Anniversary address by the president T. P. Anderson Stuart.

ROYAL SOCIETY OF NEW SOUTH WALES.

SYDNEY.

ANNIVERSARY ADDRESS

BY

THE PRESIDENT

T. P. ANDERSON STUART, M.D.,

Professor of Physiology in the University, Sydney.

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[*Delivered to the Royal Society of N. S. Wales, May 2, 1894.*]

In determining what sort of an address I should deliver, I had the excellent example of my two predecessors, who each in his turn reviewed the progress the Colony had made during their period of office in the departments of knowledge of which the work of the Royal Society takes cognisance, and I was somewhat constrained to follow in their footsteps. It occurred to me, however, that I might perhaps do wisely if on this occasion I directed your attention to matters of interest or importance to us in New South Wales at the present time or in the near future, rather than so entirely to contemplate and record what had already been achieved in the near past. And then, too, *ne sutor ultra crepidam.* In a general review I felt that I should have either to touch upon matters with which I have no special acquaintance or to depend upon others who should write up each his own department. The first alternative was not agreeable to me, and for the second I had left myself rather little time, and so I come to speak of matters which fall more or less within my own sphere of activity. Possibly the next anniversary address will be a fitting opportunity for reviewing the work of the preceding two years.

THE SUPPLY OF ARTESIAN WATER IN AUSTRALIA.

Two of the most important meetings of the past Session were those at which the question of Artesian Water in Australia was discussed, on the papers by Professor David and the Hon. W. H. Suttor. It is apparent that the supply is by no means inexhaustible, and, though of course our information is even now by no means complete, still that there are data to estimate the possible yield in New South Wales as being perhaps twenty times the present

output of forty-one million gallons *per diem*, or eight hundred and twenty million gallons daily. Taking the figures of Mr. McKinney as a basis, this quantity of water would irrigate two and a quarter million acres with average circumstances and high class management. This is $\frac{1}{88}$th of the whole area of the Colony, and about twice as much as is under cultivation now. It thus appears, that though it has its limits, yet irrigation by artesian water may play a great part in the development of the Colony, and the magnificent specimens of many vegetables and plants submitted to the Society amply proved what can be done by these waters.

Happily a suggestion that these waters might be found to be medicinally valuable has not been sustained. It would appear that in the neighbourhood of some of the bores the people esteem the waters highly for the treatment of various diseases—perhaps the mere copious use of the water in these water-scarce regions may be the real beneficial agent—at all events analyses which I had made do not disclose saline contents in such quantities as to make them on that account medicinally valuable. And very fortunate it is too, for a water useful as medicine is scarcely likely to be good as the daily supply of man or beast or vegetable.

One of the most urgent and most important questions in this connection is that of the origin of this water, for if we knew this we might then ascertain the intake and therefore estimate the output. It must be gratifying to you to learn, that the appeal which I made to the Under Secretary for Mines and Agriculture, to have proper gauges attached to all bores systematically, has borne fruit, for Mr. Wood is now having the gauges fixed and the flow measured and recorded systematically. Doubtless we shall soon have most valuable data, throwing a flood of light on the origin of artesian water, not in New South Wales only but in Australia generally.

EXPEDITION TO BORE AN ATOLL IN ORDER TO DETERMINE THE FORMATION OF CORAL.

As most of you are aware, one of the greatest works of the illustrious Darwin was his book on corals and their formation.

The leading ideas of his theory were thought of during his voyage in the *Beagle*, in which he visited our own Colony, and they were published in 1842 in his "The Structure and Distribution of Coral Reefs." So beautiful is his theory, so completely did it seem to explain all the phenomena, that it remained unchallenged till about the year 1863, when Semper published his paper on the Pelew Islands, which he made out to show elevation instead of the subsidence required by Darwin's theory. But neither this, nor the objections subsequently raised by others, succeeded in shaking the belief of Darwin, who died in 1882, still convinced that his was the true theory. In 1880, Murray, the naturalist on the *Challenger*, published the most formidable attack which has yet been made upon the theory of Darwin, and from that time till the present a keen controversy has been carried on. Murray's theory is, in some measure, a revival and development of the early theory of Chamisso, the poet-naturalist, who visited the South Seas in 1815-1818. It is not for me here to enter into the details of the argument on either side, nor indeed to express any opinion on the merits of a subject which is somewhat outside my own line of work, and is the subject of much discussion by the masters of geology of the day.

It appears, however, that the controversy, in the opinion of Darwin himself and of those who should be well qualified to judge, will be as good as settled if one could put a drill down to the bed of the coral formation of a typical atoll and bring up a core to be examined by competent geologists. Darwin himself it was who conceived the idea, for in his letter of May 5th, 1881, to Alexander Agassiz, in which he spoke of Murray's theory, he says—

"I wish that some doubly rich millionaire would take it into his head to have borings made in some of the Pacific and Indian atolls, and bring home cores for slicing from a depth of five hundred to six hundred feet."

The purpose of my reference to these matters here is to tell you, that this is about to be carried out by a Committee of the British Association for the Advancement of Science, for which I have the honour to be acting in Australia.

When I was in Europe three years ago, I was consulted as to the possibility of Sydney being the starting point for a expedition to one of the South Sea Atolls, and having for its object the realisation of Darwin's idea of boring and bringing up a core. The Chairman of the Committee is Prof. Bonney, F.R.S., and the Secretary Prof. Sollas, F.R.S., and the members of the Committee* include the most distinguished British Geologists and others interested in the work and two of the sons of Darwin. As the matter seemed to me to hardly come within the range of physiology, I proposed to pass it on to somebody else, but it was urged that as my share of the work would be entirely administrative, I determined to take it in hand myself and now I am glad that I did so, for it has given me great satisfaction to help in bringing the project to its present favourable outlook.

On my return to Sydney I sent out a circular to such as I thought might help me, giving the salient points of the scheme, and requesting information. In answer to this I received some replies, and thus, with the copious information derived by my personal enquiries amongst missionaries, sailors, and traders in Sydney, I was able to send a very satisfactory report to the Committee. The greatest material help was given by the enlightened action of the Minister of Mines and Agriculture, the Hon. T. M. Slattery, who under suitable conditions, so that the Colony shall be put to no direct expense and so that its property will be duly protected, has granted the use of a diamond drill in charge of one of the department's officers, who will be paid by the Committee.

The suitability of numerous islands has been carefully considered by the Committee and my latest advices tell me that now the choice is narrowed down to Funafuti in the Ellice Group or to

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* Sir Archibald Geikie, F.R.S., Professors A. H. Green, F.R.S., J. W. Judd, F.R.S., C. Lapworth, F.R.S., A. C. Haddon, Boyd Dawkins, F.R.S., G. H. Darwin, F.R.S., Anderson Stuart, Captain Wharton, F.R.S., (Hydrographer to Admiralty), Drs. H. Hicks, F.R.S., J. Murray, H. B. Guppy, Messrs. F. Darwin, F.R.S., H. O. Forbes, G. C. Bowne, S. Hickson, A. R. Binnie, J. D. Gregory, P. Fawcett.

one of the Northern Maldives; that the Admiralty will provide a ship, and that everything seems in train for settling matters at the forthcoming meeting of the Association at Oxford. The results cannot fail to be of the deepest interest, may be of great importance, and in any case will be creditable to the Colony of New South Wales for the share which it is taking in the work.

NAMING SOME PART OF THE BLUE MOUNTAINS AFTER DARWIN.

The mention of the name of Darwin leads me to commend the suggestion that some noteworthy feature in the mountains which he visited, should bear his name. I have had a talk with the Hon. P. G. King, M.L.C., a shipmate of Darwin in the *Beagle*, and who rode with him as far as Penrith, and Mr. King has promised to help in the matter. It must be some feature worthy of the name, and it is not easy to find such now. Still, perhaps, someone may make a suggestion—preferably of some place which Darwin actually visited or saw, for Port Darwin he never was near.

POISON OF THE PLATYPUS.

The action of the secretion of the gland connected with the spur of the *Ornithorhynchus*, or platypus, offers a tempting subject for investigation, and unless the research be undertaken before long it will not be an easy if indeed a possible matter, for the animals are getting scarcer, and at all times, even if plentiful, are not easy to get at under circumstances permitting a satisfactory examination of the effects of the poison. The poisonous action of the secretion has been alternately asserted and denied, but I have no doubt whatever that it is, at least at certain seasons, a powerful poison. I have from time to time made enquiry, and have also advertised for information, and I have two good accounts from very intelligent hunters of the animal, in widely separated parts of the Colony, which coincide perfectly, so that I have no doubt myself that they accurately represent the main features of the action of the poison in dogs and as observable by laymen.

One account shows that the males fight very fiercely while in the water during the pairing season, mostly applying themselves to

each other belly to belly. The scratches are mostly on the under surface of the tail. The females are very seldom found scratched. One of the hunters tells of a dog he had which was "stung" on three different occasions—each time both spurs were employed, and the wounds were always on the dog's cheeks. The wounds are always described as on the head or face somewhere, because they are inflicted while the dog is retrieving the wounded animal. The effects followed very quickly, like the sting of a bee, within a couple of minutes the head began to swell, and on the first occasion had reached a "tremendous" size within a quarter of an hour. This swelling gradually disappeared, and was gone in thirty-six, ten, and three hours on the first, second, and third occasions respectively. The swelling and all the other symptoms were less marked the second than they were the first time, and the third than the second time. The swollen head was tender to the touch, for the dog "sang out" when it was touched there. The eyes were at first closed up by the swelling, and when again visible were "wild looking." The dog became sleepy, as if under the influence of a strong narcotic, so that he had to be carried to the camp, and he moaned from time to time. The dog would neither eat nor drink, but there was no salivation, vomiting, diarrhœa, tremor, convulsions, nor staggering. Breathing was difficult, but not very. This dog quite recovered.

My other account is from one of two brothers who were both great hunters of platypus, and he confesses to having been wicked enough to have shot many thousands during his thirty-two years of work. He had four valuable water dogs that died from the "stings." On one occasion he actually saw the platypus strike, heard the dog whine, saw the wound, and the train of symptoms ending in death. These were comparatively large dogs. He knew that after he himself gave up hunting, his brother, who went on with it, lost dogs too. The drowsiness was so intense that he has had to carry the dogs on horseback with him for as long as three hours.

The first of the two accounts of the action of the poison in the human subject which I have found, was that communicated in

1816 by Sir John Jamison to the Linnæan Society of London (*vide* Trans. Linn. Soc., March 18th, 1817). This account is so very interesting in the light of what I have to tell you on the same subject, and has been so much discredited or so completely overlooked and forgotten that I take leave to copy it here :—

"I wounded one with small shot; and on my overseer taking it out of the water, it stuck its spurs into the palm and back of his right hand with such force, and retained them in with such strength, that they could not be withdrawn until it was killed. The hand instantly swelled to a prodigious bulk; and the inflammation having rapidly spread to his shoulder, he was in a few minutes threatened with locked-jaw, and exhibited all the symptoms of a person bitten by a venomous snake. The pain from the first was insupportable, and cold sweats and sickness afterward took place so alarmingly, that I found it necessary, besides the external application of oil and vinegar, to administer large quantities of the volatile alkali with opium, which I really think preserved his life. He was obliged to keep to his bed for several days, and did not recover the perfect use of his hand for nine weeks. This unexpected and extraordinary occurrence induced me to examine the spur of the animal; and on pressing it down on the leg the fluid squirted through the tube: but for what purpose Nature has so armed these animals is as yet unknown to me."

Jamison's description was quite unknown to the Rev. W. W. Spicer who wrote the other account of the effects of the poison on man, which I have found, (*vide* Papers and Proceedings and Report, Roy. Soc. of Tasmania, 1876), and who says—"First, both in date and value, are the observations of the veteran naturalist Dr. Bennett," whose loss we in Sydney have so recently had to mourn. Yet Dr. Bennett's writings on the subject were not published for many years after Jamison's and they were negative, for he could not get any evidence that the spur was a weapon of offence or defence, since the animals never attempted to use it on himself. These animals, however, were in captivity, and most people know how difficult it sometimes is in such circumstances to get some animals to use their weapons, while the description given by Jamison and by Spicer were from animals in their natural state and greatly irritated, the one by being shot and handled, the other by being twice captured by the hand.

Spicer's account is really that written by Mr. Stephens, Inspector of Schools, and whom I know as an extremely intelligent man. Mr. A. Simson was the victim. Here are Mr. Stephens' words:—

"After an exciting chase platypus was recaptured; but this time he revenged himself by giving my friend a severe wound on the hand, one spur slightly tearing the palm, and the other the back of the hand, making a deep puncture between the knuckles of (I think) the first and second fingers. The pain from this was intense and almost paralysing. But for the administration of small doses of brandy, he would have fainted on the spot: as it was, it was half an hour before he could stand without support: by that time the arm was swollen to the shoulder, and quite useless, and the pain in the hand very severe. No ammonia was to be had; no medical assistance was available; and the only treatment that could be adopted was to keep the whole arm for a night and day in wet bandages, which seemed to alleviate the pain a little, and to reduce the inflammation. A week later I was informed by letter that the swelling had subsided, the hand was still very tender, with a sensation as of a severe bruise. From this time there was a slow but gradual improvement."

As regards the convalescence, the victim himself writes:—

"There must be some kind of poison in them I fancy, as, though the wounds healed up quickly, I still have a queer feeling in the hand and fore-arm, and cannot bear any pressure on the hand; the flesh, especially in the morning when I wash, feels as if it were with the skin grazed off, quite sore, and the hand is still rather cramped, and incapable of grasping anything, though I can use the fingers now again. The foregoing sensations extended right up the arm at first, which was everywhere tender to the touch, and all the joints and bones of the fingers also. Some natives told me they would rather lay hold of a snake than a platypus."

Spicer goes on to say:—

"I may mention that on Mr. Stephens attempting to seize the animal, it attacked him in a similar manner; fortunately his hand was protected by a glove, and the spurs only left a deep indentation without piercing the covering. And Mr. Stephens himself wrote, 'The mode of attack is not by scratching, but (as I know from experience) by a powerful lateral and inward movement of the hind legs, the spurs being brought together like the points of a pair of calipers.' It is worth noticing that the animal was in a state of considerable irritation when recaptured; and also that the object of his attack was a strong man, in the prime of life and in perfect health."

Mr. Spicer did not know of Jamison's description nor of any account whatever of the symptoms of the poison, other than the

one case reported to him by Mr. Stephens, and consulting what literature was available to him, he found so much against the spur apparatus being really a poison apparatus, and so much in favour of its being something else, such as useful in the sexual object, etc., that he concluded thus :—

"The question is surrounded with difficulties, and cannot be determined in our present state of knowledge," and that "it was a decided and unsolvable mystery."

Now if we review these four accounts, we note that—

1. They are all absolutely independent, not one writer knowing anything of the other three, three hailing from different parts of the colony of New South Wales, and one from Tasmania, and all from different periods of time.
2. Two were in the human subject and the rest in dogs.
3. The train of symptoms, *mutatis mutandis*, agree most perfectly.
4. In all cases the poison was allowed to follow its natural course, nothing but external applications, if anything at all, being ever employed by way of treatment.
5. The symptoms were specific and differed entirely from the ordinary surgical effects of lacerated wounds.

We may, I think, conclude that the poison is powerful enough, at all events at certain seasons, but at what seasons, the accounts do not permit me to say, though I think it is the pairing season. I have set down these new accounts because I believe them worthy of record, and perhaps this allusion may lead to something more being done.

POISON OF SPIDERS.

We hear many stories of the poisonous effects of the red-backed spider, *Lathrodectus*, and some time ago I began an investigation of the variety not uncommon around Sydney, and which Mr. H. H. B. Bradley tells me is either *Lathrodectus Thorelli* or *Hasellii*, though he thinks these are only varieties. I have accounts of the results of the bite of this spider from medical men, which agree so well with those described as following the bite of the New Zealand species, the "Katipo," that I am bound

to believe that the Sydney varieties are poisonous, at all events in certain seasons, though I got no results from hypodermic injection in dogs except profuse vomiting. I could not induce the spiders to "bite," and so I had to make extracts of the glands or rather of the entire body. Just at this stage, my friend Professor Kobert, of Dorpat, wrote to me, telling me that he had been investigating *Lathrodectus tredecempunctatus*, which he said was the most poisonous spider in the world, and that he had obtained therefrom the most powerful poison up till that time known, for 0·00003 gramme per kilogramme weight of animal injected into the blood was fatal. A better idea of what this really means will be conveyed if I tell you that at this rate one twenty-eighth part of a grain injected into the blood of a man twelve stone weight would be fatal. Brieger has also found in the "Caracurt," or "Black Wolf," a poison making up twenty-five *per cent.* of the body weight, and of about the same power as the poison of the *Lathrodectus*. I collected and sent to Dr. Kobert some *Lathrodecti* from St. Leonards, near Sydney, but these yielded negative results. I am therefore inclined to think that this insect is not always in a poisonous state, but what are the conditions I do not know, for in a poisonous state a single spider should be able to kill many dogs. The records of cases of the bite in man are neither numerous nor complete in the medical literature of Australasia, while the stories of the spiders are well known to everyone. Such is the "Katipo" *(Lathrodectus lugubris)* of New Zealand, which is, as it appears to me justly, credited with fatal results to human adults, though, on the other hand, it, too, has been found in a not very poisonous condition. An interesting account of the poisonous and fatal results of the bite of the Katipo may be read in Dr. F. W. Wright's paper in the Transactions of the New Zealand Institute for 1869. From these particulars, then, it will be seen that there is quite a field open as regards Australasian spiders alone.

POISON OF THE AUSTRALIAN BUSH-TICK.

The question of the poisonousness of ticks is an interesting one, for on the one hand dogs, cats, small marsupials, and snakes are

found in the neighbourhood of Sydney and near the coast literally covered with them, and yet show not a symptom. On the other hand it is a common belief, which is I think, well founded, for I have collected a number of accounts by competent and trustworthy medical men who agree in their observations, that frequently grave symptoms often ending in death, result from the insect's bite. The train of symptoms in dogs which seems to summarise the observations on about one hundred cases, according to the letters of my correspondents areas follows: Young animals are specially susceptible. There is first moping, hot-nose, and gradually advancing muscular weakness first noted in hind-limbs from the staggering gait, then in fore-limbs, neck and muscles of respiration. Probably owing to the last mainly is a great diminution of the animal's activity and alteration of its bark, which becomes rather a gruff cough. Obstinate constipation, troubles of micturition or retention. Epileptiform attacks or prolonged convulsions may usher in a fatal issue, or there may be no convulsive sign and death ensue from failure of heart, the pulse having been flickering, or from failure of respiration, there having perhaps been Cheyne-Stokes breathing. Peripheral nerve paralyses have been seen during convalescence—such as Bell's paralysis. The tick when filled with blood falls off and leaves a hard lump which does not disappear for two to three weeks. One attack confers immunity from the evil effects upon subsequent atacks, and in some districts where the ticks abound, dogs are regularly made immune by letting the tick remain till the first symptoms appear, which may be in a few hours, and then removing it. Upon complete recovery this is repeated one or two times. The second time the symptoms are longer in appearing than the first time, and are longer still the third time. After this the dog is protected.* There are apparently, different kinds of ticks, some comparatively harmless, some, such as the large "bottle tick," a single one of which killed a dog of forty pounds weight, very venomous, the effects of the two sexes may differ

* I have to acknowledge valuable information on this matter from various correspondents, and particularly Drs. H. A. Ellis and G. W. Taylor.

and the different seasons may have their influence. There is a good subject here, and I hope that the offer of the prize by the Council may lead to some one taking it up.

THE POISON OF THE AUSTRALIAN SNAKES.

The investigation of the action of the poison of the Australian snakes has been continued by Dr. Martin in the Physiological Laboratory at the Medical School, and towards the expenses of the work the New South Wales Branch of the British Medical Association gave a grant of money. The subject is a very big one, and, from the nature of it, results come very slowly. The work is being done in a systematic manner, beginning with the changes induced in the blood of the victim—and from these it appears, that the blood is so profoundly altered as to become for the time being unfitted for carrying on its functions, and the changes affect both the corpuscular and liquid parts of the blood. These results have been already published. The changes in the heart, and blood-vessels, the nervous system, and the various cell elements of the body are now under examination. The results so far obtained make the Australian snake venom resemble that of the American viperine snakes, though with marked differences in some respects. Such researches always open up side issues, requiring to be followed out in order to throw light on the main line of work. This method, though perhaps slow, is the only sure one. It is only by ascertaining the physiological action of the venom as it affects the different organs and parts of the body, that a rational method of treatment will be definitely arrived at. And this knowledge of the physiological action must be thorough—as thorough as the present state of the science of physiology permits. It is not enough to cause a snake to bite an animal, and merely stand by and observe what happens. The experimental method must be invoked in all its variations, so as to elucidate the precise action of the venom on the separate mechanisms or organs of the body, for only when in possession of this knowledge can we hope to meet the evil effects of the poison by appropriate remedial measures. There is room for many workers in this field, and I may therefore

be permitted to refer to the prize offered by the Council for the best Essay containing the results of original research on the physiological action of the poison of any Australian snake, spider, or tick—to be sent in not later than May, 1895.

A NEW VACCINE TO PROTECT AGAINST ANTHRAX.

In these times anything which increases the productive power of the land is of interest, and such virtually is the protection of our flocks in certain districts from anthrax. This was the first infectious disease proved to be due to the presence of microbes, and it is now the best understood of them all. As far back as 1880 and 1881, Toussaint and Pasteur announced that they could produce a modification of this microbe, inoculation of which produced the disease in a milder form, that protected the animal against the more virulent form. It is true that the immunity produced is only temporary and somewhat uncertain, but there is now, of course, no doubt that it is real. The method of Pasteur has been largely employed in this Colony, but quite recently a correspondent, a station manager (who from the specimens of his work submitted to me appears to be an excellent worker), writes that he has succeeded in producing a vaccine, of which he gives the following amongst other particulars. He arrived at the fixed standard of the attenuated virus in October, 1892, and experiments, at first on smaller numbers of sheep, during 1893 gave such uniformly good results, that all the young sheep, twelve thousand, on the station were then inoculated. Without the inoculation a mortality of twenty to thirty *per cent.* was practically certain, while none of these have died from anthrax, and that this is due to their being really "protected" is proved by the direct hypodermic injection of virulent material, when absolute immunity was shown. During the current year forty thousand sheep have been inoculated, with similar results. On all the stations where these sheep were treated they were dying rapidly, but within ten days after the inoculations began the mortality absolutely ceased, except in a small flock of one thousand two hundred, in Victoria, where a suspicious death or two occurred. It is anticipated that

at least two hundred thousand sheep will be inoculated during the ensuing season. These splendid results are of the highest importance, for the loss sustained in the infected districts has hitherto been tremendous. Hereafter, according to these results, it need be no more than insignificant. But, further than that, we may in this way hope to very greatly diminish, if not eradicate, the disease, even should at some future time the inoculations be discontinued, for one of the most important circumstances keeping it persistently in a district is allowing the dead animals to rot where they die. The ground near the carcass becomes saturated with the organisms, and in the soil these have been proved to live for many years. This, of course, could be met by burning the dead bodies, and that should invariably be done where it can be done. Unfortunately in these colonies it is rarely possible. If, then, by inoculation the deaths from anthrax are either entirely prevented or very greatly limited, it is clear that the absence of rotting bodies, dead of this disease, will tend to let it die out in the district; and *a fortiori* prevent its spread to other districts.

THE SPREADING OF ANTHRAX.

In connection with the spread of anthrax from infected to uninfected country, I may mention that I am at present engaged in investigating the cause of a certain green colour which appears at times in wool, and which we have traced to the presence of a chromogenic organism—the results will be laid before this Society at an early date. In the course of the work we have, unexpectedly, obtained an abundant growth of the anthrax bacillus from wool sent to me quite unconnected with the subject of anthrax. It is thus easy to see how sheep, in themselves perfectly healthy, from an infected country may carry the organism to clean country and so spread the disease. There is, of course, nothing really new in this, but meeting it in the way I did, it rather impressed me. The practice of some cautious pastoralists who will have nothing to do with animals from an anthrax country is absolutely justified, for even while themselves perfectly healthy they may carry the organism in abundance in their fleeces.

PREVALENCE OF HYDATIDS AND THE REMEDY.

In 1888, I drew attention in the press to the prevalence of the dire disease hydatids, and urged that steps should be at once taken to lessen the number of ownerless dogs which infest the city and suburbs. Something was done at the time, and occasionally and spasmodically since, but for a long time these dogs have apparently been as numerous as ever. The disease arises from the egg of a tape-worm of the dog being swallowed in drinking water, or in food, or perhaps ingested as dust. The egg gives rise to an organism which may find its way into the blood, and so may be carried by the circulation into any part of the body producing the insidious and dangerous disease. The only way to entirely rid ourselves of the disease would be to get rid of all dogs. That is not possible, but it is possible to keep down the disease by adopting the suggestions which I made, and to which I still adhere viz., to make the registration of every dog absolutely compulsory, to issue annually a distinguishing badge to be attached to the collar, and then to impound every collarless dog or dog without the badge of the year, and dispose of it unless claimed within a reasonable time. And these regulations should be really enforced, not left as dead letters. To this end their execution should not be imposed upon the police, with whose essential duties this dog catching is quite incompatible. A few dog catchers with veritable dog carts perambulating the streets would do all that is needed, and the extra revenue derived from the better collection of the dog tax would, I am sure, meet all the extra expenditure entailed. To reinforce what I have already said, I might add that from the æsthetic point of view the removal of the wretched creatures, which meet us at every turn, would be a boon to us and a blessing in disguise to the animals themselves, for it is not the dogs with homes that would be removed, but only those that having no owner remain uncared for, pick up a living anyhow, and drag out a miserable existence to a miserable end. What I propose is less than is carried on successfully in some places, but I think it would suffice for us here, and I have gone a little out of my way to speak of it, because it

appears to me something which should be done, and that a little agitation is needed. I may point out our curious inconsistency in imposing a prolonged quarantine on imported dogs lest they should bring disease into the Colony, while we so utterly neglect the transmission of disease from dogs already here. I might here incidentally draw attention to the prize offered by the Council of this Society for the best results of original research on the subject of the origin of multiple hydatids in man, and as the competition is open to all comers, I trust that some of our younger colonial graduates may find the time and have the inclination, as they unquestionably have the opportunity, to do something towards the settlement of the question.

DISPOSAL OF SEWAGE—SEWAGE FARMS.

One of the greatest difficulties one has to encounter in these colonies is the collection and disposal of sewage, for there are special difficulties in the way of both. The collection of it is comparatively costly, because owing to the semi-tropical character of the rainfall, either the wholly or partially separate system has to be adopted in order to carry off the storm waters, or the sewers must be made large enough to do so, and these are then much too large for the ordinary sewage. This undue size of the sewer, too, brings its own troubles, because the difficulty of proper flushing and ventilation is immensely increased.

Our notions as to the disposal of sewage have of late years been much affected by the discovery of the precise manner in which nature goes about its business in this respect. A little reflection will show one that, seeing how tolerably constant is the sum of living organisms on the earth's surface at any given time, a marvellous process of disposal of the dead bodies of plants and animals must constantly be going on. Formerly it was supposed that principally chemical processes, and mainly direct oxidation by the oxygen of the air, effected the decomposition of the organic remains. Now we know that the change in buried remains is mainly due to the vital activity of the omnipresent microbes.

An examination of the soil from any part of the earth's surface discloses the presence of organisms, in the form of *cocci*, *bacteria*, and *bacilli*, which have the common property of converting the nitrogenous constituents common to all dead organic matter into harmless bodies, such as nitrites and nitrates of whatever base may be present, and so are removed, dissolved in water, and perhaps taken up by the roots of plants, the materials, the decomposition of which is otherwise offensive to the senses and injurious to the health of the living. Moreover, these organisms are mainly in the uppermost layers of the soil, diminishing in number downwards, so that at a depth of five or six feet there are comparatively few—this is why it is mainly in the surface layers that, on the one hand, the greatest amount of decomposition of organic matter takes place, and, on the other, the rootlets of plants are mainly found, for it is now clear that plants are largely dependent upon these nitrifying organisms for their food. This is proved inferentially by the fact that these organisms are distributed everywhere co-extensively with plants, and directly by the fact that if fertile soil be heated to a temperature sufficient to destroy the vitality of the organisms, that soil is no longer fertile, it has become sterile, plants will not grow in it, and it will no longer purify sewage as it did before. The term "living earth" has been most happily applied to the natural soil, and a curious experiment is to chloroform such soil and see, that when the activity of its living organisms is thus suspended, it is powerless to decompose organic matter, in short, to dispose of sewage matters as it did before. If now the chloroform is allowed to evaporate, the active properties of the soil as regards purifying sewage return.

The discovery of these nitrifying organisms and our knowledge of their conditions of activity, have given us much more definite notions of what goes on in sewage farms, and to my mind point to such farms, where the proper soil in sufficient area, in a convenient locality, and at a reasonable price can be had, as at once the most natural and most efficient mode of disposing of sewage. At the Botany Farm, according to the latest figures, each

acre in use disposes, in a perfectly satisfactory manner, of the sewage from 1,024 persons, and I do not doubt, could deal with the sewage from a very much larger number. And when one says it disposes of the sewage one means absolute destruction, for on analysis the uppermost layers of the soil at the Botany Farm showed an increase in the amount of organic matter *after five years continuous use* of only ·02 *per cent.* There is under proper management, and even with very considerable mismanagement, no chance of any "clogging" with organic matter, and there is no reason why the same soil should not go on doing its work practically for ever. Another consequence of this newer knowledge of the precise manner in which organic matter is destroyed, is to largely remove the question of the disposal of sewage from the domain of the sewerage engineer to that of the biologist, and now one may say that it is the business of the engineer to collect and distribute the sewage, but that it is mainly that of the biologist or of the chemist to say how it should be disposed of or destroyed. I am aware that the engineers do not as yet quite like such an assertion, but it is nevertheless, in my opinion, true.

These matters have their importance to us now on account of the schemes which had been devised for the sewerage of Parramatta and Granville. I believe that this scheme might have been much less costly, simply by having the sewage farm much nearer the town, and so avoiding or lessening the cost of pumping and delivery mains. But I look farther ahead than this even, for on the shores of the harbour are plenty of low lying lands, the reclamation of which with suitable material, would at once provide means of disposing of sewage of suburbs, would yield cultivated lands, reclaim unhealthy areas and improve the remaining waters of the harbour. It is true that the great Western Suburbs scheme now in course of construction provides, I believe, most satisfactorily for these suburbs, but there are still other suburbs to be provided for near Sydney, and there are unfortunately numbers of other towns in the Colony still innocent of sewerage arrangements.

But, it may be asked, is it right and safe to bring a sewage farm so near the town—was not the costly pumping plant and main sewers of the Parramatta scheme, for instance, specially designed in order to get it away from the town. Herein lies the inconsistency of some such schemes—on the one hand copious evidence is brought forward to prove that no nuisance is likely to arise, and on the other hand great trouble is taken, and much money proposed to be spent, in order to remove the farm to a distance. If no nuisance is to arise, clearly there is no need to go so far afield with the farm, there is no reason to put it in any special locality, other than for reasons of convenience and general suitability of the site. I know of no evidence to show that the vicinity of such a farm is necessarily injurious to health. The sewage applied to the land in a fresh condition, in a properly intermittent manner, is destroyed without causing a nuisance. If the farm be properly managed, the vegetables grown on the farm are safe articles of food. No disease results to the workers on the farm, nor to the cattle fed on its produce, for no special disease is generated there, and the disease particles from men and animals carried to the farm by the sewage, if not already dead, meet there conditions so adverse to their existence that they probably speedily die. Almost any sort of soil will do, the end result will be the same, but the more suitable the soil the greater the quantity of sewage it will deal with. I have seen figures up to five thousand persons per acre.

With these remarks, then, I recommend this most natural system of sewage disposal for consideration in all future sewage schemes in this Colony, where land is often comparatively cheap, where water available for irrigation is always valuable, where there are no frosts to suspend the action of the organisms, nor very low temperature, short of frost, to notably diminish their activity in winter. And one of the most interesting places to visit near Sydney is the Sewage Farm at Botany, where thirty-three and a half acres actually in use dispose of the sewage (including storm water) from thirty-five thousand souls, and where a total area of

seven hundred acres is available, enough at this rate to provide for a population of the very least three-quarters of a million.

In saying what I have as to sewage farms, I do not forget the immense progress which the chemical modes of treating sewage have made in recent years, but where the conditions laid down for sewage farms are found together, then such farms should be preferred. In other circumstances, other methods. Each case requires to be considered on its merits.

DISPOSAL OF THE DEAD.

The disposal of the dead deserves some notice here, for precisely the same prime conditions control the destruction of all buried organic remains whatever be their source. The cemetery at Rookwood is not a suitable soil—a stiff clay is one of the worst that could have been chosen, while a light, porous, well-drained site such as at Waverley is the best, for there the decomposition proceeds rapidly and with the least danger to the living. When the time comes to extend the cemetery accommodation, the authorities should try to find a sandy valley draining into the ocean—just as at Waverley in fact, and this opinion is supported by enquiries I have caused to be made at the Waverley Cemetery, where the grave diggers tell of the rapid disappearance of all the soft parts of the body. At Rookwood, on the other hand, my enquiries show that decomposition proceeds very slowly and very imperfectly. This might be inferred from the impermeable nature of the soil—wedges have sometimes to be used to get out the hard rock at the bottom, and in wet weather, as I was told, the open graves sometimes need to be baled out before the funeral.

SEWER AIR—ITS CHARACTERS.

This subject has lately been the cause of much discussion and controversy in Sydney, and it might perhaps be fitting for me to say something on the matter here, speaking in very general terms, and without particular reference to the sewers of Sydney, seeing that these will be specially dealt with by the Board of Health, of which I have the honour to be President.

Sewer air is not always offensive to the sense of smell, and it is a fact that sometimes when most evil smelling it is really least poisonous, because when putrefactive decomposition is marked, while the smell may be very bad, the chemical products of putrefaction are so inimical to the lower forms of life, the microbes, some of which may be the injurious or poisonous elements in the sewer air, that these microbes are killed. It is then important to note, that there is no necessary relationship between the offensiveness and noxiousness of sewer air: the one is not a measure of the other.

The evil odour sometimes arises from highly odorous materials of a chemical nature poured into the sewers, as, for instance, the contents of tan pits. Here, clearly, however disagreeable it may be, the odour is not particularly poisonous. But even where the odours are due to the chemical bodies arising by decomposition of the sewage matter themselves, Haldane found that they are probably not necessarily poisonous, however offensive they may be, for when considerable quantities of sewer air were drawn through weak sulphuric acid no injurious results followed the injection of the neutralised liquid under the skin of animals. Again, sewer air, as already said, even the most offensive, is not always injurious when inhaled. Haldane records that he and many others, who were not "used to it," as might be said of sewer-workmen, never suffered any evil consequences during all their work. On the other hand, there are cases where the evidence is very strong in support of its having been the cause of diseases, although in most cases ascribed to sewer gas, an examination of the evidence shows, that they were probably more coincidences than examples of cause and effect. We have thus a set of extremely variable conditions to deal with, and altogether a very complex problem to solve.

The absolute number *per litre* of organisms in the sewer air of Sydney, as it would appear from the recently published results, is greater than is commonly found in England, but less than was found in Calcutta. Obviously, the warmer and moister air being

favourable conditions, the organisms multiply rapidly. The absolute number, however, is no criterion of the evil they may do: the only way to estimate this is to ascertain what manner of organisms they are. For instance, an hundred pigeons would be less dangerous to their fellow birds than a solitary hawk. The whole question then depends, not on the quantity but on the quality, not on the number but on the nature of the organisms. In illustration of this I may mention that Haldane states, that the number of microbes he found in the air of a room in which a common door-mat had been shaken, compared very unfavourably with the number found in any sewer air!

The nature of the organisms may, in a measure, be inferred by ascertaining where they came from. It is obvious that they may come from the air that enters the sewer, or from the sewage. These organisms are distributed throughout all the lower regions of the external atmosphere, but, heavier than air, they are continually tending to subside on to the earth's surface, and so the nearer the earth's surface, the greater the number in a given volume of the outer air. But the air which enters the sewers is precisely this lowest layer of the outer air, containing the most organisms. What wonder, then, that sewer air contains at least as many organisms as the worst air outside, and, moreover, the same kind of organisms as in that outside air. It is what one would *a priori* expect, and what has been proved by experiment to be the case; for it has been shown in the case of the sewers of London, Bristol and Dundee, that the numbers and kinds of organisms observed in the sewer air were not those observed in the sewage, but those observed in the outside air at the same time.

Sometimes, however, the numbers in the sewer air are greater than in the outside air, sometimes they are fewer. These exceptions, as it were, only prove the rule; for it is clear that in very dry weather the air containing the organisms, when it enters the sewer, becomes moister and it may be warmer, and thus more favourable to the organisms. It may also be that volatile products

of decomposition saturate the now moist particles to which the organisms cling, so that they may have a food supply while yet floating in the sewer air. In these circumstances, then, it is not difficult to understand an increase in number of the organisms in the air after entering the sewer, altogether apart from any contributions from the walls of the sewer or from the sewage. Then, again, the organisms tend to subside within the sewer just as they did outside, so that when the conditions already referred to as favourable to their increase are not dominant, the longer the air resides in the sewer, the more the organisms have fallen into the sewage. Thus, when the ventilation is not enough to obliterate the effects of the subsidence, and apart from other conditions, the air, when it enters the sewer, may actually lose many of its microbes there.

As to the other possible source of the organisms, the sewage itself, it follows for what has already been said, that it is the less important. For the following reasons sewer air ought not to contain so very many more organisms than the ordinary outer air. Experiments have conclusively shown that, when organisms are contained in a liquid, the only probable ways in which they can find their way into the air above that liquid, are splashing of the liquid and the bursting of bubbles of gas. In properly constructed sewers there is not necessarily any splashing, nor are there many gas bubbles, for the sewage is disposed of before it has time to decompose so as to produce much gas, and even if there were gas, the diminutions of barometric pressure leading to disengagement of the gas are not so very frequent. In the case of sewage, the deposits on the walls may dry, become pulverulent and get carried away by air draughts, but drying does not often take place in sewers, and when it does, the mere drying kills many organisms, and the air draughts are not always there at the same time. Taking into account all that has just been said against the sewage origin of the microbes in the sewer air, and all already said in favour of their origin mainly from the outer air, the greater importance of this latter source is obvious. In a word far and away most of

the microbes in sewer air are derived from the external atmosphere, not from the sewage.

Now, if we bear in mind that we live every day and all day in the most microbe laden lowest stratum of the outer air, or what is worse, in closed spaces, close rooms etc., in the air of which the microbes are usually more numerous than in the air outside, we at once must admit that, apart from their numbers, the nature of the microbes, thus common to the outer air and the sewer air, can not be so poisonous after all. As a matter of fact there are microbes and microbes, harmless or friendly, and injurious or unfriendly, those that never prey upon the healthy animal body, but always on dead or non-living organic matter, those that never are found except as parasites preying upon the living, and intermediate kinds that vary according to the conditions. The vast majority of the microbes in ordinary air and in sewer-air belong to the group of harmless or friendlies, and the questions to be answered are, whether there are any of the second kind, the pathogenic or disease-producing organisms, and if there are any, what is their nature and how many are there of them? In this last connection the number is of importance, because the healthy animal body has means of combating the attacks of disease-producing organisms, a struggle ensues between the body and the microbes—if the latter be few they are overcome and destroyed, if too many they overcome the body's natural protectors (phagocytes?), and so obtain a footing, grow, multiply and produce their specific disease. These three questions constitute the problem of the sewer air, and the answers are by no means easy. It is not enough to say that any particular organism belongs to this or that group, for to a single group belong both harmless and harmful individual sorts. The answers to these three questions can only be given by a laborious separation of the different kinds, and an investigation of the nature and properties of the separate kinds, a task which so far as I know, has never yet been fully undertaken, and certainly has not as yet been accomplished.

We have yet the important question to consider—What likelihood is there of there being disease-producing organisms in the sewers? There can be no doubt that such organisms do reach the sewers by the dejecta, etc., of persons and animals, especially during epidemics. But, even then, the numbers of the harmless microbes are immensely greater than the numbers of the harmful; and we have no reason to suppose that the harmful organisms rise into the sewer air more easily than the harmless. Thus even in epidemics, the proportion of harmful microbes in the sewer air would be small. But all who have tried to make pure cultures of pathogenic organisms, have found how difficult it is to satisfy all the necessary conditions as to temperature and medium, and can understand how unlikely it is that the sewage will offer favourable conditions for their growth and multiplication. Lastly, they will have to compete in the struggle for existence, for food, with the vast numbers of the harmless sorts. Altogether it does not seem likely that the pathogenic organisms will readily thrive, or even survive, in their new surroundings in the sewage.

Finally, let us assume that the sewer air really does contain disease-producing organisms, and actually reaches the outer air. They are here in a usually much drier medium than while still in the sewer, and many are killed by the mere drying. They are also exposed to sunlight, and this alone kills many more. Lastly, the survivors are distributed through so large a quantity of air that the chances are more and more against any one ingesting them in such numbers that they overcome the body's protectors, as already described, and really produce their specific disease.

SANITARY LEGISLATION IN NEW SOUTH WALES.

A review of the Acts in force in New South Wales relating to the public health unfortunately does not take long. They are as follows, viz. :—

The Quarantine Act and its Amendments, 1832 – 53.

These Acts deal only with maritime quarantine and the segregation of introduced disease. They do not even apply equally fully to all the ports of the Colony.

Cattle Slaughtering Act and its Amendments, 1834 – 51.

Mainly for police, though they contain a few clauses for sanitary purposes. These, however, are so obsolete in their machinery, &c., as to be ineffective now.

Towns Police Act, 1838.

Contains some sanitary sections, though mainly police, but is largely out of date, and its sanitary sections, for many reasons, largely inoperative or inadequate to the needs of the present day.

Municipalities Act, 1867.

Gives power to municipalities to make sanitary regulations. This has been unevenly and imperfectly done, and the regulations, such as they are, are not enforced. One of the most heart-breaking tasks I have ever had is trying to induce municipalities to carry into effect their own sanitary by-laws. The indifference of municipal councils in this Colony to sanitary measures is nothing less than shocking, nor do I anticipate that it will be any better until power is taken by the central authorities to compel negligent local authorities to do their duty in these respects.

Nuisances Prevention Acts, 1875 – 92.

Deal largely with the removal of nightsoil.

Sale of Poisons Act, 1876.

This requires no remark—its purpose is a limited one.

Adulteration of Food Act, 1879

Is practically a dead letter. It is unworkable.

Metropolitan Water and Sewerage Acts, 1888 – 89.

The scope and purposes of these Acts is indicated by the title.

Infectious Disease Supervision Act, 1881.

Deals with small pox only, but that most efficiently.

Dairies Supervision Act, 1886.

A most efficient Act, though defective in certain minor respects.

Animals Infectious Disease Act, 1888.

Provides for handling or dealing with the microbes of infectious diseases, inoculation, &c. An Act of limited application and doubtful necessity.

Leprosy Act, 1890.

Provides for the segregation of lepers. Most efficient.

Diseased Animals and Meat Act, 1892.

A most useful and successful measure now meeting the approbation even of those at first opposed.

From this review it is plain that—

1. The really efficient acts are the work of the last ten years or so.
2. The acts are piecemeal. A comprehensive Public Health Bill was drafted in 1885 by the Hon. Dr. Mackellar, and was read a first time in the Legislative Council, but it has not got any further.
3. The only infectious diseases with which there is power to deal are Small Pox and Leprosy, though with regard to these two diseases the powers are most ample.

The results of the absence in New South Wales of such sanitary legislation for infectious diseases other than small pox and leprosy, may be illustrated by the following examples, all occurring during the past twelve months or so.

Diphtheria.—At Cowra, the town having some nine hundred and fifty inhabitants, the town and neighbourhood two thousand one hundred, and the district seven thousand five hundred, from November, 1892, till May 16th, 1893, there were no less than two hundred and seventy-three cases of diphtheria, and thirty-six were fatal. The town gets its drinking water from the river below the town: there is no sewerage, almost no drainage; half the houses have cesspits, and these are not properly constructed, the other half have the objectionable single-pan system. In the surrounding district the cesspits were foul and the excreta of the sick were simply thrown into them: the general surroundings of the houses were such as to encourage the introduction and prevalence of disease. The first known case was that of a girl attending the public school, and from her it probably spread. Even while sick, this girl was permitted to nurse a child, and it developed the disease. In every instance investigated, infection, direct or indirect, was proved. Further, these two hundred and seventy-three cases were only those which came under medical cognisance, and certainly here, as in every outbreak of the sort, there were a very large number of cases which appeared so slight as not to come under medical care, though they were undoubtedly diphtheria, and

fully capable of communicating the disease in a virulent form. In the State of Michigan (population, 1890, a little over two millions), on the other hand, and I take the figures from the diagram exhibited by the State Board of Health at the Chicago Fair, and a copy of which has just been sent to me, before isolation and disinfection in diphtheria were enforced, the averages in three hundred and seventeen outbreaks, were—

13·57 cases with 2·67 deaths,

and after enforcement 2·04 cases with ·48 deaths.

This represents a saving of 15,302 cases, and a saving of 2,722 lives, during the period 1886 – 90 in this one State. Think of the wretchedness and misery of parents thus saved, for it is children that have mainly thus been spared.

Measles and Scarlet Fever.—With regard to these diseases, I cannot do better than quote from the report of the Board of Health on the recent very general outbreak, which has practically overrun the whole Colony :—"Thirteen deaths from measles occurred among the three hundred and eleven cases admitted to hospital, being equal to a death-rate of 4·18 per cent. ; the deaths registered in the metropolitan district from the same disease, excluding deaths occurring in hospital, were three hundred and eighty-eight, and assuming that the rate of mortality of cases treated in their homes was the same as that of the cases treated in hospital, it is estimated that *there must have been some nine to ten thousand persons attacked with measles in the metropolitan district during the epidemic in 1893.* Most probably the numbers were much larger, as only those cases which suffered from the disease in a more or less severe form were removed to hospital, and consequently it may be expected that the death-rate among such cases was higher than among those who were treated at their own homes. Seventeen deaths occurred among the two hundred and seventeen cases of scarlet fever removed to hospital, or at the rate of 7·83 per cent. and an estimate formed on the same basis as previously stated, shows that *at least some two*

thousand persons must have been attacked with scarlet fever in the metropolitan district during the epidemic of 1893." These figures it will be noticed, refer to the metropolitan district only, with its population of four hundred and sixteen thousand three hundred and seventy. If these same ratios are extended to the entire colony, there have been thirty thousand cases of measles, and six thousand cases of scarlet fever. The report goes on to say :— "The suffering and misery caused by these two epidemics, happening as they did at the same time, cannot be estimated, and it is to be regretted that, owing to the absence of an act for the compulsory notification and registration of infectious diseases, this Board had not sufficient power to deal with the epidemics. There can be no doubt that had some of the earlier cases been reported, and proper means taken for their isolation, many lives might have been saved." In the State of Michigan already referred to and during the same period referred to, isolation and disinfection have saved thirteen thousand three hundred and sixty-eight cases and six hundred and ninety lives from scarlet fever alone.

Typhoid Fever.—The present outbreak at Aberdeen is very much to the point. The township had from six hundred to seven hundred inhabitants, and up to date at least one hundred cases have come under medical cognisance—and the outbreak is not over yet. The sanitary condition of the place is most foul, and that largely in a way that I will not particularise here. Suffice it to say, that so long as no specifically infectious matters got into the filth, which owing to the nature of the soil and the manner in which it was deposited, remained on or near the surface and was not destroyed as it would have been had it been properly buried, and thanks to the delightful locality, the fresh air and abundant sunlight, the people did fairly well in spite of their dirty surroundings. But in November last a person, whose name is known, brought the specific infection into the township, and immediately, in such, to them, congenial circumstances, the organisms, the bacilli, throve and multiplied, and the disease began to spread-

until it has reached the now notorious proportions I have mentioned. Owing to the absence of any provision for notification, the authorities here in Sydney knew nothing of its ravages until it already had a strong hold on the district.

It is to be hoped that one of the first measures introduced by the Government in the next Parliament will be one for the compulsory notification and the prevention of infectious diseases—such as the Act now in force in the United Kingdom. At present except with regard to small pox and leprosy, there is nothing of the sort in New South Wales. Should cholera, for instance, be brought here, the authorities have not power sufficient to deal with it promptly and efficiently. Unless the first cases of infectious disease are made known, the Sanitary authorities cannot take steps to prevent the spread of the malady.

This is not the place to bring forward all the arguments in favour of the legislation asked for, since I do not suppose there is a man in the room who does not assent, but it is fitting enough that I should here draw attention to the subject. It is distinctly a poor man's question—the rich can and do, in a measure, protect themselves, and the results of infectious sickness in their families are not so terrible. What we have to contend with is not any real opposition, so much as apathy and ignorance.

As shown by the voluntary vaccination returns, a single case of small pox in the harbour dispels apathy, and causes a rush of people who desire the protection afforded by vaccination, and apathy and ignorance combined sat opposite to me in a public vehicle the other day. An old lady and her grandchild were there; presently the child coughed and whooped. I looked at the old lady and suggested "whoop?" She nodded quite unconcernedly as if it were quite a matter of course. And whooping cough is a very infectious disease.

But I could go on in this strain indefinitely. The whole subject must be taken in hand and dealt with thoroughly. As an encouragement we need only read the Hon. Dr. MacLaurin's most

able Report on Sanitary Legislation in England, where we read that "the number of lives preserved to the country which would have been lost if the old high death-rate had been maintained" was in 1889, the last year given, no less than one hundred and forty-two thousand four hundred and forty-six. The reduction of the fever (typhus, typhoid and simple) mortality alone is immense—from nine hundred and ninety-four per million before 1871 to one hundred and ninety-seven per million in 1890, or a total saving in the whole population of twenty-two thousand nine hundred lives in that one year alone from this one cause. As Dr. MacLaurin remarks, "This is truly a result of which the English sanitarians may be proud." In that same year in Sydney it was four hundred per million.

NOXIOUS AND OFFENSIVE TRADES.

There is at present no law efficiently controlling such trades, but there is before the Legislature a Bill which it is hoped will be speedily passed into law.* The principal object of the Bill is to support the local authorities, which are charged with the immediate supervision of the trades (including slaughter-houses), and in order to recoup the local authorities for necessary expenditure, they are to retain the fees for licenses, &c. The central authority held in reserve behind the local authorities to help them, if need be, in performing their duties and carrying their powers into effect, is the Board of Health.

This has been a burning question in Sydney for the last twenty years, and has formed the subject of enquiry by two Royal Commissions, each of which recommended a particular site, removed from population, where the traders should be free, or practically so, to carry on their trade as they liked. To this, there is every objection, and the present Bill aims at regulating the trades so that they shall be carried on without causing a nuisance, and therefore obviates the necessity of their removal to inconvenient and unsuitable localities. If a particular site were set apart it

* This Bill became law, as the "Noxious Trades and Cattle Slaughtering Act," a few days after the address was delivered.

would soon become intolerable, population would gradually gather around it, and the old condition of things arise anew. Further, the cost of carriage and, in the case of establishments concerned in the working up of surplus live stock, offal, hides, etc., etc. etc., deterioration of material in transit, would greatly diminish the value of the raw material, lower the price of stock, lower the price of stations, and so would tell back upon every important interest of the Colony.

The Bill gives no details of the measures to be employed—these are to be set out, as far as need be, by regulations made under the Act. The principle, however, is simple enough,—prevent decomposition of organic matter, and prevent the discharge of malodorous vapours into the atmosphere. There can be no reasonable doubt that the traders will soon here, as has so often happened elsewhere, recognise the benefits conferred by the Bill, in forcing them, and all alike, to conduct their business in sanitary and therefore in profitable ways, for smells cost a deal of money. At the same time the surrounding population will be relieved from the burden of an intolerable nuisance.

SUGAR AS FOOD-STUFF IN AUSTRALIA.

An interesting circumstance worthy of mention here has been emphasised by the financial panic in Australia and the depression following upon it. In conversation with the manager of a large sugar business in Australia, he mentioned that the consumption of sugar had not diminished notably, certainly not to the extent one might have thought it would, considering what we have been passing through, and that while there has been some small reduction in the total consumption of sugar per head here, he thought that such reduction has been only in the quantity used for brewing, and not in that used for food. Even now the consumption per head in Australasia is very largely above that of any other country, notwithstanding the enormous import of confectionery, etc., from England, which is all included in the British consumption, and although the people here are supplied with other articles of diet in infinitely larger quantity and of better quality than any other

community can obtain. This statement interested me greatly because so accurately in accord with the teachings of modern physiology, which show that sugar is no longer a mere sweetening agent or condiment, but that it is really a food-stuff of high value. This fact people seem to have found out for themselves, because when all sorts of economies have had to be made, sugar has not been given up, apparently because experience has shown that it is no longer a mere luxury. Owing to the insular position of Australia and to the general distribution of the present distress throughout all the Colonies, this continent is peculiarly adapted for observations of this sort, and experimental physiology, working in the laboratory, confirms the apparent experience of the people by showing, that four times as much sugar disappears in the muscle during its activity than does while it is at rest, and Vaughan Harley has just shown, by experiments upon himself, that sugar taken as a food is a muscle-food. The apparatus he employed is the "ergograph" of Professor Mosso of Turin, and Harley performed his experiments in Professor Mosso's laboratory. By this instrument a definite group of muscles can be brought into play, and, as any one group is like all the other muscles of the body so far as the experiments are concerned, what is found to be true for a part, is true for the whole. Thus an accurate record can be obtained of the effect of any given set of conditions on the muscular work of the body generally. In his own case, seventeen and a-half ounces of sugar taken on a fasting day, increased the work done by 61 – 76%: seven ounces added to a small meal increased the muscle work by 6 – 30%: with eight and a-half ounces added to a full meal the increase of work was 8 – 16%, and the same amount of sugar increased the total work done in eight hours by 22 – 36%. Finally, he found that sugar, taken as a food about 3·30 in the afternoon, obliterates that daily fall in the muscular power common to us all, and usually happening about 5·30 p.m. These are interesting results, and, taken with the present prices of meat, bread and sugar, important, for assuming that one hundred and thirty-six pounds of bread contain

seventy pounds of carbohydrates and that bread is one penny farthing per pound, carbohydrate foods, which are absolutely indispensable in some form or other, are now as cheap in the form of sugar as in that of bread. It is true that bread contains also the nitrogenous elements of food, but these in Australia are generally preferred in the form of butcher's meat, which is cheap enough and copiously indulged in. This new position of sugar in the dietary of the people is of far reaching importance and quite a thing of our own times. My recollections do not go back so very far, yet only thirty years ago as a boy I was permitted to have either milk or sugar to my porridge, but not both, for the then costly sugar was regarded as a pure condiment and therefore a luxury, to be sparingly administered, so as not to spoil the child. This, I may add, was in Scotland.

The difference between sugar as a sweetener and sugar as a food has been much emphasised by the discovery of "saccharin," a complex derivative of the coal tar products, and which is some three hundred times as sweet as sugar, but of no value as a food stuff, if its continuous use, indeed, be not positively injurious. Some time ago it was stated that the German authorities had prepared large quantities of "saccharin" tablets for issue to the soldiers instead of sugar: if this were done the blunder was a curious one for a people who claimed that their soldiers' diet was prepared on scientific principles. They substituted for a valuable food a sweetening substance not only with no sustaining power, but which may have serious effects when taken continuously.

SUMMARY OF THE SOCIETY'S PROGRESS DURING THE PAST YEAR.

I have now to summarise the principal events connected with the Society's position and progress during the year. At the end of a period of twelve months during the whole of which there has existed an unexampled depression in trade, leading to universally diminished incomes, it would be indeed strange if this Society had alone escaped the general fate. And it has not escaped. The income of the Society has been smaller, but then expenditure has been curtailed so that the Council has had to do, what everybody

else has had to do, to cut its garments according to its cloth. When we reflect on the beneficent purposes on account of which all the funds of this Society are expended, you will unite with me in a fervent hope, that the coming year will show a turn of the tide.

Roll of Members.—The number of members on the roll on the 30th April, 1893, was four hundred and seventy-seven. Thirty-one new members have been elected during the past year. We have, however, lost by death nine Ordinary and one Honorary member, and thirty-one by resignation. Twenty have been struck off the Roll for non-payment of their subscription, and three have failed to take up their membership under Rule IXA. There is thus left a total of four hundred and forty-five on April 30th 1894; this number however, does not include the Honorary and Corresponding members. A comparison of these figures with those of previous years shows, that the loss on the total membership during the year is practically entirely due to resignation and to failure to pay the annual subscription,—due therefore to the causes already alluded to, and not to any diminished interest in the Society or its work.

The losses by death were :—

Honorary Member :

Tyndall, Prof., D.C.L., LL.D., F.R.S., Elected 1884.

Ordinary Members :

Bayley, G. W. A., Elected 1878.
Bell, Walter F., M.I.C.E. *Irel.*, Elected 1892.
Fischer, C. F., M.D., M.R.C.S. *Eng.*, Elected 1874.
Henry, James, Elected 1877.
Leibius, Adolph, Ph. D., M.A., F.C.S., Elected 1859.
Mitchell, J. S., Elected 1887.
Redfearn, W., Elected 1886.
Saliniere, Rev. E. M., Elected 1876.
Wilson, F. A. A., Elected 1879.

Professor JOHN TYNDALL was seventy-three years of age when he passed away, and had been a teacher of physics for some forty-seven years. To him the word teacher was peculiarly fitted,

for it was as a lucid expositor, a brilliant lecturer, that he made his way to fame. To him is due much of that general interest in science which is a feature of our times.

Dr. LEIBIUS was a familiar figure in this hall, for during twelve years he did yeoman service as joint honorary secretary, in 1891 he filled the Presidential Chair, and at the time of his death was Honorary Treasurer. We have thus a continuous service of some fifteen years, and to him for his careful and assiduous work in its early days much of the present success of the Society is owing. At the time of his death he had been Senior Assayer at the Sydney Branch of the Royal Mint for thirty-four years, and this position together with his genial manner and the enthusiastic thoroughness with which Dr. Leibius set about everything he undertook, contributed to make him what he must ever remain to us—one of the founders of the Society. It was indeed a sad coincidence—was it merely a coincidence?—that took Dr. Leibius from us so soon after we had lost his respected chief, the Deputy Master, Mr. Robert Hunt, who also must be regarded as a founder of the Society. Dr. Leibius really never was himself after Mr. Hunt's death, so greatly did he feel the loss of one who was more friend than master. I cannot speak of the one without thinking of the other, and of both I have personally the most grateful recollections on account of the kindly relations maintained between us from my first days in the Colony to the last days of their lives. And I am not the only one here who can say the same.

Meetings.—There have been eight general meetings at which no less than thirty-six papers were read, by far the largest number ever read in a session, the nearest to it being the preceding year, when, however, only twenty-two papers were read. The average attendance of members was forty-two, and of visitors four. This likewise was a great increase, for the highest average of attendance before this year was in 1890, when the average was a little over thirty-six members and five visitors. Thus both in the number of papers read and persons present the past year has shown a considerable advance on any previous year.

In addition to the general meetings there have been three meetings of the Medical Section, and eight meetings of the Engineering Section, at which valuable contributions to their respective branches of knowledge have been made.

The library has been duly cared for at an expenditure in money of £138, and the Society has exchanged publications with no less than three hundred and ninety-five institutions, so that in this way as many as one thousand eight hundred and sixteen publications have been received and added to the library.

Original Research.—In continuation of the practice commenced in 1881, of publishing yearly a list of subjects more or less peculiar to Australia, the investigation of which would be of interest and value, the Council invited original contributions, and offered its medal together with a grant of £25 for the best original paper on the following subjects, viz. :

Series XII.—*To be sent in not later than 1st May, 1893.*

No. 40—Upon the Weapons, Utensils, and Manufactures of the Aborigines of Australia and Tasmania.

No. 41—On the Effect of the Australian Climate upon the Physical Development of the Australian-born Population.

No. 42—On the Injuries occasioned by Insect Pests upon Introduced Trees.

No papers however were received on any of these subjects.

Series XIII.—*To be sent in not later than 1st May, 1894.*

No. 43—On the Timbers of New South Wales, with special reference to their fitness for use in construction, manufactures, and other similar purposes.

No. 44—On the Raised Sea-beaches and Kitchen Middens on the Coast of New South Wales.

No. 45—On the Aboriginal Rock Carvings and Paintings in New South Wales.

Series XIV.—*To be sent in not later than 1st May, 1895.*

No. 46—On the Silver Ore Deposits of New South Wales.

No. 47—On the Physiological Action of the Poison of any Australian Snake, Spider, or Tick.

No. 48—On the Chemistry of the Australian Gums and Resins.

Series XV.—*To be sent in not later than 1st May, 1896.*

No. 49—On the origin of Multiple Hydatids in man.

No. 50—On the Occurrence of Precious Stones in New South Wales, with a description of the deposits in which they are found.

No. 51—On the effect of the Australian Climate on the Physical Development of the Australian-born Population.

The competitions are in no way confined to members of the Society, nor to residents in Australia, but are open to all without any restriction whatever, excepting that a prize will not be awarded to a member of the Council for the time being; neither will an award be made for a mere compilation, however meritorious in its way. The communication, to be successful, must be either wholly or in part the result of original observation or research on the part of the contributor. The Society is fully sensible that the money value of the prize will not repay an investigator for the expenditure of his time and labour, but it is hoped that the honour will be regarded as a sufficient inducement and reward. The successful papers will be published in the Society's annual volume. Fifty reprint copies will be furnished to the author free of expense. Competitors are requested to write upon foolscap paper—on one side only. A motto must be used instead of the writer's name, and each paper must be accompanied by a sealed envelope bearing the motto outside, and containing the writer's name and address inside. All communications are to be adressed to the Honorary Secretaries.

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