of this large island resembled the natives in one thing, namely—as it would be hard to find one of the latter with a clean skin, all of them being more or less covered by skin disease, so the plants are nearly all infested with various kinds of insect and fungus blights. The vegetation, however, even under this great disadvantage, makes in all directions most vigorous growth, but, so far as I was able to judge, not a timber growth. I come to this conclusion from specimens which have been forwarded to me for determination during late years, from the various published accounts of other botanists, and from my own observations. Likewise, the grasses are, as compared with Queensland, few in variety, and are for the most part coarse kinds, the better ones only being seen here and there in small isolated plots. A large number of the trees and shrubs, as well as plants of smaller growth, are identical with those met with in tropical Queensland. These, as one might expect in such a moist climate, have in many instances much larger foliage, and the variegated kinds are of a much brighter colouring, than one meets with on the same species grown even in bush or hot houses. My visits to the land were only close to the beach, excepting one trip for about six miles up the Mambare River, and here the scrub was so dense that it was quite impossible to penetrate more than a few yards from the river. The scenery was grand in the extreme, and for its striking beauty was, in a great measure, indebted to the great variety of palms, but not being able to procure fruits I could only guess at even the genera to which they belonged. I was particularly taken, in more senses than one, by a grand "lawyer cane," a species of Korthalsia—a genus, so far as at present known, not belonging to Australia. It is in all probability K. Zippelii, *Blume*, but the plants were neither in flower or fruit at the time. The growth is far handsomer than any of the Queensland lawyer-canes (Calamus), its stems are rather stout, and although climbing, run up erect at some distance from the trunk of the tree it climbs—thus, when viewed from a distance its stem appears independent of the tree. The leaves are simply-pinnate, very long, bearing alternate or sub-opposite, flabellate, cuneate, plicate leaflets, often exceeding 10in. in length, enlarging gradually from the base to a width of 6in., with entire margins, then tapering to an elongated point, the sides of which are irregularly jagged or sharply toothed, the whole under side of the leaflets white. Rhachis brown, armed with distant, recurved prickles in threes or twos, alternating with which are others of smaller size. Each leaf is terminated with a long thong bearing similar prickles, but more closely set on the rhachis. On the bank of this river I saw the only fern-tree met with during the trip. The trunk was about 12ft. high, but after spending some time in obtaining specimens it was found to be only a form of our common species—Alsophila australis, *R. Br.* The absence of fern-trees along the coast is only what one would expect, as these plants are usually found in the gully-scrubs, often some distance from the coast. Near the mouth of the river was a very dense growth of that historic palm Nipa fruticans, *Wurmb.*, with fruit-heads nearly 1½ft. in diameter, of a rich glossy brown colour; the leaves, however, did not attain the height ascribed to them in other parts of the tropics. I could not hear of the natives using the fruit as food, but the leaves are used for thatching most of their houses on the coast. On the wide sandy beach of the bay into which the Mambare River empties one may pick up a large collection of both flowers and fruit, but it was of only a very few that I could find the trees or shrubs from which they had fallen. Many, doubtless, had been brought down the river and washed up by the tides. At the time of our visit a fruit closely resembling, in colour and shape, an orange, was very abundant. This proved to belong to Tabernæmontana aurantiaca, *Gaud.* The flowers of this plant were afterwards obtained at the Musa River. Another interesting fruit was a large fig which grew in clusters. The larger fruits measured 2½in. in diameter, on stalks fully 1½in. long. In shape it somewhat resembled a bergamot pear, only that the top was deeply concave. The colour when fresh was greenish-brown, with numerous rather broad, red, longitudinal stripes. There were also fruits of several palms, one of which—probably belonging to Orania aruensis, *Becc.*—was a round red ball, about 2in. or 3in. in diameter. Among the flowers picked up were some of an Elœocarpus, which were often quite perfect; thus I was enabled to make out the following description, which may assist in identifying the species when some one more fortunate than I may meet with the tree. The individual flower reminds one of the North Queensland species E. Bancroftii, *Bail.*, the Johnstone River almond—sepals five, white, lanceolate, ½in. long; petals five, yellowish with a tinge of green, cuneate, about an inch long, ending in three broad crenulate teeth; texture thick, stamens numerous, filaments shortly hairy; anthers long, opening in a terminal pore, and furnished with a long and a short (or sometimes only one) bristle; ovary velvety, style subulate, nearly as long as the corolla. Here, as in many other parts of the coast, the common shea-oak, Casuarina equisetifolia, *Forst.*, forms a graceful upright tree of 60 or more feet, which from the deck of the Merrie England had all the appearance of cypress pines. I noticed also that in this locality our common coast tree, Hibiscus tiliaceus, *Linn.*—"Talwalpin" of the Moreton Bay natives—forms tall erect trunks. Among the climbing plants which were weighing down the shrubs I observed here and there plants of a form very near the normal of Mucuna pruriens, *DC.*, the cowhage, besides others of the same genus. At the Ope River some of the party brought on board the steamer a specimen of the "green-light fungus," Hiatula Wynniæ, *B. and Br.* This beautiful object gave out its faint green light again as soon as night set in, and was a source of wonder and delight to those who had not previously seen it. The species is not of frequent occurrence. The Papuans are evidently very fond of bright showy colours, and we always found plants of this character planted near their houses. Some of these may be indigenous, but I have grave doubts as to others, although they may be recorded as such by botanists who have written upon the New Guinea flora. The mistakes have likely occurred owing to the missionaries who have sent specimens to the botanists not seeing the necessity of mentioning whether the particular specimens were taken from indigenous or naturalised plants. I saw many of these plants in the villages, but never met with them even at a short distance from habitations. Among the species so recorded will be found Bryophyllum calycinum, *Salis.*; Hibiscus rosa-sinensis, *Linn.*, the common red hibiscus of our gardens; Flacourtia cataphracta, *Roxb.*, the puneala plum; Clitoria ternatea, *Linn.*; Cœsalpinia pulcherrima, *Sw.*, the flower fence; Nicotiana tabacum, *Linn.*, the cultivated tobacco; Gomphrena globosa, *Linn.*, the globe amaranth; Datura fastuosa, *Linn.*, the Proud Datura; Vinca rosea, *Linn.*, old maid; and many bright-coloured varieties of Amarantus. So far as I could see the natives pay but little attention to the cultivation of vegetables. The samples brought out in their canoes were poor and consisted of: Sweet potato, a variety of Ipomœa batatas, *Poir*; taro, Colocasia antiquorum, *Schott*; a yam, probably a form of Dioscorea sativa, *Linn.*; a very poor kind of pumpkin or vegetable marrow, Cucurbita var.; papaw, green and ripe, Carica Papaya, *Linn.*; bananas, Musa sp., which were the most insipid I had ever tasted; and at one place (Mugula) the natives brought on board a fruit evidently allied to the date plum, Diospyros Kaki, which possessed an agreeable flavour; they called it "Dedecal"; also a ginger, Zingiber officinalis, *var.*, rhizomes, of which I brought to Brisbane and handed to Mr. MacMahon, of the Botanic Gardens, as I consider it a variety which may prove worth cultivating. The following is my note on this ginger, made upon receiving it from the natives, who call it "Tarboia":—Leaves narrow, grass-like, 6 or more inches long, on rather slender stems $1\frac{1}{2}$ft. to 2ft. high. Scape shorter than the stem, bearing an elongated head 2 or 3 inches long, the broad imbricate bracts with a pink or blood-red margin at the upper end and a subulate point in the centre. Rhizomes very pungent and not very fibrous. Stems of sugar-cane were generally brought out in the canoes, but this was the only place where ginger was offered for barter. No canoes are ever without a supply of cocoanuts, Cocos nucifera, *Linn.* These and a dirty kind of sago and fish form the principal food of the natives. There are a number of varieties of the cocoanut, some differing in shape of fruits, others in the growth of the tree. This seems an apt opportunity for making a few remarks on cocoanut planting. I know that it is a pretty general belief that these trees will thrive on coast sands without fresh water—or, as it might be, brackish water—within reach of their roots. This, in my opinion, is decidedly an error, as very few plants will thrive under such conditions, and certainly not the cocoanut palm. When to the observer's eye such may appear to be the case, it will usually, if indeed not always, be found that there is an undercurrent, or a strata of the sandy soil saturated with fresh or brackish water, or that there is a frequent rainfall in the locality. With regard to planting the nuts, also, great care should be taken never to place them deep in the soil. I would recommend placing the nuts lengthwise, sunk in the soil for about half their transverse diameter, and to prevent them moving three or more stakes might be driven around each nut. Of course if the nuts have sprouted and formed roots before planting these latter should be spread out horizontally and covered with the sand or soil. Near one settlement we were taken to see a plantation of these trees which were not thriving satisfactorily. The cause was plainly due to bad planting, shallowness of sand over the coral, and therefore a scanty supply of fresh or brackish water. The sand had been removed down to the coral bed, say about $1\frac{1}{2}$ft. to 2ft., and the nuts placed upon the coral and covered with sand. The whole of the locality was low, with no sandy ridges where the rainfall could be stored up to supply the low-lying parts in time of need. From this plantation we were taken a short distance to see a clump of these trees near a hut, which were planted, I understood, about the same time as the former. These had made excellent growth and were bearing nuts. This our guide thought might be attributed to the effect of the smoke from the hut. It was, however, I consider, plainly due to situation. The soil also was better and of a far greater depth—thus was better prepared to store up the rainfall. In concluding this note I might add that at Samarai the healthiest and strongest cocoanut trees are those growing where coal had been stacked. While at Samarai Mr. W. E. Armit, a gentleman to whom I am indebted for many herbarium specimens of Papuan plants, pointed out to me two shrubs, one of which was densely stemmed and over 5ft. high. One of the plants had not lost it leaves, but the other was quite bear of foliage. Neither of the plants had flowers nor fruit, but I think it very probable that they belonged to Euphorbia neriifolia, *Linn.*, which is common in India and the Malay islands. Mr. Armit informed me that he met with this shrub a few years ago about 80 miles from Samarai and at about 40 miles from the coast, but whether growing at a village or out in the forest I forgot to inquire. If at the former, it might have been brought by some Malay men, as several of the species of this genus are used by them medicinally. The following is a descriptive note which I entered in my pocketbook as I stood by the shrub at Samarai:—Euphorbia sp. like E. neriifolia; trunk short, at the base 10in. in diameter, the erect thick branches spirally five-angled; stipular thorns in pairs, rather short. Leaves oblong-lanceolate, 3 or 4 inches long, articulate above the two stipulary thorns. Thorns persistent on the angles of the branches. It may be thought that in a paper like this mention should be made of the new or rare plants met with during the trip, but descriptions of many of these have appeared in the August number of the *Queensland Agricultural Journal*, and others will appear as opportunities occur for working out the specimens. Not many orchids were seen in bloom, but I have described several in the publication referred to. I also gave a list of the easily recognised species, which accompanied Sir Hugh Nelson's official report of the visit. I regret that proofs of this were not shown me before going to press, and many mistakes have occurred in the spelling of the scientific names. To accompany this paper I have mounted a few specimens of curious or interesting New Guinea plants. These are:—

Nasturtium indicum, *DC.*
Pterocarpus indica, *Willd.*, var.
Maniltoa Schefferi, *K. Sch.*
Gardinia Lamingtonii, *Bail.* New species
Neubergia musculiformis, *Miq.*
Justicia Gilligani, *Bail.* New species
Gnetum latifolium, *Blume.*
Davallia paralella, *Wal.*
Scolopendrium Mambare, *Bail.* New species.
Polypodium Annabella, *Forbes.*

LIFE HISTORY, &c., OF TIMBER MOTHS.

By ROWLAND ILLIDGE.

[*Read before the Royal Society of Queensland, 24th Sept., 1898.*]

In walking through the scrub and bush a close observer is frequently confronted by strange-looking patches on the sides of trees, generally on saplings of not more than from 2in. to 6in. or 8in. in diameter, though they may also be seen on large, or even very large trees. Now, if he be indeed a close observer, the question will naturally arise as to what these curious objects are, how they got there, and what purpose they serve. He will soon find that they are the webs of certain caterpillars living in holes or burrows behind them, and that they are formed by these caterpillars as a covering or protection from other insects.

In December, 1892, I read a paper before the Natural History Society of Queensland, which appeared in volume I. of their transactions, giving an account of the Xyloryctidae, one of the families of moths whose larvae have this singular habit. I propose now to give an account of the Hepialidae and Zeuzeridae, and to make comparison between them and the abovementioned, not at all, or at any rate, very distantly related, Xyloryctidae.

The Hepialidae, to begin with, are fairly numerous in Australia, being represented by many specially large and splendid insects, of which Leto Staceyi is the grandest and Charagia Ramsayi perhaps the most beautiful of all these moths that are known. The first of these in wing expansion measures about 8in., the second 5¼in. The Zeuzeridae are even more numerous in species, and of still greater size; but are not so readily observed during their various stages as are the hepialids, hence this paper will be directed more particularly to the latter. Our earlier Australian naturalists appear to have been acquainted with only one species, and that the comparatively small but beautiful Charagia lignivora, described by Lewin. It is only within quite recent times that our species have been made known to entomological science, and principally through Scott, of New South Wales.

The caterpillars of the hepialids belonging to the genus Charagia, all live in burrows, or in tunnels, in the wood of living trees, sometimes far up the stem, sometimes penetrating a considerable distance down into the root; but in the latter case with the opening into the chamber above ground, at the foot of the tree. Those of the genus Pielus, &c., are entirely subterranean, feeding upon roots.

Beginning with the ova, we will now proceed to follow them in their transformations. The eggs when extruded from the ovipositor of the moth are of a pale yellow colour, but soon turn of slaty gray hue; they are round and about the size of a pin's head. Many thousands must be contained in the abdominal cavity, for it is almost entirely filled with them. Nearly all the eggs laid are destroyed, probably almost at once falling a prey to ants and such like insects. Those that escape destruction are possibly such as have fallen into cracks and crannies in the bark of trees, where they remain until hatched out. Even of these the larger proportion again are soon devoured. The remnant that escape this fate at once commence boring into the bark, and thence into the wood of the tree. Immediately they begin to burrow into the wood the protective web is formed, and as they increase in size so also is the web enlarged to meet their necessities. The web is formed of silken threads interwoven with bits of bark and woody matter, and is gradually strengthened with the age of the insect until in many cases it becomes of a tough felty consistence, one or two species even blocking up the intervening space with their dejectamenta, and causing the covering to assume the form of a large knot in the tree stem. In the damp scrubs these soon become covered with moss, and are not readily discernible. If one of these webs is torn away, the insect when all is quiet, will be observed to come partly out of its burrow, make a survey of the damage done, and immediately commence repairs by again weaving a web backwards and forwards across the opening with considerable rapidity. This web will not be so strong and thick as the preceding one, but will be gradually strengthened afterwards, the creature being satisfied to rest for a space after having made temporary repairs to its fortifications.

The larvae as they increase in size must enlarge the chamber they occupy, and this their strong mandibles enable them readily to do. The Charagia make their tunnels downwards from the opening. Eudoxyla upwards. That of the Charagia seldom exceeds 10in. or a foot, except in the case of the eximia moth larva, where it extends downwards as much as 3ft. or more. The food may consist of the woody matter of the tree, but seems to consist also largely of the flowing sap. Having kept some of them for fifteen and eighteen months in the wood by immersing the ends in very wet sand or even water only, many of the sticks so immersed sent out long shoots, and the bark actually grew over the upper cut end, the lower sending out rootlets. In all these cases the insects thrived very well, whereas when the wood ceased to be living, no matter how moist it might be, they died. Now if they ate the wood much, the sticks would be so eaten out that nothing but shells would be left (many of the wood-eating larvae of coleoptera we have kept have done this, thus proving that the woody matter does constitute their food), whereas the burrow is only just large enough for them to move up and down in with ease; in fact, if too large they could not do so, for the body segments play the most important part in their movements herein. The burrow is usually full of sap, and the more there is of this the larger the insect will be. The drier burrows certainly do not produce such fine specimens, hence I conclude that the sap and not the wood forms the more important part of their food. They keep their burrows very clean, and eject all droppings. The only sound noticed made by the larvae is a peculiar ticking noise, seemingly done by knocking sharply with mandibles against side of tunnel. After having lived in the wood for from one to three years, according to the species, they prepare for pupation by sealing up the opening, each species having its own special way, some cutting off and removing all traces of the protective web. The kinds that do not bite away the original web first remove impediments between the hole and the web, then weaken it by gnawing out a circular space almost through, and lastly simply spin a fine silken network around the opening into the chamber, the pupa, not the moth, forcing its way through inner and outer webs when making the final change; whilst those that do remove it form a strong operculum. Having finished these preparations, in a few days the change takes place to the chrysalis, which is at first very pale in colour, but gradually changes until in about a month it assumes a pink hue, which again begins to turn until all the beautiful tints of the imago make their appearance through the thin diaphanous shell of the pupa. Having remained in the pupal state for from six weeks to occasionally as long as three months, the day arrives when it is to make its final transformation. For some days before it has been restless, rising up and down in its chamber by alternately extending and contracting the body segments. About an hour or so before sunset, generally between 3 and 5 o'clock, it finally forces itself through all its bulwarks, until only the last few segments of the body remain in the burrow, and thus form the fulcrum for the severe exertions of a critical period of its existence, for should it come too far, slip out and fall to the ground, as occasionally happens, it can only wriggle about, and is quite unable to effect its change. It begins now to bend itself backwards and forwards with a curious nodding motion until the integument over the back of the thorax bursts asunder, continuing the motion until it frees its head and legs, and bending over at right angles catches hold with its hooked feet upon some part of the stem, when with a quivering motion it pulls itself out of the pupa case, which is left sticking out of the hole. Swinging round, it drops into position with body hanging perpendicularly downward, its crumpled wings projecting outwards; these begin almost immediately to expand. In about half-an-hour being fully expanded, they are suddenly reflexed, and the moth then assumes a somewhat leaf-like aspect, remaining quiescent until just before dusk, when its wings are sufficiently strong for flight. The flight of the male is much stronger than that of the female, which being very heavily laden with eggs is somewhat sluggish. Males which have occasionally escaped always fly very swiftly obliquely upwards until out of sight; females generally horizontally or downwards, and are usually recaptured. If left in the rearing cages, they very soon knock themselves to pieces by flying heavily against the sides.

Amongst special adornments of these fine insects must be mentioned the beautiful feathery like tufts on the posterior tibiae of the males.

Many of the species of Charagia (in the males only) are possessed of scent glands. The daphnandra moth is particularly noteworthy in this respect, as it exhales a most fragrant perfume, and is very pleasant to handle. Unfortunately a few weeks after death this quite disappears, but all the time it remains in the setting boxes to dry, and for some time after, the odour is very apparent on opening them, and is somewhat like attar of roses. Not so is this the case, however, with the superb Ramsay's hepialid, the odour of which has a disagreeable goat-like smell.

The disease with which these insects are chiefly affected is a fungus known as "vegetable caterpillar," which changes all the tissues of the creature into a cork-like substance, and completely and naturally mummifies them in their chambers. The fungus spreading outwardly from the entrance assumes an inverted umbrella-like form, and is almost snowy white. It attacks both caterpillar and chrysalis, and so prevalent was this disease a couple of years back (about 1895 or 1896) that I not only lost quite three-fourths of my specimens in process of rearing, but found the same state of affairs amongst them in their natural haunts, especially so in the scrubs. By placing some portions of this fungus inside the web of a healthy caterpillar the disease is communicable with certainty, and it is also dangerous to allow any infected ones to remain in the receptacles with healthy specimens.

Enemies are fairly numerous, but unlike the Xylorycts, the Hepialids do not appear to suffer from the attacks of ichneumons. Amongst birds, black cockatoos are fond of them, and tear away the wood with their strong bills to get the larvae out. Opossums, especially the ringtail, will also gnaw away the wood in quest of these caterpillars, the bodies of which are very fat and succulent. The traces of bush rats also have been noted, so that it is suspected they are likewise toothsome morsels to these animals. However, they are safe enough in some woods from animals, for none seem to attack them in the daphnandra tree, which is hard, and probably poisonous. Another enemy of a more insidious character is the caterpillar of a small moth allied to or belonging to the Galleriadae (the bee moth group or family), which attacks the chrysalis immediately after the change from the larval state apparently (how it gets in at present requires elucidation). Its presence is known by a web of frass leading into the burrow through the operculum, which it has gnawed through at the edge. This moth is technically described by Dr. T. P. Lucas in the last Transactions of the Society under the name of Melissoblaptes parasiticus. Amongst other foes must also be mentioned a clerid beetle, Natalis sp., the grub of which is occasionally found in dead and half-devoured larvae. In one of the boxes, in which were some pupae sealed up in the wood which had been brought home for the purpose of rearing out the huge gray goat moth, a still larger clerid beetle made its appearance, and a day or two later another was found, and as the moths did not come out it is probable these insects are parasitic upon them.

The Hepialidae, Zeuzeridae, Cossidae, and Xyloryctidae all make cylindrical chambers of various sizes in the wood of living trees, but, whereas in the first three closely-related families they do not leave these chambers until after the last transformation takes place, in the last the larva comes out at night time, and travels about in search of food, carrying leaves to its den to feed upon ; the others live either upon the woody tissue or the sappy matter of the tree. However, if not structurally related, some of the xylos approach very closely in habits to the hepialids, for at least one species has often misled me into the error of attaching it as a hepialid, for it spins a web like them, appears never to leave its burrow, feeds upon the sappy matter, and seals up with a similar operculum before pupating. Again, several species of xylos also have the pupa, though it does not protrude from the burrow, force away the operculum closing the entrance, as does Charagia and Eudoxyla, before changing to the imago. Also as there are forms amongst the Xyloryets which spin cocoons, so likewise have we such with some of the Zeuzeridae, probably all of the Cossidae, and those of the Hepialids that live upon roots underground.

The larvae of Eudoxyla, a genus of Zeuzeridae, are of gigantic size, their tunnels often are an inch, occasionally even much more, in diameter. and are usually excavated up the tree. They need no web, as they are protected by the chamber being cut off from the outside by the external wood of the tree, except for a small hole, until they are full grown, when they bore down to and through the outside surface in some species, others leaving a thin shell between themselves and the outer world. Those species, the ashy goat moth (E. cineraria), for example, that open up the external surface, before pupating, form, firstly, a curious frothy, sticky substance, and behind this a thick operculum, like a chemical gun wad almost, except that in many cases it would be much too large for any gun.

NOTES ON THE CATTLE TICK.

ITS DEVELOPMENT, LIFE HISTORY, HABITS, AND GEOGRAPHICAL DISTRIBUTION.

By C. J. POUND, F.R.M.S.

[*Read before the Royal Society of Queensland, 22nd October, 1898.*]

SINCE August, 1894, when I was first commissioned by the Government to visit the Gulf district of this colony in order to investigate and report upon a malignant disease, "redwater" (now known as tick fever) in cattle, I have had many opportunities under various conditions of circumstances of studying the habits and life history of the cattle tick, resulting in not a few interesting discoveries, some of which, I am pleased to say, have proved to be of more than passing value to numbers of stock-owners. In this paper I do not propose to discuss the nature of the disease which the tick primarily produces, or any details of the methods now in operation for its prevention, but simply confine my remarks to the subject of cattle ticks.

With regard to the life history, development, and habits of this particular species, I believe that I am correct in stating that we know more about it than we do of not only any other tick but any insect in the Southern Hemisphere, and yet, although we claim to know so much, we are every day making some new discoveries—in fact, the whole subject appears to be practically inexhaustible.

GEOGRAPHICAL DISTRIBUTION.

According to Cooper Curtice, the original home of the cattle tick is in Northern Africa. This assumption he bases upon the fact of having compared ticks taken from Egyptian Cattle with *Ixodes bovis*, and finding no specific difference between the males and females received from Egypt and the two sexes of *Ixodes bovis*, and, he adds, that in stocking America "cattle were introduced from at least two directions – one from Northern Europe into the Northern half of the States, the other from Spain, through the West Indies, into Mexico and the Spanish settlements of North and South America. The presence of the tick in Spain is not known, but on account of the latters old-time relation with Northern Africa it may be suspected there."

Again, Curtice says:—"It is in view of the exact specific identity of our cattle tick in the States with that from Egypt, and the method by which the Southern States cattle have been introduced in the early Spanish invasions, and from the fact that the tick completes its developement from the six-footed stage to the adult on cattle, that it seems to me that the oommon cattle tick of the Southern States is an introduced species, having been introduced early in the sixteenth centry into the Spanish settlement of America. The species then spread with the cattle and other agencies into all those parts where the climate and conditions were suitable.

We must not forget, in speaking of the distribution of an animal, to mention not only those places in which it existed originally, but those where it had been introduced and become thoroughly acclimatised. There can be no doubt whatever that the cattle tick is not indigenous to Australia, but that it was introduced through some of the vessels trading between Java, Batavia, and the Straits Settlement and Port Darwin. Some people believe that the tick was introduced into Australia from India or Batavia with the buffaloes. Whether this is correct or not, it is interesting to know that of the numerous specimens of ticks obtained from districts permanently infested with cattle ticks, and forwarded to the Stock Institute for examination, I have failed to discover even one that correspond with the true *Ixodes bovis*.

During the past twelve months we have acquired a great deal of knowledge as to the present extent of the distribution of the cattle tick. I have received specimens in various stages of developement from different parts of the world—namely, the Southern States of North America, the West India Islands, Argentina, and Beunos Ayres, in South America; various States in South Africa, Calcutta, Bombay, Madras, the North-west Provinces of India, Ceylon, Java, and Burmah, the south-east islands of British New Guinea, the Northern Territory of South Australia, and Western Australia. The specimens I have received from all these different parts of the word agree in all their anatomical and physiological characters with our orthodox Queensland cattle tick.

CLIMATIC AND OTHER CONDITIONS FAVOURABLE AND UNFAVOURABLE TO TICK LIFE.

The experience of the last twenty years in the United States shows that the cattle tick will thrive almost anywhere, from the tropics to those parts of the country where the minimum temperature is not below 34deg., and the atmosphere fairly humid, and the smaller vegetation sufficiently plentiful and constant to protect the ova and larvae of the tick from the direct influence of the sun's rays.

In Queensland the so-called blady grass country is found to be perfectly congenial to the cattle tick; in fact it might be most appropriately termed the "home of the tick," for the simple reason that it affords the best possible shelter for the ticks; and, moreover, among the coarse grasses grown in a state of perfection along the banks and on the deltas of our coastal rivers, and where there are all the other necessary requirements to perpetuate this particular species of tick it is found to exist all the year round. Even on this class of country in Southern Queensland we occasionally have a season which may not be altogether congenial to the movements or a continued increase of the tick; but while remembering that these seasons are of short duration, we must also not forget that the cattle tick in a certain stage of its existence—i.e., the pre-parasitic stage—is extremely tenacious of life. I have just concluded some observations, where I find that during our coldest weather in Brisbane the eggs of the cattle tick may remain unhatched for over four months, while the larval ticks will live for even a longer period without a host. These facts only apply where the ticks or eggs are protected from the direct sun's rays.

Many years of practical experience have shown conclusively that the cattle tick cannot possibly exist for any long period upon our open plains in the Western country, where the atmosphere is mostly dry and arid, and where the sun shines the greater part of the year, and the vegetation is very sparse. Placing eggs, larvae, and adult ticks in a test-tube for only a few hours in the direct rays of the sun is sufficient to destroy all vitality. But while the sunlight prevents the spread of the tick and formation of fresh centres in Western Queensland, we have an entirely opposite experience in the United States, for in that country the march of the tick in a northerly direction is prevented by the prolonged severe frosts. Although we in Australia cannot boast of anything like an American blizzard, I am of opinion that in the immediate vicinity of Mr. Wragge's observatory on Mount Kosciusko, the tick would certainly have a most uncomfortable time.

HOW TICKS ARE DISTRIBUTED.

Careful and close observations have shown that although the bovine is the only perfect natural host of the cattle tick, it is only one of very many different agencies for its distribution. It has been proved that the tick will mature under favourable conditions upon the horse and the sheep, and that the eggs from such ticks are fertile. I have also found them in various stages of developement attached to goats, kangaroos, wallabies, and various kinds of birds, as the ibis, crane, peewit, wild duck, and even on the little shepherd's companion (wagtail).

In addition to these different hosts which are more or less responsible for the principal transmission of ticks into new or clean country we have other agents and accidental means for the dissemination of ticks. In studying the habits of various species of ticks living apart from their host under natural conditions on some of the Northern rivers of this colony, I noticed that in the larval stage there was a natural inclination or instinct to attach themselves to any moving object, no matter whether animate or inanimate. By way of illustration, I may mention a little incident in my experience which took place on the Herbert River about two years ago. I was particularly anxious to obtain a photograph, as nearly as possible the natural size, of several colonies of larval ticks on the tops of the blady grass, which necessitated placing the camera in close proximity to the object. Everything being ready, I made a final trial of the working of the pneumatic shutter for time exposure, and on my releasing the rubber ball, attached to the shutter by means of a long piece of tubing, it commenced to swing round in an elliptoid movement, and accidently touched the edge of one of the colonies of young ticks; instantly every tick released its hold from the blade of grass and became attached to the rubber ball, which I at once steadied in order to watch what would take place. The young ticks in the colony commenced to separate and run all over the ball, and eventually up the tubing to the lense and then on to the camera, evidently thinking that they would come across a bullock; but their anticapations were not to be realised, for instead of finding a dainty piece of living hide they wandered about in a sort of discontented manner over the morocco leather bellows.

In some districts I have seen the larval ticks in considerable numbers attached to the star grass and "roley poley," which is familiar to all bushmen when it accumulates in huge masses and is rolled over the open plains for miles and miles with the force of the wind. I have also seen young ticks picked up by leaves and feathers, and blown in all directions by the wind. It must be apparent to any one that is familiar with the activity of ticks in grossly infested districts how readily they may be transferred from one place to another in their larval stage by marsupials, dingoes, and other native animals, also by swagsmen and blackfellows "on the wallaby."

These facts serve to clearly illustrate how great and difficult is the task that we are asked to perform in devising means for the prevention of the spread of the tick pest.

I know of several instances where some new centres of infection have been discovered in which every possible means that time, money, and science could suggest has been tried to eradicate the pest; but as with the experience under similar conditions in other countries, principally the United States, the whole thing has unfortunately proved unsuccessful.

LIFE HISTORY.

To complete its life history the tick, like almost all insects, has to undergo four distinct changes, technically known as metamorphoses—first, the egg; second, the larva; third the pupa or nymph; and fourth, or last stage, the sexually mature adult.

After due consideration I have deemed it advisable to commence by describing the process of oviposition or egg-laying, and the changes occasioned thereby in the female tick.

If we remove a number of fully-developed female ticks from a beast and place them in a small covered dish, we notice from day to day various obvious changes taking place. First of all, the fully developed female tick is somewhere about the shape and size of the seed of the castor oil plant; as a rule the ventral or underneath parts are of a dull leaden or bluish colour, while the dorsum or back of the tick has a slightly dull greenish hue. Under favourable circumstance in a few days several irregular yellow marks make their appearance all over the body. These gradually increase in size, and indicate that at an early date the egg-laying process will commence.

I need hardly mention that this process of oviposition, which was first of all carefully worked out some eight years ago in London by my friend Mr. R. T. Lewis, of the Quekett Microscopical Society, is a most interesting and fascinating study for the microscopist. To the unaided eye it appears as though the eggs were ejected direct from the mouth itself, whereas the microscope reveals the fact that the ovipositor, or termination of the little duct down which the egg passes from the ovaries, is situated immediately behind the mouth organs, which, however, assist mechanically during the process of oviposition. By means of the microscope I have watched for hours together on different occasions this interesting process, and I must admit that each time I elicited further information.

The first indication that an egg is about to be laid is the continued, peculiarly slow waving movement of the anterior pair of legs, which are invariably turned in an upward direction; then the ovipositor, which is retractile, is pushed forward; also a membraneous sac makes its appearance just above the palpi, which are gradually seen to separate. In the next stage we notice the extension of the egg from the ovipositor and the membraneous body afterwards enveloping the egg. While the ovipositor is retracting into its normal position the egg is moved about freely in the grasp of the membrane, which at the same time covers it with a kind of viscid albuminous secretion. On the withdrawal of the membrane the egg is seen suspended by one end from the under surface of the dorsal aspect of the head plate or skutellum. The palpi next come into operation, slowly closing together until in close touch with the rostrum, so that the elevation of the head brings their spoon-like terminal joints in contact with the egg; a continuance of this motion effectively removes it from the depression, and leaves it adhering to the outer margin of the skutellum which makes the process complete. The head is again depressed, the palpi resume their former position, and the series of operations just described are again repeated, each successive egg displacing, but, by means of the sticky coating, adhering to the one which preceded it, until a chain is formed, and ultimately on reaching the ground an elongated heap of eggs is formed through the tick gradually receding as the eggs are expelled from her body.

When once the procedure is established it goes on uninterruptedly until complete, but the length of time occupied to make the process complete depends entirely upon climatic condition. As a result of many observations during summer months, I find that the entire process of laying a single egg occupied approximately three minutes. From this it would appear that, assuming on an average that a tick lays about 2000 eggs, the process would be finished within five days; but such is not the case, for the simple reason that there is always an uneven interval of time elapses between the laying of the eggs. I have seen as many as forty eggs laid by one tick within one hour, while in the next five hours she only laid twenty-two eggs. However, as a rule under the most favourable circumstances the whole process of oviposition is complete in from ten to twenty-one days.

If by accident or intentionally the tick is molested in any way there is immediate cessation of the process, which in some cases that I have observed did not commence again for several weeks, while in other cases the apparent shock to the system of the tick was so great that the process of oviposition was suspended altogether, and the ticks died.

During the winter months the period of time occupied in the laying of the eggs and their incubation varies considerably.

As the exact nature of the material with which the eggs are coated has not been determined, it is interesting to know that it posseses the property of retaining its viscidity for a very long time (many weeks, in fact) without becoming hardened by exposure to the air; so that if the eggs are put separately into a bottle and the latter shaken, the eggs readily become aglomerated into a ball by contact with each other.

A most noticeable feature during the process of oviposition is the deepening in colour of the yellow bands which just before the death of the tick become a brilliant orange.

A fully-developed tick will lay from 1,800 to 2,000, and sometimes 2,300, eggs, each of which is about one-fiftieth of an inch long and one-seventieth of an inch broad. They are bluntly oval in shape, of a light brownish colour, and vary in size according to the mother tick. For instance, several female ticks were removed from the skin of an animal before they were half-grown; these laid eggs, pale in colour, mostly very much smaller, compared with normal eggs; moreover, with few exceptions, instead of hatching, they collapsed, and eventually withered up, from which it might be concluded that the female tick was imperfectly fecundated.

The various changes which the egg undergoes before hatching can be watched under the microsope, the outer membrane, or shell, remaining almost transparent till the young tick is fully developed, when, within four to six days before hatching, the shell gradually becomes opaque-looking, like a small pearl.

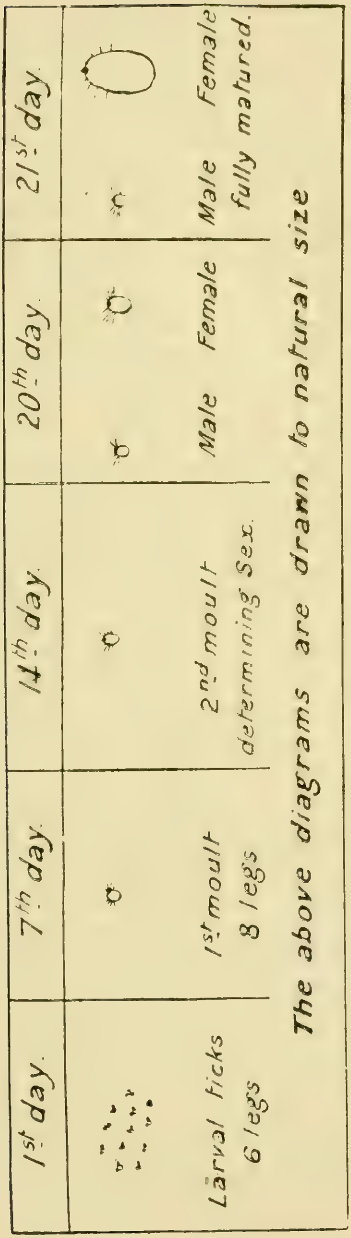
On emerging from the egg, the larvae, which are very minute creatures, have only six legs, and are of a peculiar brownish, translucent, waxy colour. The pulvilli, or foot pads, on the anterior pair of legs are very much larger than those on the second and third pair of legs; in fact, altogether the first pair of legs exhibit a higher development than the remainder.

It is quite evident that this peculiar formation is necessary to assist the young tick in gaining access to its host, for after my tick-infested camera experience, I spent the remainder of the morning in examining the larval ticks forming colonies among the grass, and I noticed that all the ticks in the cluster were attached to one another by their four posterior legs, while the anterior pair were continually wavering backwards and forwards after the fashion of the antennae insects, and ever ready to attach themselves to anything that might brush against them, while the last segment of the foot being provided with hooked-like claws, the slightest touch gives them a hold.

The larval tick, having attached itself firmly to its host, takes up a certain amount of nourishment, and then undergoes its third moult, which usually takes place in about seven days. If we examine the tick just before its nymphial change under the microscope an extra pair of legs can be seen through the skin just behind the three pairs of legs, also a pair of stigmata, or breathing organs, behind these again. The three first pairs of legs and the head are withdrawn gradually from the external skin, which now commences to split down the sides and round the bottom end, and by the combined force of the limbs this outer skin is cast off.

The fourth, or last, change is from the nymph or pupa to the adult. As in the previous moult, the head and limbs are withdrawn, and the skin splits laterally, and the tick in its adult stage emerges without any appreciable modification of the digestive, respiratory, or locomotory organs. The greatest change, however, occurs in the reproductive organs, which have developed internally during the nymphial stage ; both males and females are now sexually mature, and are now provided with the full complement of legs, a perfect digestive and respiratory system, and sexual organs.

At this stage the males and females differ but very little in size ; the length of the body is about one-tenth of an inch, and as a rule the males are distinguished from the females by their being much more active, and the bodies being smaller and more rounded, and of a dark-brown colour ; while a conspicuous feature is the absence of the head shield, and the presence of



two triangular-striped lobes on the lower end of the abdomen, one on either side of the anus. The females at this stage are almost colourless ; the body is somewhat elongated, and on either side of the abdomen there are two distinct longitudinal furrows or depressions, and three on the back, while the most pronounced feature for the size of the body is the head shield or scutellum. If the change from the nymphial stage should result in a female, she still remains attached to the skin in the same position, but if it be a male he at once releases his hold, seeks his mate the female, attaching himself to the hide, immediately underneath the female, in an inverted position.

From this period the male grows but very little, while the female, on the contrary, after being fecundated, attains, so to speak, an immense size. During the first five or six days she only sucks up a small amount of blood, while within the next two days she becomes fully engorged, and at once releases hold, falls to the ground, walks away to some secluded spot, either in a tussock of grass, or under some dead leaves, and lays her eggs ; and then the life cycle commences again.

After the departure of the female from its host, the male releases his hold, and usually dies in a few days. Occasionally, I have kept male ticks alive in a glass vessel for nearly four weeks.

What appears to be a very remarkable fact is, that although so many eminently qualified men in England, America, and South Africa have devoted years of study in endeavouring to elucidate the biology of the cattle tick and numerous other species, all have apparently failed to notice that the legs of the mature male and female cattle tick are quite white and semi-transparent, which serves to distinguish the *Ixodes bovis* from all other known species of ticks, all of which have either red or dark-brown legs.

HABITS AND PECULIARITIES.

The cattle ticks in their larval stage only can readily walk up the sides of a vertical piece of glass and on the underneath side when inverted ; but there are species of scrub ticks that in both adult and larval stage can walk on glass situated at any angle.

To demonstrate the objection which ticks have to strong light, place a number of either larval or adult ticks inside a vessel covered with a piece of glass, and having a label affixed ; in the course of a few minutes all the larval ticks will congregate immediately under the label, while the adult ticks, which cannot climb up the glass, will mass together in the most shady part of the vessel.

A large number of larval ticks will, if placed in a glass vessel, live for a longer period than a few ticks, even when kept under precisely the same conditions.

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TUBERCULIN, ITS HISTORY, PREPARATION AND USE.

By C. J. POUND, F.R.M.S.,

Director, Queensland Stock Institute.

[*Read before the Royal Society of Queensland, 17th Dec., 1898.*]

Every day brings forth evidence of the prevalence of tuberculosis among cattle, in every country throughout the civilised world, but it is particularly interesting to note that by far the greater number of cases have only been detected by means of that most invaluable agent, Tuberculin.

HISTORY.

In 1882, Robert Koch, the eminent German Bacteriologist, announced that he had discovered a special bacillus in tubercular tissues, which he isolated and cultivated artificially in or on specially prepared nutrient media outside the animal body; also, that he could reproduce the disease by means of inoculation with the cultivated bacillus. Subsequent investigation proved that the bacillus of human consumption was identical with that which caused Tuberculosis in cattle.

In 1890, Koch made another interesting discovery, viz., that the isolated poisonous products of the tubercle bacillus were (1) capable of preventing the effects of the inoculation of tuberculous material, (2) of healing in certain manifestations of tuberculosis in the early stage, and (3) of indicating the presence of tuberculous lesions, when all other methods of diagnosis entirely failed.

Tuberculin is the name given by Koch to the glycerine extract of the poisonous products of the tubercle bacillus.

Although there are some authentic cases of Tuberculosis in the early stages in human beings that have completely recovered after treatment, generally speaking tuberculin, as a cure, has not come up to expectations, but it has been definitely proved, by means of thousands of experiments in every part of the world, that tuberculin is capable of detecting the existence of tuberculosis in cattle even in the very earliest stages of the disease.

During the last three years the somewhat exhaustive experimental investigations conducted at or in connection with the Queensland Stock Institute have shown that when the tuberculin test is applied with judicious care, it is practically infallible; moreover, it has proved itself of such incalcuable benefit to stockowners, and is so very easy of application when the details are understood, that the following description of its nature and use will, I trust, be found acceptable to all interested in cattle, from the breeder of stud animals to the dairy farmer.

By means of this information, a stockowner should be in a position to test his own cattle; but it is advisable, first of all, to receive some practical instruction and see the test several times applied by one of the officers attached to the Queensland Stock Institute.

Up till 1893, tuberculin was only prepared in Koch's Laboratory, in Berlin, but when the nature of its composition became known, and it was pointed out by Nocard and Roux, of the Pasteur Institute, that tuberculin must ultimately come into general use for detecting tuberculosis in cattle, it was not long before this agent was prepared in several other institutions. At the present time tuberculin is prepared on a very extensive scale, specially for diagnostic purposes, by the following institutions:—Koch's Laboratory, in Berlin; Pasteur Institute, in Paris; Bang's Laboratory, in Copenhagen; Royal Veterinary College and the Institute of Preventive Medicine, in London; Bacteriological Laboratory of the Bureau of Animal Industry, Washington, U.S.A., and Board of Health Laboratory, New York; while in the Southern Hemisphere, the Stock Institute in Brisbane claims to be the first and only place where standardised tuberculin is prepared, practically speaking, on a scale to meet the demands of all Australia.

THE METHOD OF PREPARING TUBERCULIN IN THE STOCK INSTITUTE.

Tuberculin is a sterilised, filtered, glycerine extract of pure cultivations of the tubercle bacillus. That which is prepared in England, France and Germany, is made from cultures of the bacillus growing in peptonised beef broth, containing from 6 to 8 per cent of pure glycerine, as per samples exhibited. When I first commenced in an experimental way preparing Tuberculin in Brisbane, I adopted the same kind of nutrient media; but in consequence of the various lots of beef from which boullion was prepared, varying so much in quality, more particularly the necessary salts of serum, which very materially interfered with the standardising of the resulting tuberculin, I endeavoured and succeeded in preparing a special form of nutrient media, made up of pure chemicals, the whole being analogous in composition to the very best quality beef.

Pure Peptone, an important and expensive item in the old nutrient media is disregarded in the new formula, thereby considerably reducing the expense of turning out a first-class article.

The most important point is, that whenever we wish to prepare fresh batches of tuberculin, we always have the satisfaction of knowing exactly to a day when to filter our culture, providing of course the regulators attached to the Incubators have maintained an even temperature throughout the period required for obtaining the desired amount of growth of the tubercle bacillus.

The following is the formula of the nutrient media used in the Stock Institute:—

Magnesia Sulphate	0·2	grammes
Acid potassium phosphate	1·0	,,
Ammonium phosphate	10·0	,,
Sodium chloride	10·0	,,
Asparagin	2·0	,,
Glycerine	70	cc
Distilled water	1000	cc

It will be noticed that there is no albumum material present, while the nitrogenous element is supplied in the Asparagin.

Having prepared a stock of the above material, it is transferred to a number of 50 cc Erlenmyer's conical shaped flasks which have been previously chemically cleaned, plugged with cotton wool and sterlised.

It is necessary that in order to obtain as large a surface of the fluid exposed to the air, that only 20 cc of the nutrient media be placed in each flask.

The flasks and their contents are sterilized on four successive days for 20 minutes at each operation, in a steam sterilizer at 212 degrees Fahr., or for 30 minutes on two successive days in an autoclave or steam digestor, under a pressure of 27 lb. on the square inch. On removal they are allowed to cool down, when each flask is ready to be inoculated with the pure culture of the tubercle bacillus, which to perform for the first time is an extremely difficult and tedious operation. Night after night, for many weeks at a time, I have worked away by myself in the laboratory in order to perfect this operation.

If we take a trace of the growth from the surface of an Agar Agar culture of tubercle baccilli, and place it into the flask, it gradually sinks to the bottom of the fluid ; if this flask of inoculated media is placed in an incubator we have to wait many months before we see a perceptible increase in the growth of the colony of tubercle bacilli, the reason being that the organisms have not had free access to oxygen, which is absolutely essential for their rapid development. Although this specific bacillus is recognised as one of the slowest growing organisms, we have succeeded in obtaining most luxuriant cultivations by growing it on the surface of this fluid media. In the first place this is only accomplished by inoculating from an old and very dry Agar Agar culture, a very large number of flasks, special care being exercised to make the minute traces of growth of bacilli float. After the flasks have been in the incubator for about three weeks, it is possible to find out of 100 flasks, perhaps one flask with an extremely delicate film, almost imperceptible to the naked eye floating over a small portion of the surface fluid. Should a microscopical examination of this film after staining with special aniline dyes result in showing nothing but a pure culture of the tubercle bacillus, immediate steps are taken to transfer by means of a flattened platinum needle, portions of this film to the surface of fluid media in each of the other flasks, which are afterwards returned to the incubator where they remain at 98·6 deg. Fahr. for another 10 weeks. On examination at intervals during this period, it will be noticed that the film, which has grown all over the surface of the fluid media becomes crinkled, breaks up gradually, then a new film forms, and so on, until the growing bacilli have exhausted all the nutrient properties in the fluid media, at the same time generating or setting free their poisonous products, the tuberculin. The next part of the process is to carefully destroy the vitality of every bacillus in the culture and then separate them from the fluid by passing the contents of each flask through a Pasteur-Chamberland filter, under a pressure of 500lb. on the square inch.

This porcelain filter, the manufacture of which is practically a French Government secret, is so uniform and fine in texture that the very smallest spores of bacilli or micrococci known to bacteriologists cannot be forced through even under this enormous pressure.

The filtrate is now placed in a series of Florence flasks, fitted with perforated rubber corks, and connected one with another to a Sprengel's exhaust pump by means of glass and thick-walled rubber tubing. The flasks thus connected are placed in a steam sterilizer and kept heated up to a temperature of 120 degrees Fahr., while the exhaust pump assists in evaporating the contents of the flasks in vacuo until the fluid is so concentrated that the glycerine, originally in the proportion of 7 per cent., amounts to 50 per cent.

The next part of the programme is the standardising, and requires the greatest care and attention, inasmuch as it can only be performed by a large series of physiological experiments on guinea-pigs.

The 50 per cent. glycerine in the finally standardised Tuberculin will prevent the development of any foreign micro-organisms which may gain access to the glass bottle when the stopper is removed : moreover, if this material is kept in a cool, dark cupboard, no alteration takes place with regard to its chemical composition and its physiological effects upon tubercular animals.

Some tuberculin prepared in November, 1895, and kept under favourable conditions, has not deteriorated in the slightest degree, and is just as efficacious for diagnostic purposes as when it was first prepared.

THE USE OF TUBERCULIN AS A MEANS FOR DIAGONISING TUBERCULAR DISEASE IN CATTLE.

Tuberculin as a test agent is always used in the diluted form, in the proportion of one (1) part tuberculin to nineteen (19) parts of a 5 in 1,000 Carbolic Acid solution.

Of this diluted tuberculin the following doses are required for different animals :—

8cc for bulls, high-class and aged animals.
6cc ,, medium-sized animals.
4cc ,, calves six to twelve months old.
2cc ,, calves under six months.

Example of method of diluting tuberculin :—4/10cc pure tuberculin to 7 6/10cc carb sol. = 1 to 19.

APPLIANCES REQUIRED.

Syringe.—A strong well made hypodermic syringe holding 10cc, with a strong needle attached, that used in connection with preventive inoculation for Tick Fever is specially recommended.

Thermometer.—For taking the temperature a clinical thermometer is necessary, as this form has a self-registering index, but as the ordinary medical thermometer is such an extremely delicate instrument, and very liable to be broken, a special strong thermometer, suitable for taking the temperature of cattle and horses has been designed and approved of by the Stock Institute.

Thoroughly sterilize the syringe and needle (*i.e.* destroy all germs that may be in or on them) by soaking them in 5 per cent. solution of carbolic acid.

THE APPLICATION OF THE TEST.

The diagnoses of tuberculosis in cattle by means of this test depends entirely upon the characteristic elevation of temperature produced in a tuberculosis animal within a limited period after injection.

This constitutes the only real difficulty, for while determining that an abnormal rise in temperature has taken place, due allowance must be made for variations within the normal range of temperature and for those produced by causes other than the injection of tuberculin, for instance :—

(*a*) As a rule young animals are much warmer than old animals.

(*b*) The temperature of the surrounding atmosphere, especially during the summer months, affects different animals unequally.

(*c*) The drinking of cold water lowers the body temperature for sometimes over one hour afterwards.

(*d*) The presence of other diseases.

(*e*) The approach of calving.

(*f*) In the case of cows in heat, the temperature of the body is usually abnormal.

(*g*) Excitement due to fast driving.

Having due regard to the above facts, it is recommended that all cattle except those manifestly too ill should be tested.

According to very numerous exhaustive experiments even cows in the last stages of pregnancy do not seem to react from the tuberculin injection unless they are tuberculous.

When, however, the preliminary temperature before injection is above 104 degrees, the animal may be temporarily passed and tested on a subsequent date, but if it is suspected that the high temperature is due to a tubercular condition it is advisable to proceed with the test.

By following a fixed rule the work becomes, so to speak, automatic, and greater accuracy is obtained if the following order of procedure is observed :—

I. Place all the animals to be tested in bails or a crush, and have them marked.

II. Take the preliminary temperature at 2 p.m. and 6 p.m. on the day of injection.

III. Inject the tuberculin at 6 p.m.

IV. Take the temperatures every three hours from 6 a.m. to 6 p.m. on the following day, or until there is no further rise of temperature, and the normal level has been resumed.

USING THE THERMOMETER.

The temperature of cattle, as well as all other of the lower animals, is taken in the rectum. Before inserting the thermometer by sure that the mercury stands below 97 degrees Fahr.

With the left hand, firmly but gently grasp the animal's tail about eight inches from its root ; lift it slowly just high enough to permit access to the anus.

The bulb and lower part of the thermometer may be moistened with saliva, lard, glycerine, oil, or vaseline, to prevent its sticking to the mucous membrane of the rectum. When inserting the thermometer avoid catching the bulb in a fold of mucous membrane by changing its direction either to the right or left, or upward or downward as occasion requires. It has been found that the thermometer is best introduced in an upward direction. The thermometer should be pushed into the rectum sufficiently far so that it can be easily withdrawn, and yet evade the swinging motion of the animal's tail when the latter is released.

The thermometer should remain in position at least four minutes.

Injecting the Tuberculin.—When the syringe is filled and the proper dose set, the operator should take his place, if the animal is in a bail, by the right shoulder of the animal, or on the side opposite to that in which he intends to inject. Reaching over the animal with the left hand, he must pinch the skin firmly at the chosen point with the left thumb and forefinger. With the syringe resting in his right palm, the needle between the thumb and forefinger, he pierces the skin with a quick thrust, and while retaining hold of the folded skin, the piston is taken with the right thumb and the contents of the syringe slowly intrcduced into the subsutaneous tissue.

The Reaction.—It may be affirmed that an animal has tuberculosis if its temperature rises 2·5 degrees Fahr., or more, on the day following the injection.

If there is any rise less than this, a repetition of the injection after three or four weeks is desirable.

As a rule, with tubercular animals the temperature in a typical case will begin rising 12 hours after injection—*i.e.*, at 6 a.m., and by noon may reach 107 degrees Fahr.

One point worth remembering is that, generally speaking, the smaller and fewer the lesions of tuberculosis, the greater and more certain is the reaction produced, while on the other hand cattle suffering from advanced tuberculosis will give only a slight reaction ; in fact, it is very often observed that in the very latest stages of the disease the animal may show no reaction whatever. This is explained by the fact that the animal, in consequence of the generalised form of the disease, is so literally saturated with tuberculous products, that the very small amount of tuberculin injected fails to excite the tissues. It is also worthy of mention that as such advanced cases do not require tuberculin injection to discover their diseased condition, this source of failure does not count against the value of the test.

TABLE SHOWING TEMPERATURES BEFORE AND AFTER INJECTION OF TUBERCULIN OF A HEALTHY AND A TUBERCULOUS ANIMAL.

Healthy.

BEFORE INJECTION		AFTER INJECTION.	
9 a.m.	102·4	†6 a.m.	100·6
12 noon	100·8	9 a.m.	101·2
3 p.m.	101·4	12 noon	101·4
*6 p.m.	101·6	3 p.m.	101
		6 p.m.	102·1

Tuberculous.

BEFORE INJECTION.		AFTER INJECTION.	
9 a.m.	102·1	†6 a.m.	103·1
12 noon	101·8	9 a.m.	105·8
3 p.m.	101·7	12 noon	106·9
*6 p.m.	102·3	3 p.m.	106·1
		6 p.m.	104·8

* injection took place at 6 p.m.

† Twelve hours after injection.

At the present time there are many different brands of tuberculin (each of which possesses its own particular properties) obtainable from various commercial agents in each of the colonies; but it is specially recommended that in order to obtain uniform results, only that tuberculin should be used which is prepared and supplied by the Stock Institute: precisely on the same lines that in Germany only Koch's tuberculin is used; while in Denmark the Government will only allow that to be used which is prepared under the direction of Professor Bang, at Copenhagen; and in the United States the Government specially recommend that prepared in the Laboratory of the Agricultural Department.

The overwhelming evidence collected in different countries throughout the world have shown that the use of tuberculin as an aid to the diagnosis of tuberculosis in cattle is one of the most brilliant discoveries of the nineteenth century, and as time passes, its real value and significance will be more and more appreciated by the masses of mankind.

Now that this test has proved itself to be almost infallible, it should be the desire of every person interested in cattle to commence at once in a judicious and systematic manner and eliminate from his herd, with the least possible loss, every tuberculosis animal, not forgetting the obligations to the public both in the exchange and sale of live stock and products, both of which should be guaranteed free from tubercular taint. At the same time special attention should be directed to the preservation of certain strains of well known and productive blood, which have taken many years of intelligent thought and careful study by the most observant minds to bring certain well known breeds of cattle up to their present high standard of perfection.

HOW TO ELIMINATE TUBERCOLOSIS FROM A HERD.

The following is the method, based on the practical experience of such keen observers and eminent scientists as Professor Bang, of Copenhagen, Professor McFadyean, of London, and Dr. Salmon, of Washington, I have adopted for the eradication by tuberculosis from the dairy herd at the island of St. Helena:—

I. All animals showing outward signs of disease should be immediately killed and the carcase destroyed by fire.

II. The remainder of the herd tested with tuberculin every six months.

III. All animals of little value, such as old cows or bulls and very young calves that have shown evident reaction to the test are carefully slaughtered and examined, and the whole carcase thoroughly boiled down as food for the pigs.

IV. The remaining reacting animals are carefully separated from the healthy animals by removing them to some distant isolated paddock.

V. On large estates it is recommended that a separate set of attendants should look after the cattle for each division.

VI. Where, however, one man milks and cares for all the cows, he should serve the sound division first, then he changes his shoes and outer garments for special clothing used only in the diseased division.

VII.—The sheds and stalls occupied by the cattle in both divisions are cleaned and disinfected as follows :—

a. All manure and litter is removed out of reach of the cattle and burned, or treated in such a way that by spreading it in a thin layer over cultivated land, the sun's rays can exert their germicidal influence.

b. The entire interior of the buildings are disinfected by means of spraying, or washing with a large brush with the following mixture :—1oz. of corrosive sublimate (Bichloride of Mercury) to 8 gallons of water. After disinfecting the interior and edges of the mangers, they should be washed with water.

c. After an interval of a few days all the woodwork, including partitions, stanchions, walls, and ceiling are whitewashed, the mixture containing in every 4 gallons 1lb. of chloride lime and $\frac{1}{2}$oz. of corrosive sublimate.

VIII.—All calves born of reacting mothers should at once be put into the healthy division before they get a chance to suckle their mothers, and can be fed either on the milk of the guaranteed healthy cows, or with milk from their own mothers—but only after it has been heated up to a temperature of 190 degrees Fahr. for 30 minutes.

IX.—When any animal in the reacting or diseased division shows signs of sickness, it should be destroyed.

X.—No new animal should be introduced into the healthy division unless it has passed the tuberculin test.

XI.—Avoid breeding from very young or too old cows, as the offspring is apt to be weak and puny.

XII.—No consumptive person should be allowed to work amongst the cattle or prepare their food.

CONCLUSIONS.

By following these rules the unsound animals will be wiped out, but hardly before they have replenished the healthy divisions to its original dimensions. Of course, if only a few animals are found tuberculous, it will not pay to go to the trouble and expense of keeping them as a separate herd; but when dealing with a considerable number of valuable prize animals, whose qualities are worth propagating, it will undoubtedly pay, as demonstrated by several authorities, to adopt the above method.

It is simply a question of which is the cheaper course in the end, to try and raise a sound herd from an unsound one by observing rigid rules, or to get rid of all the tuberculous animals at once. Each stud breeder or dairy farmer must determine this for himself, and in doing so must not overlook the fact that heredity and predisposition are mere minor factors in the production of tuberculosis.

FRAUDULENT PRACTICE IN CONNECTION WITH THE TUBERCULIN TEST.

To those who have devoted several years in watching the practical working of the test, it was quite easy to see how readily frauds might be, and, in fact, have been perpetrated by evil disposed persons, and it is only right, in my opinion, that the method of working these frauds should be exposed.

It is a well established fact that if a tuberculous animal has been injected with a large dose or with repeated frequent small doses of tuberculin, it will fail to give a reaction temperature on a subsequent testing, unless a considerable period (many months) is allowed to elapse for the previous dose of tuberculin to be eliminated from the system.

The following examples serve to illustrate how simple a matter it is for animals to be fixed up and sold, in such a manner that the purchaser is perfectly satisfied that they are absolutely free from tubercolosis.

Case I.—Mr. A—— has a well bred Ayrshire bull for sale.

Mr. B——, an intending purshaser, comes along and says to Mr. A——, "I like the appearance of that bull, in fact I have taken a great fancy to him."

Mr. A—— says, " Well, you can have him for a ten-pound note."

" Alright," says Mr. B——, " but now-a-days I get a bit particular ; I will take the bull on condition that you test him with tuberculin and he shows no reaction."

This is agreed to by Mr. A——, who invites Mr. B—— to come round in two or three days' time and witness the test being carried out.

Now comes the opportunity for Mr. A——, for as soon as his premises are vacated by Mr. B—— he injects a large dose of tuberculin into the bull, which he has previously proved, to his own satisfaction, has got tuberculosis in an incipient stage. The next day, of course, the bull reacts to the tuberculin, but the fact is only known to its present owner.

On the following day Mr. B—— comes back with the standard dose of tuberculin, which Mr. A—— very courteously allows to be injected into his bull ; this is followed by a very careful and accurate record of the animal's temperature from the twelfth to the twenty-fourth hour after injection, with the result that there is no perceptible alteration from the normal before the injection.

Both seller and buyer shake hands and compliment one another on the success of the test, and Mr. B——, after paying his £10, wends his way homeward with his purchase, perfectly satisfied that he has a bargain in the animal which, in his opinion, is free from tuberculosis.

CASE II.—Mr. C—— is anxious to buy a dairy cow for the purpose of supplying milk to his family.

Mr. D——, a breeder of dairy cattle, is also anxious to meet the requirements of Mr. C——, and allows him to select any cow in his herd at a certain price.

Accordingly Mr. C—— picks out a three-quarter bred Jersey cow, and as it is such a very quiet animal, he is desirous of having it tested with tuberculin without further delay.

The ever obliging Mr. D—— at once produces the clinical thermometer and two small stoppered bottles—one bearing the characteristic label of Koch's tuberculin, and the other of Bang's.

Mr. C—— remarks "that as there is a great deal in a name, he prefers to use Koch's tuberculin;" consequently a definite quantity of the contents of the bottle labeled "Tuberculinum Kochii" is diluted with weak carbolic solution and injected into the selected cow; the records of the animal's temperature taken next day indicate that no reaction has taken place.

Mr. C—— then purchases what he conscientiously believes to be an animal which has been proved by the tuberculin test to be free from tuberculosis, and ever afterwards feels proud in informing his numerous friends how very much better it is, instead of having a limited quantity of inferior milk supplied by a dirty careless milkman, to have, practically speaking, an unlimited supply of pure fresh milk from his own cow, which, he says, is guaranteed free from tuberculosis from the fact that it has passed the tuberculin test.

Little does Mr. C—— imagine that although the stoppered bottles and labels are the genuine articles, the contents was cold tea placed there intentionally by that courteous gentleman, Mr. D——, who can rest assured that his cattle, whoever purchases them, will find no tuberculosis if tested with the tuberculin which he generously supplies at the time of purchase.

Should, however, an animal react to the genuine test soon after purchase Mr. D—— will say, "Oh, yes! I have no doubt whatever about the correctness of the test, but you see the animal passed the test with me, therefore, it could only have contracted the disease after it left my premises."

From the foregoing remarks it will be readily apparent that the supply of tuberculin should be strictly under Government control, and that the application of the test should only be carried out by experienced Government officials and duly qualified veterinary practitioners.

TABLE SHOWING TEMPERATURE OF THE CAPITAL OF EACH COLONY OF AUSTRALIA DURING THE YEAR 1898.

By Mrs. Charles Coxen, M.R.M.S.

[*Presented at Annual Meeting, 21st January, 1899.*]

1898.	Maximum.					Minimum.				
	Brisbane.	Sydney.	Melbourne.	Adelaide.	Perth.	Brisbane.	Sydney.	Melbourne.	Adelaide.	Perth.
January	82·3	79·5	82·3	90·1	83·8	69·1	66·2	58·3	62·0	64·2
February	82·4	78·6	86·4	90·9	87·2	68·5	65·9	61·9	67·4	66·0
March	80·9	76·3	75·5	82·9	84·0	66·2	64·1	55·0	58·6	62·3
April	80·0	71·6	67·3	70·3	76·1	61·0	57·3	50·3	52·9	56·5
May	71·0	61·7	60·0	62·0	70·8	50·7	51·0	43·7	46·3	52·8
June	68·8	60·2	56·8	60·2	60·8	43·8	49·1	44·0	47·1	47·3
July	64·1	58·7	55·7	59·1	64·5	45·2	45·3	43·1	45·2	49·2
August	70·6	61·7	60·1	63·6	65·7	49·4	48·4	44·4	46·9	49·3
September	77·2	68·9	62·5	67·8	67·9	55·0	53·1	47·5	48·2	52·5
October	81·7	74·4	70·5	75·9	68·2	57·0	57·1	49·8	51·5	54·8
November	86·4	77·3	72·4	74·4	74·4	64·9	61·5	52·1	54·0	55·9
December	83·7	74·6	78·7	89·7	81·1	64·0	61·3	54·5	63·2	61·0
	77·4	72·9	77·3	73·9	73·7	57·9	56·6	54·1	53·6	56·0
Mean for the Year ..	67·6	64·7	65·7	63·7	64·8					

TABLE SHOWING RAINFALL AT BULIMBA, NEAR BRISBANE, DURING 1898.

By Mrs. Charles Coxen, M.R.M.S.

[*Presented at the Annual Meeting of the Society, 21st Jan., 1899.*]

Month, 1898.	Total rainfall in each month.	Aggregate rainfall from 1st Jan. to end of each month.	Heaviest rainfall in 24 hours.	Number of days on which not less than .01 of rain fell.	Total number of such days from 1st January up to the end of each month.
January	15·56	15·56	4·30	21	21
February ..	9·39	24·95	3·80	12	33
March	14·04	38·99	3·70	17	50
April	1·81	40·80	·93	9	59
May	3·34	44·14	2·20	7	66
June	1·98	46·12	·58	10	76
July	·26	46·38	·15	3	79
August	1·06	47·44	·34	10	89
September ..	2·12	49·56	·85	8	97
October	1·97	51·53	1·40	4	101
November ..	4·42	55·95	2·13	9	110
December ..	5·00	60·95	2·00	7	117

PROCEEDINGS

OF THE

Annual Meeting of Members,

HELD ON SATURDAY, 21st JANUARY, 1899.

The Annual Meeting of the Society was held on Saturday, 21st January, 1899.

The President (Mr. S. B. J. Skertchly), occupied the chair, and about 80 members and visitors were present.

The Hon. Secretary read the following report of the Council for the year 1898.

To the Members of The Royal Society of Queensland.

Your Council has pleasure in submitting their Report for the year, 1898 :—

There have been eight Meetings of Members, the attendance being very fair. A list of papers read at these meetings as well as of the exhibits will be found in Appendix A.

The Council have met twelve times, and the attendance of Members is given in Appendix B.

During the year four new Members have been elected viz:— Sir H. M. Nelson, K.C.M.G. (Life Member); Messrs. T. McCall, O. Granowski, and Pascoe Stuart, and the following Members have resigned: G. B. Brier and A. E. Elmes.

In August last, Volume XIII. of the Proceedings of the Society containing Papers read at Meetings during the year 1897 was issued.

The Library has been enriched to the extent of four-hundred and fifty-two donations during the year. A number of volumes and parts of volumes of proceedings of various societies and institutions were missing in the Library, and on application to the donating societies many of these were kindly supplied. The Council regret that funds at present will not permit of any expense being incurred in binding the many valuable works in the Library. Something in this way might be done if Members whose subscriptions are in arrear would pay the same. The Hon. Librarian, Mr. R. Illidge, is at present engaged in compiling a catalogue of the works in the possession of the Society.

In January last, the meeting of the Australasian Association for the Advancement of Science was held in Sydney. The General Council of that body invited this Society to send a representative for that occasion, and Mr. C. J. Pound, the President at that time, at the request of this Council, attended the Meeting for that purpose.

QUEENSLAND CATALOGUE OF SCIENTIFIC LITERATURE.

In July, 1896, under the auspices of the Royal Society, there was held in London an International Conference on the compilation of an Universal Science Catalogue. Sir J. Gorst acted as President, and there were delegates from Austria, Belgium, Canada, Cape Colony, Denmark, France, Germany, Greece Great Britain, Hungary, India, Italy, Japan, Mexico, Natal, The Netherlands, New South Wales, New Zealand, Norway, Queensland, Sweden, Switzerland, and the United States.

At this Conference it was decided :—

(1) That it is desirable to compile and publish by means of some international organisation, a complete Catalogue of Scientific Literature, arranged according both to authors' names and to subject matter.

(2) That any country which shall declare its willingness to undertake the task shall be entrusted with the duty of collecting, provisionally classifying, and transmitting to the Central Bureau, in accordance with rules laid down by the International Council, all the entries belonging to the scientific literature of that country.

Under advice from Sir Horace Tozer, the Queensland representative, the late Premier, the Hon. T. J. Byrnes wrote requesting the Royal Society of Queensland to undertake the duty of constructing the catalogue in accordance with rules embodied in the second report of the International Conference, dated March 30th, 1898.

This Society appointed a committee of two to carry out the work ; but one of these, under pressure of business, was obliged to withdraw, and the sole charge of compiling the record was undertaken by Mr. John Shirley, B. Sc., District Inspector of Schools. Mr. Shirley has held the offices of Secretary, Vice-President, and President of the Royal Society of Queensland, General Secretary of the Australasian Association for the Brisbane meeting in 1895, and is still Local Secretary for the same Association. His experience has therefore specially fitted him for this duty. During the last twelve months he has devoted the whole of his time after office hours to the task, and the material is now in the hands of the Government Printer and partly in type.

The work is to be divided into two parts. The first part will show the pamphlets or books arranged under sixteen subjects from A. Mathematics to Q. Anthropology. An Alphabetical list of authors' names is given for each subject, with the title of each production, and a reference to the scientific work in which it may be found.

The second part will group the scientific papers under fixed subdivisions, so that future workers in any given science may see at a glance what has already been done in any subdivision of a subject which they have selected for study, and reference to published works may be prompt and easy. The author has requested the Hon. J. R. Dickson, by whom the printing has been authorised, to supply one hundred copies for the use of members of the Royal Society. The work will contain, with index, about one hundred and fifty pages.

CONGRESS OF ZOOLOGISTS.

The Hon. the Prime Minister invited the Society to appoint a representative for the International Congress of Zoologists which was held at Cambridge, England, in August last, and Mr. Saville Kent, a Past President and Life Member of the Society, kindly consented to act in the capacity abovementioned.

THE CERATODUS.

It will be remembered that in compliance with the wishes of this Society, that the Ceratodus should be acclimatised in new habitats, Mr. D. O'Connor of Oxley undertook the work of obtaining and distributing specimens. The practical experience gained by Mr. O'Connor while carrying out this work encouraged the hope that Ceratodus might be conveyed to England. He, therefore, in April last tried the experiment with four fish, which had been caught and fed some few weeks previous to the departure of Mr. O'Connor in the S.S. *Duke of Devonshire*. The fish arrived safely at their destination in eight weeks; two of them found a home at the Gardens of the Zoological Society, Regents Park, London, and two in the Jardin des Plantes, Paris, where they have excited considerable interest. All the fish were in excellent condition when Mr. O'Connor left England in October last.

The condition of the finances will be observed on reference to Appendix C. The Council would request Members to pay their subscriptions early in the year, in order that the Volume of Proceedings, containing the Papers read at Meetings during past year, may be published without delay.

In accordance with the rules, all the officers retire but with the exception of the President and Vice-President (neither of whom, according to Rule 16, can hold the same office for two years in succession), are eligible for re-election. It is now the duty of the Society to proceed to the election of officers for the ensuing year.

SYDNEY J. B SKERTCHLY,
President.

J. F. BAILEY,
Hon Secretary.

Brisbane, 9th January, 1899.

APPENDIX A.

List of Papers Read, also Exhibits during 1898.

No.	Date.	Title or Exhibit.	Author or Exhibitor.
1	March 19 ..	Nests and Eggs of some Queensland Birds ..	J. W. Fawcett
2	,,	Scrubs and the part they play in the Mitigation of Tropical Floods ..	Dr. T. P. Lucas
3	,,	Note on Bees and Wax Scale	J. Shirley, B. Sc.
4	May 21 ..	The Bilbi, a rare Marsupial	C. J. Pound, F.R.M.S.
5	,,	Diamonds & Diamond Drift	J. W. Sutton
6	June 11 ..	Fossil Wood from Mount Astrolabe, New Guinea ..	J. Shirley, B.Sc.
7	August 20..	The Poisonous Principle of Macrozamia	J. Lauterer, M.D.
8	,,	The Vegetation of New Guinea	F. M. Bailey, F.L.S.
9	Sept. 24 ..	Life History, Habits, etc., of Timber Moths	R. Illidge
10	October 22	Life History, etc., of the Cattle-Tick	C. J. Pound, F.R.M.S.
11	Dec. 17 ..	Notes on Tuberculin; its use and preparation ..	C. J. Pound, F.R.M.S.
		EXHIBITS.	EXHIBITOR.
	March 19 ..	Entomological Specimens ..	T. P. Lucas, R. Illidge, and R. H. Relton
	May 21 ..	A Specimen of the Bilbi ..	C. J. Pound, F.R.M.S.
	,,	Diamonds & Diamond Drift	J. W. Sutton
	,,	Diamonds	H. L. Davis
	June 11 ..	Wood Cells from a Fossil Pine	J. Shirley, B.Sc.
	,,	Microscopical	Mic. Section
	August 20..	New Guinea Plants ..	F. M. Bailey, F.L.S.
	,,	Fruit Moths	R. H. Relton
	Sept. 24 ..	Timber Moths	R. Illidge
	October 22	Ticks; Lantern Views, etc.	C. J. Pound, F.R.M.S.
	Dec. 17 ..	Tuberculin, etc.	C. J. Pound, F.R.M.S.

APPENDIX B.

Attendance of Officers at the Twelve Council Meetings Held During 1898.

Office.	Name.	Number attended.
President	*S. B. J. Skertchly	1
Vice-President ..	*J. W. Sutton	2
Hon. Treasurer ..	Hon. A. Norton, M.L.C.	6
Hon. Secretary ..	J. F. Bailey	12
Hon. Librarian ..	†Rowland Illidge	7
Members of Council	F. M. Bailey, F.L.S.	7
Members of Council	W. J. Byram	3
Members of Council	Richard Edwards	2
Members of Council	C. J. Pound, F.R.M.S...	4
Members of Council	John Shirley, B.Sc.	8

* Elected 19th March, 1898. † Elected 9th May, 1898.

APPENDIX C.

THE ROYAL SOCIETY OF QUEENSLAND.

Financial Statement for 1898.

Dr. RECEIPTS.	£	s.	d.	DISBURSEMENTS. Cr.	£	s.	d.
To Balance last Report	7	19	3	By Printing	38	13	6
,, Subscriptions	69	16	6	,, Rent	23	16	8
,, Rent	2	12	0	,, Advertising	1	18	6
,, Sale of Proceedings	0	2	0	,, Postage and Petty Cash	11	10	0
				,, Cheque Book	0	2	6
				,, Balance per Bank Pass Book	4	8	7
	£80	9	9		£80	9	9

Examined and found correct.—ALEX. J. TURNER, *Hon. Auditor.* A. NORTON, *Hon. Treasurer.*

Liabilities: Printing, £8 1s. 2d.
Rent, £4 6s. 8d.
£12 7s. 10d.

Brisbane, 6th January, 1899.

On the motion of Mr. G. Watkins, seconded by Mr. W. A. Hargreaves, the Report was adopted.

The Treasurer's Statement was read and adopted.

The President then delivered his address.

PRESIDENTIAL ADDRESS, JANUARY, 1899.

Ladies and Gentlemen,—

Happily for your retiring President, the one note of sadness which is first sounded in the Annual Address needs not to be struck by me, for we are fortunate in having no requiem to sing. Death's grim angel has passed us by without alighting. Yet we must realise that, with the American poet, we have to say—

> 'Twas at thy door, O friend, and not at mine
> The angel with the amaranth went in."

Aye, went in and culled one of the fairest of Queensland flowers, on the eve of its blossoming. In the Hon. T. J. Byrnes, Premier of this colony, we lost not only a prospective fellow—for he had promised me he would throw in his lot with us—but one who had the higher education of this colony close to his heart.

This leads me naturally to speak of one of my predecessors in this chair, Mr. R. Logan Jack, Government Geologist, who has left us for a while to take a well-merited holiday after nearly 23 years of continuous work in the colony. Mr. Jack's contributions to the geology and the mineral development of his adopted home, constitute a magnificent testimonial, graven with his own hammer, indited with his own pen. We may be permitted to hope that such great merit will be made known to the Lady he has served so well in her own Queensland.

Would that these honours fell less sparsely on the scientific veterans of the colony. Kindly time has chapletted with silver the honoured heads of two of your former Presidents, and on one of them—Hon. A. C. Gregory—the coveted Companionship of SS. Michael and George has been conferred, and right worthily, for is he not an uncrowned king of explorers? Is he not a sturdy relic of ancient geology in himself?

But there is yet one other, whose gentle courtesy has always led him to seek the lower seats in the synagogue of fame, till it would almost seem as if his seventy years' service were to pass by without the comforting recognition, "Well done, thou good and faithful servant." Need I say I refer to Mr. F. M. Bailey, Government Botanist, doyen of Australian botanists, friend and helper of all who desire to know aught of herbs and trees; and whose Spirogyra-like locks seem almost destined never to be bayed by the gentle hand that loves to honour those that have helped to make her Empire great: and this only because, like charity, he was not self-seeking.

Following the good example of my immediate predecessor in this chair, I shall not attempt to review the progress of science during the past year but devote myself to the subject of my own particular researches. It has been my privilege to spend the greater part of the year in studying the geology and mineral deposits of that part of our colony which has lately become so famous under the name of Chillagoe; and as I had some three years previously spent several months there, the results I now place before you may be taken as the matured opinions which have grown from a year of minute study in the field. The title of my address is therefore :—

The Geology and Mineral Deposits of the Country around Herberton, Watsonville, and Chillagoe, North Queensland.

(1.) *Geographical.*—It is curious to note the almost complete ignorance of the North displayed even in the South of this great colony. The intrepid explorer who bids farewell to sorrowing relatives on the wharf at Brisbane on his voyage to Cairns is looked upon as a sort of minor Nansen or Andrée, about to plunge into the pathless wilderness, and to face moving accidents by flood and field in the fell climate of the deadly tropics. Nor is this altogether to be wondered at, for the distance from Brisbane to Chillagoe is about equal to that between London and Naples. For the sake, then, of strangers let me describe this distant land.

The port at which we disembark for Chillagoe is Cairns, situated on the shores of the fine-sheltered Trinity Bay. The steamer lays us alongside the wharf, so that all the horrors of being transferred to the miserable little inadequacies that do duty for tenders at such places as Rockhampton and Townsville are avoided. We are now well within the tropics, the latitude being 16deg. 56mins. S., and this is attested by the wealth of vegetation—by stately trees festooned with trailing rattan and many a swinging lliana, and coronetted with glorious fern and lycopod and orchid. It is hot, but the sea breezes temper solar fervour, and the result is not unpleasant.

Cairns lies upon the alluvium of the delta of the Barron River, which yields rich crops of bananas, sugar-cane, and other tropical produce. Immediately behind this low land rises a rampart of rugged mountains, which are in truth but the weather-frayed edges of a noble table-land. On this plateau rises the Barron River, which has gnawed out a grand gorge, some 900 feet deep, as steep and as impressively beautiful as many of the canons of Western America. Along this gorge, and in places well-nigh over-hanging it, the Cairns and Mareeba Railway climbs, reaching an elevation of 1,325 feet in 46 miles, and passing close by the renowned Barron Falls, which come cascading down a wild rock-staircase 900 feet high. The last 20 miles are along the plateau. The terminus is Mareeba, and why the railway stops there, for it is nowhere in particular, is a mystery known only to politicians and tax-payers.

This plateau, which is of basalt, runs as level as a table for about 27 miles, to Atherton. On the table-land we have left behind the genuine tropical vegetation, and have entered upon typical Australian scenery—open forest of eucalyptus. But at Atherton we come suddenly upon a total change, for a belt of scrub, some four miles wide, is drawn across our path as accurately margined from the open forest as if it were the skilled work of the Indian Forest Department. The change is startlingly sudden. One moment you are in Australia, the next in equatorial Asia. Giant trees, thick underscrub, tangled bush-ropes, all proclaim the tropics ; but it is Asiatic and not Australian. To this subject I shall return.

Our journey still is westward, and in about two miles from Atherton we leave the plateau and begin the ascent of the Herberton Range, the coach-road reaching an elevation of over

4,000 feet. From Atherton onwards, as far as Chillagoe, not one trace of scrub occurs; all is open forest. The summit of the range is about midway—say six miles—between Atherton and Herberton, which latter lies 3,000 feet above the sea.

We have now fairly entered upon the mineral field, and for 100 miles west, and, say, 20 miles north and south of the main route, or about 2,000 square miles, it is not too much to say that it would be difficult to find half a square mile without some trace of useful mineral.

The climate of Herberton is superb. Of course, it is hot in the noon of a summer day, but not hotter than Brisbane, and the nights are so cool that blankets are seldom dispensed with. Then, too, as summer is the rainy season, the heat is much tempered by the overcast skies. In winter it is really cold, and ice forms every season. Here we have no hot winds to parch the skin, no Southerly Busters to enervate one into despair, and the worst one can say is that in the early party of the year there are plenty of those days which our Scottish brothers carefully describe as "a wee bit saft."

From Herberton we pass on to Watsonville, a distance of seven miles, crossing the Watsonville Range at a height of about 4,000 feet, and descend to the township, whose height is 2,565 feet above the sea. We have now left the Pacific waters behind us, and are upon the Gulf watershed, the creeks going to feed the Walsh River. From Watsonville onwards to the limits of our area the ground gradually falls to about 1,300 feet above sea-level; but, as we shall see, there are many a steep slope to be toiled over ere the limestone bastions of Chillagoe signal that rest awaits the weary.

Immediately at the back, or south, of Watsonville, the hills begin to rise into mountain magnitude, and form range on range, from which grand views of the country can be obtained, and the winding valley of the Walsh River traced.

Leaving Watsonville, the road takes us in 20 miles to Montalbion, of silver fame, passing through the mining camps of Bakerville and the Orient, now practically deserted, but soon to rise again to assured prosperity. Montalbion is 2,000 feet above sea-level, and the old silver mines have all been taken up again, and will probably be in full work by the end of this year. The mineral ground over which we have hitherto been travelling has been chiefly tin, and we now enter upon the silver and copper region, to be broken only by one other tin centre at Koorboora.

From Montalbion the route follows a branch of the Walsh known as Gibb's Creek, and after passing Copper Hill at five miles, runs roughly parallel with Emu Creek to Oakvale, near which an interesting mineral spring breaks out through a hole in a rock in the centre of a creek. The water is chalybeate, and contains a little lithia. It is a fact always impressed on the new chum that the water tastes of whisky: always of the brand in vogue at the adjacent hotel. Mr. Wade, the proprietor of the said hotel and of the spring, says he cannot account for this strange phenomenon, which seems from my own investigations not to have been known to the aborigines before the advent of the white man.

Another twelve miles brings us to the tin-mining township of Koorboora, now waking into fresh life, but ere it is reached is a range grimly called the Featherbed, from the knuckly character of its ups and downs. Hereabouts for awhile we are in the watershed of the Tate River, which flows roughly parallel with the Walsh. A long stretch of granite country succeeds, and then about a mile east of Atherton's Station we enter the true Chillagoe region. Speaking broadly, the country is a synclinal trough, the rim and much of the bed of which is formed of schists, slates, sandstones and quartzites. In this trough, and lying unconformably upon the schists, &c., is the Chillagoe Limestone, very much denuded, its chief fragments standing up as fantastic ruins of battlemented bastions. These, as a rule, form more or less isolated masses, having the same general trend as the trough, that is, north-west. Very strange indeed is this country to the geologist. The road winds in and out between the limestone fortresses, along dead-level bottoms covered with a soil so red that one instinctively thinks of basalt. It is, in fact, only the insoluble residue from the wasted limestone. This country extends all the way to the boundary of our area, varying in width from a mile to ten miles, and flanked to the north by rugged granitic country, and to the south by gnarled schists and contorted gneiss, with intercalated granites.

The Chillagoe region is pre-eminently that of argentiferous copper, while the schist series carries in addition argentiferous galena, gold, and tin.

The township of Mungana has grown up around the Girofla and Griffith mines, and is the furthest west: though 20 miles further on a still newer township, started as Bedford, continued as Klondyke, and finally christened Arbouine, has come into existence within the past few months.

This more western region is undoubtedly hot, and even in winter the days does not demand greatcoats, though blankets are very welcome at night. The one plague, and it is no slight one, is the fourth plague of Egypt—flies. Ramsees II. would not have detained the Israelites ten minutes if his seat had been at Mungana instead of Zoan.

In the rainy season the creeks are sometimes impassable for a few days, owing to the entire absence of bridges; but this is only what can be said of every newly-opened country.

2. *Classification of Deposits.*—The classification I shall adopt differs from that we adopted on the Geological Survey of Queensland in some important particulars, because detailed observation has enabled me to correct some points, and to divide certain deposits which have, of necessity, been grouped together. This must always be the case in a new colony like ours, and reflects no discredit on my predecessors; indeed I hope to improve on my own scheme hereafter, and shall be glad of any facts which will enable me to do so. The formations are as follows, the newest being at the top:—

(1.) *Alluvium and Gravels of Modern Rivers.*—Carrying stream tin, carbonate of bismuth, and gold in places.

Age; *Post-tertiary.*

(2.) *Basalt.*—Chiefly confined to the plateau between Mareeba and Atherton, and to the district west and south of Herberton. Of no commercial interest except as covering up deep-leads or other mineral-bearing deposits.

Age.—*Pliocene.*

(3.) *Deep Leads and other Old River Gravels*—Gravels, sands, and loams; in places, as at Nigger Creek, Herberton, partly covered by basalt. Often very rich in stream tin. Sometimes gold-bearing.

Age.—Probably but little older than the basalt. *Pliocene.*

(4.) *Granite and Diorite Masses, Porphyry Masses and Dykes, Elvans and other Dykes, Intrusive Eclogyte and allied Rock.*—Of these igneous rocks the granite masses are the oldest, and are generally intimately associated with the porphyry masses, and porphyry dykes. The other rocks are for the most part newer than the granite and porphyry, but almost invariably associated with them. These are *par excellence* the mineral-bearing rocks. All are newer than the Chillagoe Limestone.

Age.—*Upper and Lower Permian.*

(5.) *Chillagoe Limestone.*—Beds of more or less crystalline limestone, lying in a synclinal trough, unconformable to the Herberton Beds. Much denuded, full of caves, and probably originally about 400 feet in thickness. Contains obscure crinoids, corals, polyzoa, brachiopods, &c. Much altered in places by contact with and intrusions of granite-masses and dykes of eclogyte, when it becomes ore-bearing, the ores being copper, lead and silver, but not gold or tin. The ore is seldom in the limestone itself, but confined to the intrusive eclogyte. (Rarely, old cave-deposits carry rich copper ore.)

Age.—*Lower Permian or Upper Carboniferous.*

(6.) *Montalbion Beds.*—A series of comparatively unaltered shales and sandstones, with calcareous seams and bands of nodular clay-ironstone. Often lying at low angles. Separated provisionally from the Herberton rocks, on which they lie, in consequence of their marked lithological peculiarities, and unaltered character. Only seen around Montalbion Hill. Contains silver-lead, copper and fahl-ore in lodes and mineralised beds.

Age.—*Lower Carboniferous.*

(7.) *Herberton Beds.*—A great series of arenaceous and argillaceous rocks, ranging from coarse conglomerates (the Ringrose Conglomerate) to fine sandstone and quartzite: greywacke, slate and mica-schist; with occasional beds of limestone, which have been mistaken for Chillagoe Limestone. Continuous right across the area, narrowing towards Chillagoe, where they pass below the Chillagoe Limestone. Is the chief home of all the mineral wealth.

Age.—*Devonian.*

(8.) *Dargalong Beds.*—A series of highly metamorphosed rocks, chiefly mica and hornblende-schist and gneiss. Flanks the Herberton Beds to the south. Contains rich silver and copper lodes, as fissure veins, in this differing from the typical Chillagoe ore-bodies, which are carbonas. Gold not uncommon. Tin at the Tate on the junction of these beds with the granite.

Age.—*Silurian, or possibly older.*

III. *Description of Rocks.*—*(a) Alluvium.*—The Alluvial Deposits of N. Queensland do not call for detailed description, consisting as they do, of the usual alluvial and gravel beds. As, however, this part of the country has been dry land since the close of the Cretaceous epoch, an enormous amount of denudation has taken place, which has left its traces in high-level deposits which reach in places to 100 feet above the present stream courses. Some of these still lie exposed to atmospheric waste, other portions have been sealed beneath great basalt flows, and constitute Deep Leads, such as that which yields so much tin at Herberton. Of the unsealed deposits the extensive alluvial workings of the Tate Tin Mining Co., form a good example. The alluvial beds yield gold, tin and bismuth carbonate (bismuthite) as commercial products.

(b) Basalt.—The enormous flows of basalt which extend at intervals throughout the length and breadth of the Colony, from Cape York to N.S. Wales, and from the Pacific Coast westward into South Australia, often covering many thousands of square miles in continuous sheets, constitute one of the most interesting features of Queensland geology.

The basalt generally lies almost perfectly level, and must have been poured out in an almost limpid condition of fluidity. No geologist can traverse these rusty plains, with their choking dust, without the impression crystallising into certainty that the basalt was never ejected from ordinary volcanic vents, but must have welled up from beneath through innumerable fissures or dykes, and deluged the land in a fiery flood from 100 to 300 feet in depth.

As this black infernal vomit solidified and cooled, it spurted and spat its imprisoned gasses and liquid remains into the air, forming small volcanic vents some of which still dot the landscape, while others lie as deep dark tarns, unsuspected, on the level plain.

The exact geological date of this tremendous outpouring is as yet hard to determine, but several lines of reasoning tend to show that it is of Pliocene age.

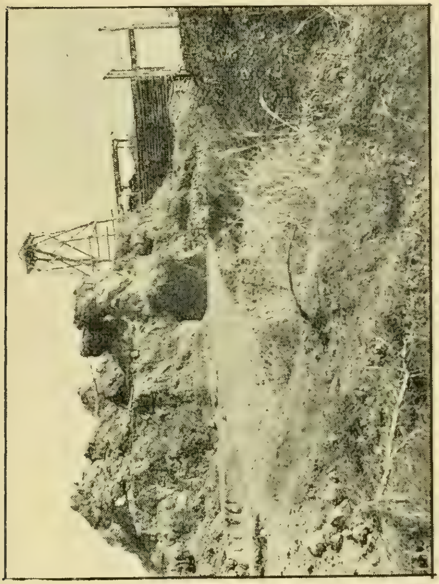
What the effect of this fiery cataclysm must have been upon animal and vegetable life geologists do not seem to have paused to consider. To my mind it suggests a reasonable cause for the destruction of the gigantic marsupials such as the *Nototherium* and the *Diprotodon.*

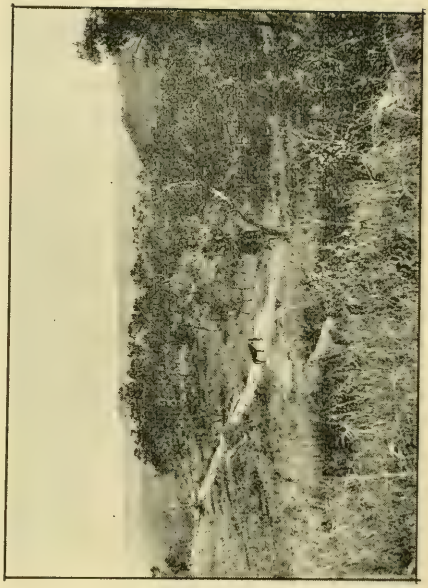
It is true that the remains of these gigantic marsupials have been referred to Post-Tertiary times, but this is largely owing to the remains being found in alluvial and allied deposits, and as these have been accumulating all through the Tertiary epoch, there is no reason why they may not be much older than has hitherto been supposed.

This suggestion also affords an explanation of the remarkable character of the Australian flora. The mass of the species are of temperate or sub-temperate forms, the true tropical genera are either confined to certain definite lines of scrub, or are dotted sporadically like aliens in a native army. In fact, the old original tropical flora was either exterminated or survived in mountain fastnesses like the dark human races of the Eastern Archipelago. The war of extermination was indeed a fiery trial.

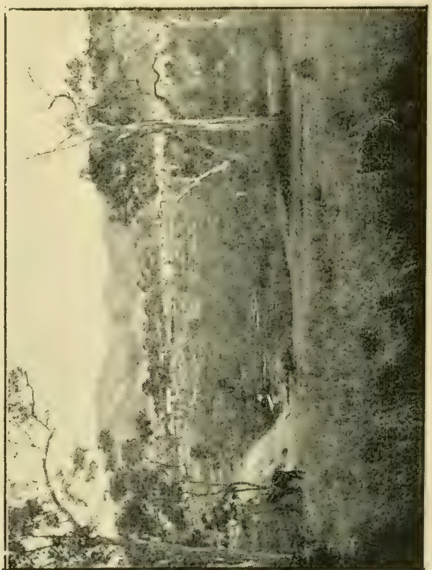
Here it is that such forest belts as the Atherton Scrub have such a profound scientific interest. When we consider further that the timber is of great commercial value, and that practically no reliable information has been gathered concerning it, it is not too much to hope that the Government will immediately see their way to despatching our Hon. Sec., Mr. J. F. Bailey to report thereon, he being the only person qualified to carry out such an investigation, for it would be almost cruel to ask his father to undertake so arduous a duty.

(c) Chillagoe Limestone.—After nearly a year's detailed mapping and investigation in this area, I have been led to the con-


GIROFLA MINE.


CHILLAGOE ROAD (looking toward Featherbed Range).


DAM SITE.


KOORBOORA.

clusion that the interpretation of the geological structure of the Chillagoe district as heretofore adopted by Mr. R. L. Jack and myself must be profoundly modified. Neither of us had had opportunities for more than making rather hurried traverses, our official duties necessitated our time being mainly devoted to the more commercial problems of the actual mines. Hence, it was not until I had time and opportunity to study the limestone, that the true significance became apparent. We had both naturally concluded that as the limestone appeared to lie along the general strike of the rocks, and as the slates, etc., cropped out between the various limestone bluffs, and finally, as the limestone is seamed with more or less vertical division planes, that there were several beds of limestone intercalated in the slate and sandstone series, that any peculiarities in the lie of the limestone might be accounted for by faulting.

With this impression still on my mind, I started to map a great part of the country in detail, and found that our old theory was not borne out by facts, and that instead of the Limestone being one or more beds of intercalated in the slaty rocks, it was really quite unconformable to them. The Chillagoe Limestone, in fact, lies as a much denuded cake extending over the upturned edges of the Herberton rocks, and losing itself on, and partially in, the granite which has disturbed and altered it. What we thought to be bedding-planes are really a rough system of cleavage planes, which like those in the underlying rocks owe their origin to the strains set up by the intruding granite. No system of faults, however complex could account for the lie of the limestone, and in many places both round Mungana and thence to Calcifer, the last relics of the limestone can be seen fading out, as it were, into isolated patches a few inches thick lying upon the Herberton rocks.

So far from the limestone being nearly vertical, it really lies in a series of low folds. Here and there, as in the caves at Mungana, lines of broken encrinites and other organisms can be seen still occupying very nearly their original horizontal position.

In many places both along the Northern and Southern boundaries of the granite the limestone is altered into a very coarse crystaline calcite, individual crystals being often several inches across. I generally found I could predict the coming on of the granite by the alteration in the structure of the limestone.

Here and there, as for instance at South Ruddygore the the limestone is faulted and tilted, and then seems to be inter-bedded, but the true lie of the beds can always be made out by accurate mapping.

The limestone contains a certain amount of silica and iron, and the iron has in many places been deposited as a true iron-stone at its base. This ironstone, when exposed on the surface by denudation, has often been mistaken by prospectors for the ferruginous gangue of the copper and silver ore. It is, of course, quite barren.

The obscure and scanty fossils as yet found in the limestone do not warrant us in speaking confidently of the exact age. Both Messrs. Etheridge and Jack consider the evidence tells in favour of its being Carboniferous.

I hope shortly to present a memoir on this interesting formation to the Society.

(d.) Montalbion Beds.—The hill which gives its name to Montalbion and some of the adjacent country, is made up of a series of more or less calcareous shales and sandstones, with seams of clay ironstone. They are, as a rule, so little altered, and lie at such comparatively low angles, that I am inclined to suspect they are distinct from, and overlie unconformably, the Herberton beds. The boundary I have not had time to follow out, but they seem to be limited to the vicinity of Montalbion, and probably only exist as outliers.

Should this suggestion prove correct, the Montalbion beds will probably prove to be of Lower Carboniferous age.

(e.) Herberton Beds.—The enormous series of slate, shales, conglomerates, grits, sandstones, and greywackes, which constitute the mass of the country between Herberton and Arbouine, were formerly classed with the Gympie Beds, which are of Permo-Carboniferous age. Mr. Jack has since obtained evidence that they are older, and must be relegated to the Devonian system, a conclusion in which I agree, and which fits in well with my proposed new classification.

The beds are much twisted and contorted, and seamed with faults. Speaking broadly, the series is more arenaceous towards the east, and more argillaceous as we travel westward. The massive Ringrose Conglomerate (so named by me after Mr. R. C. Ringrose, of Herberton, who first described them) probably constitutes the base of the series, and marks an old shore-line. The beds, however, are faulted in too complicated a manner to allow of this being demonstrated until after prolonged study and mapping. They are traceable for a considerable distance round Herberton, and are again seen at the Jumbo Mine, six miles west of Koorboora. In both localities they are associated with silver deposits.

Still speaking broadly, the argillaceous series is stanniferous in the east and south, the tin extending as far west as Koorboora.

Copper occurs throughout the whole region, and entirely replaces the tin west of Koorboora.

Silver is more or less disseminated throughout, but is more plentiful around Newellton, Montalbion, and the west of Chillagoe. In most of these places the original argentiferous ore is galena, but most of the copper carries silver also, often in paying quantities.

(f.) *Dargalong Beds.*—Flanking the Herberton series to the south is a mass of schistose and gneisic rocks, so different in character and in strike, that I feel quite sure they belong to an older and unconformable series. They were first separated by Mr. Jack, who, however, thought they might be only a more highly metamorphosed condition of what he then thought were the Gympie Beds. Three years ago I expressed the opinion that they were probably Silurian, and a closer acquaintance with them during the past year has strengthened this belief.

They consist of mica-schist, hornblende, and gneiss, with beds of pegmatite. Occasionally they fade away into the granite, which has eaten through them. They are highly contorted, twisted and gnarled, and are in marked contrast to the Herberton Beds.

They contain lodes of copper and silver ore, and, here and there, payable gold.

(g.) Igneous.—(1.) *Granite.*—So far from the granite being one of the oldest rocks of the district, it is in reality one of the newest, for it can be seen cutting through and altering the Chillagoe Limestone. It occurs in great masses along the northern parts of our area, and in smaller masses to the south, and throughout the district generally. In no part of Queensland have I seen it penetrate the Trias-Jura Beds, and a prolonged study of its behaviour in the field has convinced me that it is not older than Permian times.

As a rule, it is an ordinary ternary granite, composed of orthoclase, muscovite and quartz. Its more central portions are often coarsely porphyritic, in which case it is generally void of useful minerals. Biotite and plagioclase felspar sometimes form essential ingredients. In some places, as around Calcifer and near Dargalong, it becomes hornblendic, but I have not yet found it as a true quartzless syenite. It sends spurs and dykes into the surrounding rocks, and both the tin and copper deposits are almost invariably associated more or less closely with it. There is hardly a mineral deposit of any size more than a mile from its boundary, or from some associated igneous rock.

It several places it is stanniferous. Thus, at the Hadleigh Castle Mine, near Watsonville, cassiterite is found as a compact ore in irregular masses, and at Mount Borunda, on the Tate, the tin occurs in a more crystalline form in more or less greisenised portions of the rock.

(2.) *Porphyry.*—The typical porphyry of the district has a felsitic groundmass, with sporadic quartz blebs, and isolated crystals of pink orthoclase.

It sometimes constitutes extensive masses, as around Herberton and Watsonville, and very frequently occurs as elvans. At the North Australian Mine, Watsonville, a curious variety occurs, which is so highly quartzose as to have been mistaken for quartzite. This rock is only known to me elsewhere as occuring around Indooroopilly, Brisbane.

The porphyries, though of different ages, are newer than the granite, through which they can be seen to cut.

Porphyry, whether massive or as elvans, is both here and in South Queensland intimately associated with tin.

(3.) *Diorite.*—The diorite of this district is almost invariably of the quartzose variety. It occurs in masses, as at Sun Rise, south of the Tate, in sheets fed by dykes, as at the Pirate Mine, on the Tate River, but generally occurs as dykes. These dykes around Herberton and Watsonville are the principal carriers of tin, and have been much altered into chloritic and serpentinous rock at the time they were charged with mineral.

The diorite dykes are certainly in many cases newer than the granite, but I have not yet found them traversing the Chillagoe Limestones.

(4.) *Eclogyte.*—This peculiar rock is essentially the ore-bearing gangue of the true Chillagoe deposits. It is essentially a siliceous rock charged with lime garnet. It varies from a rock almost indistinguishable from quartzite to a pure garnet rock, with crystals half an inch in length.

It traverses alike the Herberton Beds, the Chillagoe Limestone, and the granite. Where it is ore-bearing it is nearly always highly ferruginous. It occurs at or near the line of contact of the sedimentary rocks and the granite.

(IV). *Classification of Ore-Deposits.*—No system of classification of ore-deposits is quite satisfactory, but the following scheme seems to be best suited for the district under consideration. Intermediate varieties are of common occurrence which might with almost equal propriety be placed in either of two divisions.

(1). *True Fissure Lodes.*—These are characterised by well defined walls, often showing zones of crushed rock, and with flucans or clayey selvages. Both walls and flucans generally show one or more sets of slickensides. Their course is generally more or less sinuous, and they generally pitch or hade at a steep angle. The ore occurs either in bands or shoots, and seldom occupies the whole width of the lode. Where they are of any size they may be deemed absolutely permanent. They are principally confined to the district between Watsonville and Montalbion. An excellent example of a tin fissure lode is the Stewart's T Claim, at Watsonville, which is down 440 feet, and has averaged 23% of tin from top to bottom in a lode averaging

6 feet wide. Beautifully banded copper lodes, proved to a depth of 200 feet may be seen at the Lady Mary and Cumnor mines, at Montalbion.

(2). *Dyke Lodes.*—Characterised by the ore being associated with intrusive dykes of igneous rocks such as elvans and diorite dykes. They are true fissures, but the dyke rock forms the boundary of the lode and the country rock lies outside. They are as permanent as class 1. As examples we may cite the Great Northern Tin Mine at Herberton, over 600 feet deep, in which the tin ore seems to occur in irregular almost parallel shoots cutting diagonally at steep angles across an altered diorite dyke. The chief silver lodes at Dargalong similarly occur in a fine grained dyke of hornblendic granite, and the Sun Rise group of copper and silver mines, south of the Tate, are in dioritic dykes, which in places become pure hornblende rock.

(3), *Carbonas.* I have adopted this term to designate the irregular copper and silver deposits which characterise the Chillagoe area. They occur at or near the junction of the granite with the other rocks, are sometimes of enormous dimentions, and occasionally run almost uninterruptedly for over a mile. They are irregular in all their dimentions, but being of undoubtedly deep-seated origin they justify a large expenditure in sinking. The typical gangue is eclogyte, and where ore-bearing, are highly charged with iron.

Where denudation has removed the adjacent limestone they often form marked features in the landscape, standing up as bluffs occasionally as much as 80 feet high and 200 feet wide.

They are by no means confined to the limestone for I have in over 50 places traced them downwards into the Herberton Beds. It is, however, quite probable that in the limestone the carbonas have larger dimentions than in the less soluble Herberton beds.

Most of the Chillagoe mines are of this character and it is unnecessary to cite examples.

(4). *Impregnations from Faults.*—In this class the ore has been brought up through the faults and become disseminated through the country. Hence there are no true walls, and the mines are very indefinite and can only be proved by carefully following the system of faults. Some of them are of great richness, and, as in the case of the North Australian Tin and Copper Mine, at Watsonville, and the Vulcan Tin Mine, at Irvinebank, huge masses of almost pure ore worth many thousands of pounds have occured and are likely to occur again.

(5). *Bedded or Cleavage Deposits.*—These are similar to the above, but bedding or cleavage planes, being the lines of least resistance, have proved the channels for the introduction of the ore which has impregnated the adjacent country.

These are always indefinite and unreliable, and though they occur in our district none are of sufficient importance for commercial purposes.

(6). *Cave Deposits.*—As might be expected, it has occasionally happened that copper has been carried by underground drainage into caves, and there been deposited as ore. This can be seen on a small scale near the Harper Mine, and on a large scale in the Griffith Mine at Mungana.

(V.) *Dymanics of the Deposits.*—The geological history of the district repeats in a more complicated manner the story I have worked out for the mineral region of South Queensland.

We start with a rugged mountainous country formed of the Silurian rocks, which had already been metamorphosed into schists and gneiss, and which we now call the Dargalong Beds.

Then came a long period of depression beneath the sea, probably in Lower Carboniferous times, during which the Herberton beds were laid down. Fragments of the old shingle beach still remain in the Ringrose Conglomerates. This was followed by a gradual elevation, which to some extent upturned the Herberton beds. The new land was sculptured into hill and vale by the denuding action of rain and rivers.

A repetition of this process laid down the Montalbion Beds.

Then, towards the close of the Carboniferous period, ensued another depression, during which the Chillagoe Limestone was laid down on the worn edges of the Herberton beds.

Up to this time little or no mineral deposit had been formed. During the ensuing Permian period a total change occurred. The granite slowly " Wrought its skyward impulse from Earth's

the lines of least resistance, that is along the joints, and so are formed bedded lodes, Class V. If the plates crack, faults are formed and an easier outlet produced, and so we get impregnations from faults, Class IV, evidently richer than Class V. If the boiler breaks or splits we have true fissures, Class I., through which and along which the steam will pass and condense: clearly they are richer than any of the other classes. If the boiler were lined with a more or less plastic substance this would be forced through the fissures and steam with it, and so we get Class II, the dyke lodes.

Finally we have Class III, the Carbonas, to account for. Let our boiler cool down after large quantities of the plastic inner material had been extruded. It is plain that along the junctions of the extended masses with the plates we have lines of weakness, and if the boiler be again heated, the steam will most readily escape along the sides of the old rents. This is precisely what has happened; the extruded plastic matter is the granite, etc., and here we have the clear explanation of the law laid down above, that the carbonas are on or close to the junction of the igneous and sedimentary rocks.

One other point deserves notice, the ironstone outcrops. The ironstone is in the form of limonite, hæmatite, or magnetite, and as the old German adage has it:—

"Happy is the lode that wears an iron cap."

There are, however, unfortunately for prospectors, two sets of ironstone, the one valuable, the other valueless, and they are mineralogically the same. The ironstone which is valuable as an indication of lodes has come from below as described; the worthless ironstone is simply the residuum of the iron suffused through the limestone, carried down by rain-water and deposited at its base. It often forms really good hæmatite, but of no thickness, and where the limestone has been denuded away and left the ironstone outstanding, only a knowledge of the geological features can discriminate between this and the true lodestuff.

Concluding Remarks.—Having thus sketched, though in meagre outline, the chief geographical and geological features of this remarkable district, a few words may appropriately be devoted to the question of its future. If wisdom is born of experience, that future is a bright one, close at hand; but if with Tennyson we cry:

"Knowledge comes, but wisdom lingers"

the day which promises so fair a waking will close once more in sadness and hope deferred again make the heart sick. Nature has prepared the way—valuable minerals are there in plenty—around Atherton is an unparalleled supply of timber, and a rich food-producing area. Indeed everything lies at hand, but without co-operation and the application of the highest of modern skill and knowledge, the story of the past will be repeated, and disappointment again sadden the land. The first thing to remember is that the day of poor men's mines is over; the windlas-and-bucket miner with his cinque-cento adages about not seeing further than the point of the pick will soon be as extinct as the Diprotodon. He has had his chance, and done useful work, but he must give way now to him who with money and knowledge at his back, can attack problems far beyond his predecessor's ken, and who needs not unthriftily to wring out of the unwilling earth daily ore for daily bread. Mine-owners must have sufficient capital to enable them to carry on exploiting and development work at the same time as ore-raising, and the tenure of the ground must be made safe enough to justify capitalists in locking up their money for years. A mine ought to be as permanent a property as a farm, and it is useless to expect people to go to great expense in plant, unless security is given that the property may not be jumped owing to unforseen accidents. Security of tenure should be a right, and not a privilege. Happily legislation is tending this way. It is also pleasant to notice that legislators are beginning to realise that tin, copper, and silver mines, whose produce is more variable in value than wool, are not to be dealt with as if they were gold-mines, whose material is the standard in which the other mine products is purchased. Gold is not wealth, it is simply the means of purchasing it. Tin, copper, lead, silver, &c., are wealth, and are necessaries of life.

Another crying want is improved communication. For years the local tradesmen, miners, agriculturalists, timber-merchants, etc., have been petitioning for the extension of the railway at least as far as Atherton. There is no difficulty whatever about it, for the ground is as level as an American prairie; yet one sees with dismay that this agricultural and timbered land is in a state of stagnation, and that timber is being brought from the south for the construction of the Chillagoe railway, which passes within a few miles. When I left the district at Christmas, timber could hardly be bought in Cairns, yet if the line had been carried on to Atherton it would have been abundant. This leads me again to express my deep regret that the Mareeba-Chillagoe line did not pass through Atherton, Herberton, and Watsonville—it would then have tapped proved rich mineral ground all the way, whereas its present route is over quite half its distance through country without even a settler.

I should not like to close without saying a word of praise of an Institution which, through great difficulties, and I believe with no external aid, is by sheer merit forcing itself upon the public attention. I allude to the Technical College, Brisbane. It has advanced by leaps and bounds, and is the strongest proof of the growing yearning for more accurate training in the arts and sciences. To the students of this College I look in great measure for the advance in accurate methods of reasoning to which we must trust, if our noble Colony is to keep pace with the rest of the world—it is the outward and visible sign of an inward and spiritual grace, which will prove of incalculable benefit in the very near future.

Foot Note.—For the admirable set of diagrams with which my address was illustrated, I am indebted to my friend, pupil, and late colleague, Mr. Leonard C. Green, of the Geological Survey of Queensland. The blocks herein produced are kindly supplied by one of our members, Mr. W. Lees, of the firm of Messrs. Outridge and Co., who is bringing out an admirably illustrated work on Chillagoe, &c.

The Hon. A. Norton moved, and Mr. J. Shirley seconded, a vote of thanks to Mr. Skertchly for his address, and also that it be printed in the Society's Proceedings. This was carried by acclamation.

The election of Officers for the year 1899 then took place, with the following result:—*President*, J. W. Sutton; *Vice-President*, Dr. A. Jefferis Turner; *Hon. Treasurer*, Hon. A. Norton, M.L.C.; *Hon. Secretary*, J. F. Bailey; *Hon. Librarian*, Rowland Illidge; *Members of Council*, F. M. Bailey, W. J. Byram, C. J. Pound, J. Shirley, B.Sc., and S. B. J. Skertchly; *Hon. Auditor*, A. J. Turner.

The proceedings then terminated.

END OF VOLUME XIV.

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