should be sorry if anything Mr. Johnston said—and I don't think it will—should have the effect of in any way lessening the exertions made in the way of looking carefully after our sanitation. Mr. Johnston pointed out that there are other causes which may make an apparently high death-rate beyond those that man has power to deal with. But I think the very fact that there is such a large difference between the urban and rural death-rate, enforces on us this: that the efforts of science ought to be to make life in towns as healthy as life in the country. (Applause.) I shall ask you to join me in a vote of thanks to the authors of these interesting papers. (Loud applause.)

Mr. G. S. Perrin, Conservator of Forests, drew attention to the following specimens of Tasmanian trees, which he had laid on the table : — Arthrotaxis cupressoides, do. selaginoides, Dacrydium Franklini, and Microcachrys. Flowering branchlets of these were affixed to a card, and along with them were shown specimens of the wood of the different varieties. They all belonged to the class of Tasmanian conifers, and were collected from various parts of the island. One specimen, the Arthrotaxis cupressoides, had been obtained from the back of the La Perouse range, one of the most difficult places of access in Tasmania, where probably no one but Mr. Perrin has penetrated. One of the pieces of wood shown—a bit of celery-top pine—had been 11 years under water, and formed a portion of the first water-wheel erected at Mount Bischoff. It was in perfect preservation, as was also a piece of Huon pine, which had for 40 years been part of a plank in a jetty at Macquarie Harbour that was originally cut for that purpose by order of Sir William Denison. Mr. Perrin's specimens will remain for a short period in the Museum, where they may be inspected.

The meeting, after Mr. Perrin had given his account of his specimens, closed.

## MAY, 1887.

The monthly evening meeting of the Royal Society took place on Tuesday evening, the 10th May, the President, His Excellency Sir Robt. G. C. Hamilton, K.C.B., in the chair. There was a large attendance of Fellows and several ladies present.

The following gentlemen were declared elected as Fellows of the society:—The Hon. the Minister of Lands (E. N. C. Braddon, M.H.A.), Messrs. F. J. Young, B.A., Cambridge, H. H. Gill, M.H.A., W. J. Jones, David Barclay, C. A. Payne, M.R.C.S., A. J. Taylor, J. W. Toplis.

List of additions to the Library:—

Bibliothique Gèologique de la Russie redigeè par S. Nikitin.

Bolletino della Societá Geografica Italiàna, Serie II., Vol. XII., Feb., 1887. Anno XXI., Fasc 2.

Bulletins du Comité Geologique. Nos. 1 to 11. St. Petersburg, 1886. —From the Society.

Bulletin de la Société Royale de Botanique de Belgique, Tome-Vingt-cinqueieme, 1886.—From the Society.

Imperial Federation, March 1, 1887.—From the Editor.

Memoires du Comité Geologique. Vol. 2, No. 2. Les Ammonites de la zone à Les Ammonites de la Zone â Aspidoceras Acanthicum, de lest de la Russie par A. Pavlow. Vol. 3, No. 2. Carté Gèôlogique Générale de la Russie D'Europe, Feuille 139. Description Orographique par A Karpinsky et Th. Tehermycheff.—From the Society.

Monthly Notices of the Royal Astronomical Society Annual Report of the Council, No. XLVII., No, 4, February, 1887.—From the Society.

*Nature*. Current Nos.

Plants Poisonous and Injurious to Stock. By F. M. Bailey and P. R. Gordon (bound). Brisbane, 1867.—From the Authors.

Report of the Surveyor-General of the Army to the Secretary of War for the fiscal year ending June 30, 1886.—From the Department.

ADDRESS TO THE QUEEN.

His Excellency said that, before proceeding with the business of the evening, he would read to them an address which had been prepared for presentation to Her Majesty the Queen. He then read the following address :—

To Her Most Gracious Majesty the Queen—

May it please Your Majesty—We, the President and Fellows of the Royal Society of Tasmania, desire to offer our warmest and most respectful congratulations on the auspicious completion of the 50th year of Your Majesty's illustrious and beneficent reign.

Hitherto Your Majesty's reign has been unparalleled in English annals for discoveries in arts and sciences of priceless importance to the State, for enlightened legislation on matters more intimately connected with the social interests and well-being of the community, but still more, perhaps, for the marvellous expansion of the colonies of the Empire in everything which can foreshadow for them a great and glorious future.

That a reign so pure, so prosperous, so fraught with everything which can contribute to the power, progress, and prosperity of the nation should have been so prolonged is a matter for the deepest thankfulness; and with earnest prayers that the succeeding years of Your Majesty's reign may bear even a favourable comparison with those that are past, we humbly subscribe ourselves, Your Majesty's most faithful and most loyal subjects,

On behalf of the Fellows,

R. G. C. Hamilton, President.

J. W. Agnew, Hon. Sec.

The text of the address, which was engrossed on parchment, had been executed by Mr. Albert Reid, and a very handsome border of flowers, consisting of native fuschias, clematis, and maiden-hair fern, was painted on it by Miss V. Hall.

PAPER.

A paper, entitled "The Comets of February, 1880, and January, 1887," by Mr. A. Biggs, was, in the absence of the author, read by the secretary, Mr. A. Morton. The paper was accompanied by a star-chart of the comets of February, 1886, and January, 1887. The writer drew attention to the strong resemblance between the two comets in general appearance, length of tail, absence of any visible nucleus, and, as exhibited by the chart, the close similarity of their apparent paths in the sky. The author expressed an opinion, founded upon a rough heliocentric projection of their orbits from the uncertain data available, that these orbits were nearly, if not quite, identical, but differing from that of the great comet of 1882-3 with which the orbit of 1880 had been supposed to coincide.

Commenting upon the apparent absence of head in the case of the two later comets, the author suggested from the fact that the tail of a comet is not amenable to the laws of gravitation that the bodies in question were possibly not comets at all, but the main body of a meteoric stream, not far from the position the earth occupies at the end of January.

MR. JOHNSTON'S PAPER.

The discussion, adjourned from last meeting, was resumed on the paper by Mr. R. M. Johnston, F.L.S., on "How far the general death-rate for all ages can be relied upon as a comparative index of the health or sanitary condition of any community."

Mr. JOHNSTON said before the discussion was commenced he wished to correct an error that had occurred in his paper. On page 8 they would find the statement, "Where, as in Tasmania, 36·74 per cent. of the deaths exceed the allotted span," etc. The words, "the mean age of," should have preceded the figures 36·74. Several other errors of a less important character had occurred in the paper.

Dr. C. J. PARKINSON then opened the discussion, and said:—In the few remarks I have to make on the very interesting and instructive paper of Mr. Johnston, I am sorry I have not had the material or the time to go into the question so thoroughly as I should like to have done. The two points I wish to deal with are the age limits of his health standard, and the conclusion he draws on pp. 10 and 11, with regard to the health of Hobart. Speaking of the influence of migration on the total death-rate on p. 11, what Mr. Johnston points out constitutes an argument against including the deaths between 0 and 5 in the health standard. The reason is manifest: the bulk of immigrants consists of persons between 5 and 50. The proportion of children under 5 is thus reduced in a colony, and, therefore, for comparison with England or any old country, deaths at this age should be omitted. Also, on p. 12, Mr. Johnston points out the effect of the birth-rate disturbance, showing that an increase in the marriage and birth rates arising from a general improvement in the material welfare of a country may considerably increase the total death-rate without implying a deterioration in the general health and sanitary condition. This further suggests the desirability of omitting deaths at this age. To illustrate this, let us assume that the births in Tasmania in 1885 had been 20 per cent. larger, while the death-rate for all ages remained the same. The effect would have been to add 927 to the population and 104 to the deaths, and the general effect on the health standard used by Mr. Johnston would be to raise the death-rate from 10·5 to 11·2; thus, in Mr. Johnston's words, increasing the total death-rate without any disturbance of matters affecting the local health and sanitary condition. With regard, now, to the upper limit of the health standard, I venture to think that 60 is too low an age to take. We are not in the habit of considering deaths at that time of life as due to "extreme old age," and since Mr. Johnston, on p. 8, speaks merely of the desirability of excluding deaths from "extreme old age" in his health standard, I think he ought to have fixed the upper limit rather higher—perhaps 65 or 68 would be a better limit. (Hear, hear.) In England about 25 per cent. of the population die between the ages of 0—5, and 25 per cent. at 69 and upwards, the middle 50 per cent., that is those from 5—68 would probably afford a more desirable index for the purpose in view. It would also be desirable for greater accuracy to omit deaths from violence. This may seem an unnecessary refinement, but, bearing in mind the frightful losses of life in adjoining colonies from the recent shipping and colliery disasters, the result of including such deaths may occasionally be very great on the general death-rate; though suggesting these alterations in Mr. Johnston's present health standard I still think it a far more reliable test than any other in use. The next point I should like to touch upon is that of the health of Hobart compared with other towns. See pp. 10 and 11. As indicating the great utility of the health standard, the comparision made is most useful, but as proving the superior "health and sanitary condition" of Hobart, it is hardly so satisfactory, and for this

reason—the other towns selected for comparison are so much more populous, and have such very inferior climates. As far as England is concerned, instead of London with a population larger than that of all Australasia, it would be much fairer to institute a comparison with health resorts such as Cheltenham, Hastings, and Eastbourne, and notwithstanding the presence of numerous invalids and elderly inhabitants, the result will be found the reverse of consolatory. In the places mentioned, including their suburbs, the total death-rates are 17·89, 17·49, and 14·19, as compared with 24·70 in Hobart. Taking the average percentage of deaths over 60 years to total deaths in England these towns will show a health standard death-rate of 13·06, 12·77, and 10·56 respectively, or in other words, a considerable improvement on Hobart. I am aware that the returns for these towns include a certain amount of rural district round each, but in the three cases I have taken, this outside population is very insignificant compared with the towns themselves, and further, the death-rate in towns of this size in England approximates very closely to that of rural districts. As far as regards the colonies themselves, it would be manifestly fairer to compare our capital with towns enjoying climatic conditions more like ours than the comparatively tropical cities of Queensland and New South Wales. This means, of course, with such places as Christchurch, Wellington, and Dunedin; but I have been unable to obtain the necessary statistics to do this. To show still more forcibly the immense influence of density of population, of which Mr. Johnston is well aware, and that absolutely nothing is learnt of their relative sanitary condition by comparing small and large towns, I need only mention that while the death-rate of towns in England of about the same size as Hobart varies from 12 to 18 per 1,000, that of the 20 largest towns varies from 18 to 34 per 1,000, and these are towns with the same climate and similar sanitary arrangements. We now come to the important question of the seasonal variation in the typhoid curve, to which Mr. Johnston pays so much attention in his paper, and which he considers such a difficult problem. I am unable to see any necessity for invoking a hidden cosmical influence to account for its periodical rise and fall. (Hear, hear.) Local hygiene and a seasonal influence are quite sufficient to explain it. As Mr. Johnston shows in his diagram, the months of highest temperature are January and February, and the diarrhœa curve shows a maximum mortality at exactly the same point, showing conclusively the direct influence which heat has on this disease. When we turn to the typhoid fever curve, which I will try to show is also directly influenced by excessive heat of weather, we find the maximum death-rate to be a month or six weeks later, that is in the month of March, and in accounting for this, I hope you will pardon me if I digress for a few moments to explain the causation of this disease. It has been proved beyond all cavil that typhoid fever is above all fevers the fever of fæcal decomposition; that it occurs only amongst those who are exposed to the influence of defective drains or foul overflowing cesspools, especially when these are so situated as to pour their fetid gases into the interior of houses, or to contaminate by their emanations, their soakage and their leakage, water and other articles of food. Now, it has been observed over and over again, that these excreta, which are probably at first wholly ineffective, become in the course of putrefaction, through great heat, virulent in a high degree. This process of fermentation or putrefaction of the germs has been observed to take about a fortnight, and adding to this the incubative period of the germs after they have been received in some way into the human body, which is also about a fortnight, and as death in the majority of fatal cases occurs about the end of the second week from the onset of the disease, this makes altogether a period of six

weeks, which brings us exactly from the maximum point of temperature at the end of January to the middle of March. (Applause.) Even if the specific virus of the fever may be generated *de novo*, the same process has to be gone through, showing most conclusively the direct effect of excessive heat, in causing the disease to pass from an endemic condition in the winter to an epidemic form in the summer. And if this is so apparent in the months of one year, surely it is only reasonable to expect that a similar increase in the disease will take place in cities where sanitary arrangements are grossly neglected in years with an unusually high temperature such as this year, when we had several days in succession in January with a temperature, ranging from 90deg. to 103½deg., the highest recorded temperature since 1849. (Applause). The periodical variation in the temperature curve corresponds roughly, I believe, with the sunspot periodicity, but what influence Jupiter can have, of course, we are unable to imagine. Surely to prove this influence Mr. Johnston should have shown corresponding waves in the typhoid death-rate in England, but there we find a very different picture. From 1871 or 1872 a most marked but gradual diminution has taken place, totally irrespective of the position of Jupiter, or even the number of spots on the sun, but it is certainly a noteworthy coincidence that this great diminution should begin to take place immediately after the passing of the Public Health Act of 1872, and the further Act of 1875. From 1871 to 1880 the typhoid death-rate had declined from 89 per 100,000 in the previous decade to 49 per 100,000, and it has since gradually diminished to 18 per 100,000 in 1885. To further illustrate this important point, I may mention that the eminent authority on sanitation, Dr. Buchanan, found that in 25 English towns in which sanitary improvements had been properly carried out, the typhoid death-rate diminished largely in the five years succeeding the completion of the works—to an extent varying from 33 to 75 per cent. In startling contrast to this satisfactory state of things, due entirely, be it observed, to human efforts, consider for one moment the present condition of Hobart where there have been already 34 deaths in the last four months, equal to an annual rate of 115 per 100,000. I would venture to suggest that the one great test of the relative sanitary conditions of towns as regards sewerage, drainage, and the purity and abundance of its water supply, is the typhoid death-rate—and here Tasmania and Australia compare most unfavourably with England, for the simple reason that sanitation in these matters is practically *nil*. It is in this disease that human action has been conclusively proved in England to be the all-important factor all other causes, with the exception of phthisis, contributing to the death-rate, have been apparently undiminished by man's efforts. Therefore, when Mr. Johnston suggests the probability of cosmical causes adding to or varying the intensity of disease, he should have made a special exception in the case of typhoid. When here in Hobart the foul water from a stagnant pool like the Cascade reservoir is allowed to pollute the general town supply; when we have filth lying exposed to an almost tropical sun, and then carried in leaking and open pans, in some cases through the very rooms of the houses; when we have the house slops trickling all day along slimy channels in front of our very doors; and when acting on all this mass of filth and foul water there comes great heat, such as that of the past summer, is it any wonder we have this fearful epidemic of a filth disease among us? (Applause.) With this epidemic in full activity every summer and autumn, is it not quite within the limits of possibility that some person of note, or a near relative of such, may fall a victim to it? Would not such an event be an almost irreparable injury to the city from a monetary point of view by ruining its present high reputation in the other colonies as a health resort? And does it not as a simple

matter of business behove us to apply all possible remedies at once, to preserve that reputation rather than suffer its loss, and then have to struggle for many years to come to regain it; when, it may be, other towns have gained the fame that was ours and occupy the proud position we now hold of being the sanatorium of the Southern Hemisphere. (Loud applause.)

Mr. MAULT said that, taking Mr. Johnston's paper as a whole, he had been disappointed with it, because the consideration of such a subject gave Mr. Johnston a chance of aiding sanitary work in our midst, and he was afraid that, on the other hand the paper had had rather the effect of retarding that good work. He did not see from one end of the paper to the other any thing like an attempted proof of the value of comparative statistics in regard to the sanitary condition of Hobart itself. It was the Hobart of to-day only that he had spoken about, not the Hobart of to-day compared with any other time. If he had taken advantage of some of the statistics that Dr. Parkinson had advanced in regard to England he would have seen that while Jupiter was approaching the earth, while the sunspots were diminishing or increasing in number, there was one continual march in the way of diminution in the death-rate generally, amounting in the decade between 1870 and 1880, as compared with the decade between 1860 and 1870 to 1 per cent., and of that 1 per cent. at least three-quarters was due to a diminution in deaths from what are called preventible diseases. That would show most clearly that sanitary science and the inculcation of the duty of cleanliness can override such cosmical influences as were at work. He could not help thinking that Mr. Johnston had been led wrong by his love of comparative statistics. He (the speaker) did not like them. Their duty was with positive statistics. In his opinion they should look at a death from preventible disease as a homicide chargeable to something or somebody. There was one detail on which they ought to have information. He alluded to the manner in which deaths were registered here. He found that in the register of deaths in the City of Hobart it was apparently quite sufficient if at the time of registration the name of the deceased person was given, with his occupation, and the street in which he lived. It would be of infinitely more importance—in fact, it would make all the difference between usefulness and uselessness to give not only the street, but the number in the street. Parliament, by a vote it had passed last session, had given him a little leisure, and he thought to employ that leisure by preparing a mortality map of Hobart. But he found himself debarred from making this map because he could not get anything like precise information as to the locality of disease. He knew that a person had died in Argyle-street, but he could not tell whether it was at this end or a mile away. In most cases it appeared the deaths were registered by undertakers. He thought, perhaps, they could give him some assistance, and he had gone to an undertaker who had the largest business in the town. He gave all the information in his power, but even that was almost useless for the special purpose required. For the future they should know exactly where every death occurred. Mr. Mault explained the system adopted by Dr. Russell in Glasgow by which every case of disease was localised and registered. A death occurring at a certain house in a certain street was registered, and if other deaths followed at short intervals in the same house the fact was at once known, and the sanitary condition of the house was looked into. The same principle was followed in regard to localities. Some system of this kind in Hobart

would enable them to reach at once the original source of disease or contagion, and stamp out epidemics before they reach serious proportions. (Applause.)

Mr. W. F. WARD, Government Analyst, said: I was so entirely convinced by Mr. Johnston's argument and figures of the superiority of his "health standard" for comparative purposes, and of the absolute necessity for taking into account the difference expressed in the saying, "The young man may die, but the old man must," that I was the more forcibly struck by the unduly favourable figures assigned to Hobart by the table on page 11. For this table all deaths over 60 are eliminated, but all persons living over 60 are calculated in. Now this would be fair enough if the "old age groups" in each case were tolerably equal in number, but on page seven we find that Tasmania has more than 80, and Queensland fewer than 19 persons per 1,000 in this group, yielding 36·74 and 6·38 per cent. respectively of the total deaths, but the capitals of the two colonies give decidedly higher percentages than those of the total deaths, which fact I have assumed (subject to correction) to mean correspondingly higher proportions of old people. On this assumption, which, whether correct or not, is applied all round, I have ventured to recalculate the table for each 1,000 living under 60, and not for each 1,000 living of all ages.

| | I. (Actual). Deaths under 60 per 1000 of all ages living. | II. (Calculated). Deaths under 60 per 1000 living under 60. | (Calculated). Living under 60. per 1000 of all ages. |
|---|---|---|---|
| Hobart | 13·97 | 15·44 | 905 |
| Adelaide | 15·42 | 16·14 | 956 |
| Sydney | 19·52 | 20·16 | 968 |
| Brisbane | 19·79 | 20·30 | 975 |

Taking the two extremes, Mr. Johnston's table may be taken as comparing the death-rate of 905 persons under 60 in Hobart with that of 975 in Brisbane, or 1,000 with 1,077, or taking the figures for the whole colony in each case, and not my calculated figures for the towns they would be 920 Hobart, and 981 Brisbane, or 1,000 or 1,066. The effect is to place Hobart in a much less favourable light with an increase of 1·47, nearly three times the increase of Brisbane; while the *difference* between Hobart and Adelaide in favour of the former is diminished from 1·45 to 0·7, or by more than 50 per cent. The order of merit, however, remains unchanged, but I must admit that my figures must give a very much closer "approximation to *relative* value of conditions affecting health" than those of Mr. Johnston. The death-rate shown on Mr. Johnston's diagrams, which illustrate so well that rhythm of action which Herbert Spencer teaches us to look for throughout Nature, we are all agreed are too high, and the aim of sanitary science is to lower them until they represent gentle undulations instead of billows. The crests represent mainly excess of zymotic diseases, and it is on these that we must pour the oil of sanitation until, if we cannot obtain a perfect calm, we may have only gentle ripples, such as those which in many places now represent the enfeebled action of small-pox. Let us compare for a moment visible with invisible vegetation. The seeds of thistle and dandelion in a good year are produced more abundantly and start on their travels. Some fall on stony ground, and perhaps get no start in life, while others get into good pasture, increase and multiply. So the invisible fungoid germs of zymotic disease have their good years (doubtless regulated by the sun if not by his spots), but they find no rest in clean, dry places; but in dirty water, foul yards, and gutters, they multiply exceedingly after their kind, or perhaps produce a more

fatal progeny. To check, and ultimately even to stop this multiplication, is what we all wish, and the only way to do this is to sterilise our surroundings—in the country as well as in town—by keeping our water supply clean and unmixed with our sewage or surface drainage, our air unpolluted by accumulation of filth, animal or vegetable, which should be removed by proper sewers—in the former case at once, and in the latter by a regular system of carts at frequent intervals, as recommended by Mr. Johnston. The isolation and registration of all cases of infectious or contagious disease, and not of deaths merely, should also be rigidly carried out, and the plague spots in the town being known, they should be severely cauterised until the sore was healed. The opponents of a system of underground drainage for Hobart make a great outcry about the formation of sewer gas, but ignore the more or less close resemblance of that made on the premises for home consumption. Parkes, in his "Hygiene," says: "There are several cases on record in which typhoid has constantly prevailed in houses exposed to sewage emanations, either from bad sewers or from the want of them, and in which proper sewerage has completely removed the fever." Referring to a town in Devonshire, he says: "It used to be always liable to outbreaks of typhoid fever, but after the drainage of the place the fever disappeared." Without multiplying instances, here, surely, is a sufficient encouragement for us set to work with a will, taking care to keep our sewers, when we get them, well ventilated, but wholly unconnected with the inside of our houses, lest a worse thing befall us. Mr. Ward went on to say that in *The Mercury* he was was reported to have said that the mixing of good water with bad water had diminished its power of doing harm. That was true enough under certain conditions, but supposing typhoid germs to be present in the bad water, the statement amounted to saying that 50 of them in a pint were bad, whereas 50 in a gallon were good. Of course they would understand that he had no intention of saying anything of that sort. (Applause).

Mr. E. C. Nowell pointed out that when in estimating a death-rate they took the people of all ages together, they mixed two things which were utterly antagonistic. They had a measure of disease, and at the same time a measure of health. In the younger ages deaths, no doubt, were a criterion of disease, while those which occurred at greater ages were, of course, a measure of health, because if they had not been healthy persons they would not have lived to such a period. Dr. Parkinson had suggested that a greater age than 60 should be taken. He (Mr. Nowell) would submit whether the age might not be taken at 65. According to the life tables showing the average expectation of life, a person might expect to live till 65. Then as to the deaths under one year; they stood out as quite peculiar. The most dangerous time of life was the first year. It was just worth consideration whether in giving the general death rate of the whole country, not only the ages over 65 should be excluded or placed by themselves, but also whether the same should not be done with the deaths under one year. That, no doubt, would be favourable to Tasmania, because deaths of children under one year were very much less here than in the other colonies. As to the influence of cosmical and other causes, he thought that did modify the death-rate. When they saw the fact before them that this outbreak of typhoid fever extended over all the group of Australian colonies, they could have very little doubt but that it was influenced by a certain condition of the atmosphere. If they could analyse the air it would be an immense assistance to investigation in this matter. He did not see why that should not be done. At the same time it was to be remembered that while the condition of the atmosphere might influence diseases, there was no doubt they were not caused by it. It could not be too strongly

impressed on the public mind, that even though diseases were exaggerated by causes such as he had indicated, that was no reason for relaxing one's efforts to stamp out disease. Indeed, it was rather an increased reason for bringing to bear everything that sanitary science could suggest to preserve the public health, for the better the sanitary state the less harmful would be any baneful condition of the atmosphere. He was glad to see the chairman of the Board of Health present, and he would suggest to him that the attention of the board should not be exclusively given to towns, but also to the country and especially to some of the country inns. In conclusion, he said that those who read Mr. Johnston's paper carefully must feel that there was no sufficient ground for the impression that it discouraged sanitary work. (Applause.)

Captain SHORTT contributed the following on the relation of the weather and typhoid during the last six months:—1st. Temperature. —Sudden changes frequently occurred during the summer. In January the mean temperature 66deg. was 2·5deg. above the average of previous 43 years' record. The 9th was an exceptionally hot day, registering 103·5deg. in the shade. The two previous days were also warm, 92deg. and 92·5deg. In February highest temperature 95; lowest 39deg. 2nd. Rainfall.—The precipitation of moisture was abnormal, as only ¾in. of rain fell in the months of December, February and April, though in November it was 2·88in.; January, 3·43in.; and March, 2·57in. Total amount about equal to former averages. 3rd. Wind.— There was an absence, excepting in January, of southerly winds and cooling rains; northerly winds predominating. To assist the epidemic, when the rainfall was slight the winds were light; generally strong winds act greatly in purifying cities, scattering the dust, which has already absorbed foul matter in drains, etc. The direction and velocity of the wind, rainfall, and temperature during the epidemic will, I think, justify the probability of an insufficiency of ozone. Ozone is a good disinfectant of the atmosphere, inasmuch as it hastens the oxidation of decomposing animal and vegetable matter, hence it is important to life and health, and it improves the health in respect to diseases of a zymotic character, such as typhoid. In Melbourne, Sydney, and Hobart the mortality from typhoid fever has been unusually large. These cities in the summer season generally experience S. and S.E. winds, which bring considerable quantities of ozone from the sea, and these winds having been much less frequent this season than usual, I think the virulence of the disease may be in some degree owing to the lack of the purifying ozone. (Applause.)

Dr. PERKINS President of the Health Board said he would not rely upon the general death-rate of the community as a guide to its sanitary condition. He was rather inclined to take up the position of those who say the general average death-rate is no test of the health of a community, but rather the amount of sickness among the population. (Applause.) The qualifying conditions of old age had been familiar to medical officers of health for many years. Speaking of qualifying influences, Mr. Johnston might very fairly have introduced that of the occupations of the people. The occupations of many persons were unfavourable to length of life. Mr. Johnston had mentioned only one qualifying influence, and that was one most favourable to Tasmania. Density of population was a very important qualifying influence. Mr. Johnston himself pointed out that there was a difference of 70 per cent. in the death-rate between town and country districts, and that was a proof of the importance of density of population. If they were to take in qualifying influences at all they must include them all. There was another test also they might apply; that was, the qualifying test of the birth-rate. Mr. Johnston told them that the birth-rate

of Tasmania was less than of the other colonies. But they must not forget that a large birth-rate would mean a larger death-rate owing to the number of deaths that occurred among children. He could not attach the same importance as Mr. Johnston to cosmical influences. There were always atmospheric influences at work, but these operated as much towards health as disease. If they could bring their sanitary arrangements up to a proper degree of efficiency they could afford to disregard cosmical influences. They had never yet obtained the active and hearty co-operation of the people in the carrying out of sanitary measures, but when they did it would be possible to reduce the number of cases of zymotic disease even in summer to a minimum and keep it there. If they had sanitary measures carried out with knowledge and spirit, the number of cases of typhoid fever might be counted on the fingers of one hand. (Applause.)

Mr. Morton, the secretary, also read the following communication received from Dr. Agnew :—I much regret being unable to be present at the discussion on Mr. Johnston's valuable and highly interesting paper. It is satisfactory to note that it more than confirms the general impression as to the salubrity of the Tasmanian climate, and proves by the inexorable logic of recorded facts, that in no part of the world from which we have statistics, is the prospect of a long life so good as in this colony. Some of Mr. Johnston's observations on the present epidemic of typhoid are worthy of careful consideration, and will, no doubt, insure discussion. My own impression is that the cause and origin of this disease are not yet clearly determined. No doubt the commonly assigned causes, filth or dirt, and certain foul gases, generally play a very considerable part in forming or fostering the disease, and therefore these noxious agents should unquestionably, in all cases, be done away with. But the question still remains, would the disease ever arise were these agents absent? Information, I venture to think, is still wanting before a conclusive answer can be given. From my own experience, however, and from the recorded experience of others, I think the disease may arise at any time without any hitherto recognised cause, but that its diffusion is generally influenced to a large extent by insanitary conditions. As these conditions, however, are frequently present, even in an intense degree, without producing fever they cannot be the sole cause, although they may constitute a great and palpable factor. But something more subtle appears to lie beyond. In the course of at least 25 years of my practice I do not think I saw six cases of typhoid, yet Wapping and other parts of the city were probably in a worse sanitary condition than they are at present. The few cases I saw, too, were quite solitary, and never acted as *foci* for the spread of the disease. Why was the city not scourged, at least occasionally, during all this time with fever if the real cause was persistently present? Again, like other epidemics, the present one has had its rise and fall over vast areas of town and country, the insanitary conditions still remaining a constant quantity. Weather, I am told, exerts little or no influence. Now, speaking of a loeality under our immediate observation, if well-known noxious agents were (as frequently alleged) the sole causes of the fever, why should a healthy person, if exposed to their evil influence in Hobart to-day, be less liable to take the disease than he was a month ago, and why, if he took it, should it be of a milder type? The sanitary conditions remain virtually as they were. It cannot be said that the weak and puny alone succumbed at the onset, and that the robust who are left are better able to resist the poison. The disease, in fact, as far as age, health, and physical condition are concerned, has been very impartial as to its victims, nor does locality itself seem altogether to confer immunity. If the usually assigned agencies too, were the sole cause

of this disease, why should persons employed in cleansing sewers be so healthy as they are said to be, how, indeed, could any of them escape? These men in stirring up the foul deposits, inhale continuously the nascent sewer-gas in all intensity; for however well the sewer may be ventilated it is clear the gas must exist there in greater proportion than is possible in the upper air. It may be said these men have become acclimatised to their surrounding, but as this suggestion cannot apply to their first exposure to the gas before acclimatisation was possible, the argument falls to the ground. I fear to trespass on the time of the meeting by going more fully into this very wide subject, and will therefore only add that although I do not agree with those who think the ultimate cause of typhoid has been discovered, many a report as to the beneficial effect upon it of sanitation leaves no room for doubt as to our proper mode of procedure. Our clear course is to do that duty which lies nearest to us, *i. e.*, to thoroughly cleanse and purify all our surroundings. When this is accomplished, although I think occasional cases will still occur, the disease will probably be robbed of all, or most of all, its terrors.

His Excellency: Before calling on Mr. Johnston to reply I would like to say a few words. In the observations I made at the last meeting of this society I pointed out that I scarcely thought the public realised how much they owed to societies of this sort. Nothing could better exemplify this obligation than the paper we are discussing. (Applause.) The duration of human existence, and the influences determining it, are of the intensest interest to all, and men like Mr. Johnston, who, by patient labour in their study, tabulate and intelligibly state the results of observations, carefully recorded, as to the duration of life, are real benefactors to their country — nay more, to humanity at large. (Applause.) The science of statistics is a very difficult one—it requires so much measuring and weighing of facts in their relation to each other. But the common saying referred to by Mr. Johnston that "figures prove anything," is only correct when they are not properly used. Now, Mr. Johnston has conclusively proved to us that in certain conditions you cannot rely upon the death-rate by itself as an index of the health of a community. Does this prove that all statistics so based and accepted hitherto have been wrong? Certainly not. It only proves that this index may be misleading where, from accidental causes, you have an abnormal number of people of certain ages living in any particular locality. In a perfectly normal state of society the number of persons living at each year of age will depend entirely upon the rate of mortality among them, and when this is so the general death-rate is the readiest and most comprehensive test we can have of the health of the community. But in the colonies we are not in a normal state, nor shall we be for many a year to come, and migration, as Mr. Johnston has shown, in their case clearly vitiates any general conclusions as to the health of localities based upon the death-rate alone. Now, he has shown us a very simple way of testing the health of the community. He says, discard all deaths over 60 and you then get a trustworthy test of the comparative health of the community. I agree with him in a large measure, although there is much to be said for somewhat raising the limit, and for the purposes of this test I should also eliminate deaths of children under five years of age, as Dr. Parkinson proposes, respecting which period I shall have something to say presently. But even so, you must take the results with some qualification. People who emigrate to the colonies are generally more healthy and strong than those of similar ages who stay at home, and whether the death-rate among them in their new home is greater or less than that of the colony is yet to be proved. Now, as regards children under five, the death-rate at present everywhere is simply appalling. At the last meeting I said that the influence

of women in matters of health and sanitation was of great importance, and in this group I may say it is paramount. I would commend to Mr. Johnston a careful analysis of the causes of death at this period, and would ask our medical friends to consider this subject most carefully. (Hear, hear). I now come to the question of typhoid, and about this I speak with sadness, not only because of its general prevalence at the present time, but also because my dear son is now suffering from it. Whatever obscurity may prevail regarding this disease all must admit that it is largely preventible by sanitary arrangements. As I pointed out in one of my first public utterances in this island, one of the imperative duties of the State, whether central or local, is to safeguard the health of the community. This society, in its corporate capacity, can force upon the proper authorities the paramount importance disclosed by statistics for energetic action in the matter, and I hope it will do so. But, individually, they can do much to urge on action on the part of those directly charged with the duty. In a self-governing community no one is relieved of his responsibility in such a matter. The representatives of the rate and taxpayers are bound to carry out the views of their constituencies on such matters, and the constituencies are bound to let them be known. No one is justified in sitting with his hands folded and saying, "It is not my business." (Applause.) As I said at the last meeting, so far from relaxing our efforts in the direction of prevention of disease, all Mr. Johnston's figures point to further and energetic action, and so long as the country is more healthy than towns we are bound to go on doing everything in our power to improve the sanitary conditions of life in cities. (Applause.) As regards the very curious and highly interesting waves of disease which appear to pass over countries often far apart, with something approaching to regularity, there is much to learn. They require to be most carefully analysed, with the view of determining how far they are general throughout the world, what the nature of the deaths is, and at what ages they mainly occur. We know but little of this at present, but I think everything points to these waves being due to climatic influence, although their causes are obscure. It is undoubtedly man's business to counteract as far as possible climatic influences which are painful to human existence, whether these may be local, as is possibly the case to some extent with typhoid, or general, as would appear to be the case with these waves of disease. Before calling upon Mr. Johnston to reply upon the whole subject, I would again desire to impress upon you how much we owe, first to the persons who carefully record the facts on which vital statistics are based; and secondly, to able statisticians like Mr. Johnston, who tell us what these records disclose. It is interesting and useful for us of the general public to discuss these matters, and sometimes at discussions of this sort persons who are not in themselves accustomed to scientific investigations, may hit upon great truths, or find out blots in statistics, but it is to the men who spend their lives in scientific investigation that we have to look for any real and sound progress in the knowledge of such subjects; men who with conscience pursue their laborious investigations for the sake of science itself, and who seldom receive the credit and honour which the benefits they confer upon humanity merit. (Applause.) It may be interesting to this Society to know that the two gentlemen Mr. Johnston refers to in this paper as authorities on vital statistics, viz., Mr. N. A. Humphries and Mr. T. A. Welton, are personal friends of mine, and that I have written to each of them, sending copies of Mr. Johnston's paper. (Loud applause.)

Mr. JOHNSTON, in the course of his reply, said some of Mr. Mault's criticisms were not justified. The subjects he had been charged with omitting or insufficiently dealing with did not come legitimately within the scope of his paper. Mr. Mault in extolling human effort in matters

of health seemed to be under the impression that he (Mr. Johnston) differed from him on that point, and yet he had devoted more space to extolling the value of human effort in mitigating disease than most other causes except one. In his paper he had said :—"Let me not be understood, however, to assert the valuelessness of human effort by ascribing the periodical death-rate, rise, and fall, mainly to far reaching superterrestrial causes, among which the sun's varying energy plays a large part. On the contrary, I desire to affirm that human effort, directed to selection of sites for dwellings ; supplies of pure food and water ; to provision against poisonous food and drinks ; to improvements in sanitary matters, and to facilities for healthful recreation ; to improvements in workshops and factories ; to the multiplication of acknowledged health safeguards and of convenient centres for the proper treatment of disease, as well as to improvements in treatments of injuries and diseases. In all such matter human effort does much, and can do more, to mitigate the intensities of attacks of disease, from whatever source they come, even if it cannot wholly subdue them. That sanitation and improved treatment has done much in England during the last 20 years to lower the death-rate of the younger lives cannot be reasonably doubted, and this of itself should encourage local effort to strive for further improvement." He had been entirely misunderstood by those who assumed that he under-valued human effort. Indeed, there had been some preconceptions with regard to the paper which were not entirely justified. At the same time he was thankful for the generous way in which the paper had been criticised, for it was necessarily open to many misconceptions, and some errors on the part of the statistician would naturally creep in. He agreed that greater information should be given in their public registers for localising any kind of infectious disease, so as to control it as far as they could. With respect to this efforts had been made by the registrar and by the Government, and he had no doubt the Government would take measures to give the registrar power to get information as to locality. At the present time the registrar could not compel any person to give more information than was now recorded, which was all that could be demanded under the Act. He quite sympathised with those who wished to see the limits of age separating the old age group from the younger, raised from 60 to 65. But the reason he adopted 60 was that in examining statistics for other countries it was one of the limits that could be generally found. Those who had to toil through immense masses of figures would know the difference it made in the labour to adopt a figure which was easily and generally accessible. Besides, his researches had satisfied him that the advancing of the age to 65 would make no material difference in the result as regards Tasmania. To eliminate the ages under five in a general health standard as suggested by Dr. Parkinson and others would not be a wise course, as this group affords the most sensitive index to local health conditions. Besides it would be unfair to such a colony as New Zealand, where deaths under 5 are relatively very few ; while the reasons advanced for excluding the group, owing to the small variation in proportion living in different colonies, are not of much force. Mr. Johnston further pointed out that the general health standard was only supplementary to the indices for each specific age group given separately in page 21 of his paper, and he showed that for age group 5-60 Tasmania stood first of all the colonies, New Zealand not excepted ; thus the deaths 5-60 per each 1,000 living are—Tasmania, 5·60; South Australia, 5·67 ; New Zealand, 6·17 ; New South Wales, 7·37 ; Victoria, 7·72 ; Queensland, 12·66. He did not agree with those who would not allow Tasmania credit for her climatic conditions in their effect upon death-rate. Nature had done a great deal for this country, and it

would be an absurd thing if in announcing their position to the world they could not credit themselves with the advantages that had thus been conferred on them. Coming again to the question of sanitary work, he stated that in his paper he had shown that in death-rate we were 70 per cent. worse in Hobart than in the country districts of Tasmania. With that standard before them there was no need to travel further to show how far human effort might reach in dealing with preventible diseases. It had been said that sickness was more reliable than death in showing the health of a community. He thought there was not much in that, and he had formed his opinion by studying the comparative number of deaths to cases in the public hospitals. In the Tasmanian hospitals in 1883 the proportion of deaths to cases treated was 8·05 per cent; in 1884 9·17 ; in 1885, 9·84. There was scarcely more than 1 per cent. of difference in the different years. Mr. Johnston concluded by explaining a series of charts he had drawn on the suggestion of His Excellency, showing the undulation of waves of disease in different years. These dealt for the most part with England, and showed that, notwithstanding the undoubted advance in sanitary science and the improved condition of towns, the occurrence and virulence of disease had been marked by an irregularity in different years, which plainly indicated to Mr. Johnston's mind that they were not entirely controllable by human effort, and that other influences must have been at work. The diseases thus shown on his diagrams were cholera, measles, small-pox, typhoid, and diarrhœa. (Loud applause.)

The Hon. P. O. Fysh moved a vote of thanks to those who had taken part in the discussion of the paper. He said it must be argeeable to find that in the diversity of opinion that had been expressed all were working towards the same goal, and that in thinking that Mr. Johnston did not attach sufficient importance to sanitary work they were under a misconception. It must be exceedingly satisfactory to know that there had evolved out of the discussion on this paper a deep feeling in the mind of every gentleman present that the work which had been commenced with respect to sanitation was not a work which they could afford to lose sight of, but were more deeply impressed with the necessity of all those efforts which man could make to keep down preventible diseases. (Applause.) They were indebted to Mr. Johnston for having initiated the discussion, which had been a most valuable as well as a most interesting one. He would be wrong if he did not thank their President for the very interesting manner in which he also had dealt with the subject. (Applause.) It was agreeable for them to know that they had a President who would take something more than a perfunctionary interest in their proceedings. As President they would like to see him frequently among them. (Applause.) There was one point he would like to mention that had been omitted in the discussion. He would like to call Mr. Johnston's attention to the frightful state of affairs that existed in the colony in the years 1851-2-3. In 1851 they had a population of 59,000 people, with a normal death-rate of 1,000. That was very nearly what their statistics for 1885 showed them to be now—about 15·40. But there came some disturbing cause in 1852 and 1853, which those who then resided in this colony were never likely to forget. With a declining population they had a death-rate which immediately doubled. They had a population of 64,000 in 1852, with a death-rate of 2,000, and in 1853 a population of 63,000, with a death-rate exceeding 1,900. This had been due to some disturbing cause that had never been satisfactorily explained. He had no doubt if Mr. Johnston would look into the subject he would be able to supply them with some valuable information about it. (Applause.)

Mr. JUSTIN BROWNE seconded the motion, which was carried with acclamation.

Owing to the lateness of the hour, the reading of a paper by Mr. R. A. Bastow, "On the Riccia natans (water plants)," was postponed till next meeting.

The proceedings then closed.

## ANTARCTIC EXPLORATION.

A deputation from the Council of the Royal Society, consisting of the Bishop of Tasmania, The Hon. J. W. Agnew, M.D., M.E.C., Messrs. James Barnard, R. M. Johnston, T. Stephens, and Alex. Morton (secretary), waited upon the Premier at his office on Monday afternoon, April 25th, with reference to the above subject.

DR. AGNEW stated that they had waited as a deputation from the Royal Society to ask for the sympathy of the Government on a matter in which the society had taken a great deal of interest—that was the exploration of the Antarctic Seas, with a view to any discovery that might be made towards the South Pole. It was a subject that many other bodies had taken a deep interest in, and he believed the Government of Victoria had expressed its readiness to do a good deal towards the object of such an undertaking. As Tasmania was the most southern colony it was fitting that she should take a deep interest in the proposal, and the colony had already been linked with discoveries in the South Seas by Hobart having been the port from which the ships Erebus and Terror, with Crozier and others, sailed on their memorable voyage. The port has been very largely interested in the whaling industry, and he thought it behoved them to take part in the undertaking. About £10,000 would be required to fit out vessels in a thorough manner, and it was estimated that some of the other colonies, besides Victoria, would join, and, if so, the pecuniary share Tasmania would have to take in the undertaking would not in the least degree be beyond her means. Under these circumstances they were anxious to enlist the sympathy and support of the Government, and any information the Society might obtain from time to time would be promptly placed before the Government. They hoped in the course of another year to have one or two ships arrive in Hobart fitted out for a voyage of discovery to the Antarctic Seas. He could not say what the results might be to some people if any land were discovered not dreamt of hitherto, but possibly a new flora and a new fauna might be there discovered. They knew that in all probability those seas would be found the haunts of whales, probably only the black kind of whale, but that furnished in its bone an article of increasing value to commerce. He did not think the sperm whale was likely to be met with so far south in the colder waters, but those who were engaged in commerce, like the Premier, would probably know more about this subject. It was thought that probably a sum of about £500 would be sufficient to furnish Tasmania's quota towards the expense of the undertaking, and he hoped the matter would be favourably considered by the Government.

Mr. BARNARD thoroughly agreed with Dr. Agnew in what had been suggested as to the advantages and benefits that might be supposed to accrue, and the scientific results that might be made elements in the consideration now being bestowed upon the question of raising the requisite ways and means. It had now become a practical question. They wanted to see what could be done in Tasmania in comparison to what would be done by the adjacent colonies. All colonies, no doubt,

were interested more or less in the success of such an expedition, but Tasmania was specially interested, and the Royal Society had taken the matter up, as would be seen by the resolutions that the secretary would read. He felt peculiarly interested in the question, inasmuch as he had lived in the time, and had witnessed the advent into our waters of the Erebus and Terror when they returned from their exploration, and had the gratification of meeting their distinguished commanders at Government House at the time of Sir John Franklin's Governorship. The project had been initiated in Victoria, and he did not yet know what New South Wales intended to do, but it would never do for Tasmania, which had the greatest interest in such a project from its position, to fail to engage in an expedition in the essential success of which it would share very fully in. He did not know either whether the Home Government would share in the expense, but the leading scientific men in Great Britain, including those who had ventured towards the North Pole, had taken a very great interest in the matter. In conclusion, he expressed an earnest hope that Government would give the proposal a favourable consideration.

The BISHOP, and Mr. R. M. JOHNSTON did not think it necessary to occupy further time, as the matter had been very fully placed before the Premier.

Mr. ALEX. MORTON said the society had passed the following resolution in September, 1886, upon which occasion Mr. C. P. Sprent read a paper on "The Proposed Antarctic Exploration":—"That in the opinion of this society it is desirable, in the interest of science and commerce, that the exploration of the Antarctic regions should be continued, and that Tasmania should co-operate with the other Australian colonies in the despatch of an expedition for that purpose, and that the council communicate this resolution to the Premier." This was done, and at the last monthly meeting of the Society the subject was again considered on the reception of a communication from the Royal Society of Victoria and a progress report of the Antarctic Exploration Committee. It was then resolved that the council be authorised to approach the Government on behalf of the Royal Society, in connection with the Antarctic Exploration Fund.

The PREMIER, in reply, said they would be well aware of the multifarious matters brought under the notice of Ministers, including many that were far out of the ordinary routine of official duty. This was one of these, but it was a matter in which the Government desired to co-operate in any possible way it could, and they had to thank the Royal Society for having taken the initiative. The Government would still have to look to them to give direction to any practical support it might feel disposed to accord. But before Parliament was asked to vote any assistance there should be something to demonstrate that it was the wish of the people, and he would suggest that Parliament should be asked to grant £1 or £2 for every £1 subscribed. He did not know whether Victoria proposed that the £10,000, which it was estimated the expedition would cost, should be divided over the Australian communities *pro rata*, or whether Victoria and New South Wales proposed to bear the larger share of the burden. If it were federally divided, Tasmania's share would be a comparatively light one, and he would not at all fear that Parliament would not vote it. Still it would very much strengthen the case if the Society would collect from the commercial, scientific, and other portions of the community, sufficient to show that the public took an interest in it. Personally, he hoped to see the colony carrying out the traditions of its fathers. The Anglo-Saxon race were a discovering people, and many of them regretted that Christopher Columbus was not one of the race. They were all

sorry he did not obtain from England the assistance he asked for. England had identified herself with Antarctic exploration, for Captain Cook had sailed as far south as 71deg. a century ago, and it would be derogatory to our credit to let Sweden or any other nationality take the work to a more successful issue. In Tasmania we occupied a vantage ground in respect to this exploration, and the colony would most probably form the base of operations. In this colony we lived in an atmosphere of discovery, and we should possess in vain the statue standing in Franklin-square if we did not feel the deepest interest in any future Antarctic discovery. As an offshoot of Great Britain we should be wanting in the national characteristics if we did not take the responsibilities as well as the advantages of the origin. Such responsibilities, in this part of the world, could not be better exercised than in voyaging over that unexplored portion of the earth nearest to us. If Ministers thought as he did, and if the Fellows of the Royal Society thought as he did, a public subscription should be initiated, and then the Government would be able to see what support they could ask Parliament to vote. At present Parliament was in recess, and any promise the Government could give would be subject to the reservation that Parliament would have to sanction it. He promised to submit their views to the Government, and thanked them for having taken the matter up.

Dr. AGNEW thanked the Premier for his reception of the deputation, and the tenor of his reply.

## JUNE, 1887.

The monthly meeting of the Royal Society was held on June 14, the President, Sir Robert Hamilton, occupying the chair, and about 30 Fellows and several ladies being present. His Excellency was accompanied by Miss Hamilton, Miss Hervey, and Mr. H. W. B. Robinson, the Private Secretary.

### NEW MEMBERS.

Messrs. N. E. Lewis, M.A., B.C.L., and Samuel Clemes, proposed as members of the society were balloted for, and declared elected.

### ADDITIONS TO THE LIBRARY.

The secretary read the following list of additions made to the library during the month of May :—

Analele Institutului Meteorological Romanici. Tom. 1, 1885.—From the Institution.

Annals and Magazines of Natural History, 5th ser. No. 112.

Bollettino della Societa Geographica Italiana. Fasc. 3, 1887.—From the Society.

Bulletin of the Museum of Comparative Zoology, Harvard College, February, 1887.—From Professor A. Agassiz.

Bulletin de la Société Imperiale des Naturalistes de Moscow, 1886.—From the Society.

Chemist and Druggist of Australasia, June, 1887.—From the Editor.

Die Scen der Dutschen Alpen line Geographische Monographie. Von Dr. Alois Geistbeck.

Acht Tafelu, Mit 128 Figuren, Geologischen und Geographisehen.

Profilen Tiefenschichtenkarten und Dia grammen. Leipzic, 1885.—From the Society.

Draft of Prospectus of Selden Society.—From the Society.

Geological Magazine, April, 1887.