which is made of prime importance, diverts the mind from the observance and consideration of far larger questions. Yet notwithstanding the veil which has for a time been drawn before the eyes, there are already signs that the field of vision is extending. It is now many months ago that I read of a distinguished German professor using, as he tells us, extraordinary precautions: "that, on an operation morning, he gets up early, and washes himself all over; that his assistants wash themselves; and that the patient is also washed"; and although a famous Scotch surgeon, who relates the story, adds, "Surely all these washings are unnecessary", let us hope that, in interests besides those of surgery, the expectation, at least of an operation, may become of daily occurrence. We cannot, indeed, render the air absolutely or "optically" pure for the practice of surgery; but I think, under fairly favourable conditions, and with the means at our command, operations may be performed and wounds treated in an atmosphere not so impure but that, on the whole, the least risk is run by the practice I have ventured to advocate.

One word farther. I have spoken without reserve—as I take it I was bound to do if I spoke at all—of this now famous plan of treatment. By this I think I have shown the truest respect for the author of it. If I esteemed the practice of Professor Lister less, it would have been easy to offer him the homage of flattery, to congratulate him on his renown. It appears to me that I have evinced more regard for his authority, and placed a higher estimate on his work, by studying to the best of my ability the method he has introduced; by not expressing an opinion adverse to it in public, or from a position of responsibility such as this, until my conviction had grown clear and strong; and then I think I best mark my appreciation of his purpose by thus speaking out freely and fully. And though I am thus—not on principle, but in practice—opposed to him and many others whose ability and knowledge I admire and respect, I know very well that on a yet greater issue—the advance of surgery—we are heartily together; and, with unfeigned diffidence of my own judgment, I have yet farther consolation in the assurance that, if I am in error, these words of mine, even from this place, will prove no serious obstacle to the progress of truth.

Whatever defects may be charged against surgeons in the practice of their art, indisposition to accept new ideas, or lack of zeal in testing new proposals, cannot be reckoned among the number. And if in some the desire may appear to be excessive, it must be remembered that this is the natural outcome of discontent at the inadequacy of the resources they can at present command, and that such dissatisfaction is the parent of progress and improvement. A curious list, indeed, might be drawn up of the numerous novelties which from time to time have been introduced into surgery, and which, after attracting much attention, have been tried and found wanting. And if it so happen that this particular mode of dressing wounds should share their fate, still, like many others, it will have served some useful purpose; for it will at all events have helped largely to fix the attention of surgeons on a great source of danger from wounds. Nor is it perhaps likely to be superseded altogether by any plan of management which does not include among its chief objects the reduction of this risk to the utmost extent possible. Henceforth, no doubt, as the result of all the attention and discussion which have been given to this matter, the words cleanliness and purity will have a wider, deeper, fuller significance for the surgeon. Hospitals and all institutions where the practice of surgery is carried on will soon, let us trust, be no longer open to the shame of even a suspicion of their state. They must not only be made free from all doubt that in their wards mischief may be fostered; but they must offer year by year in their records the surest guarantee that they are the safest places for patients. At present, in the worst, antiseptics are the only means employed for counteracting this gigantic evil; and its proportions may, perhaps, in some degree, be measured by the lavish manner in which antiseptics are consumed. But, after all, they fulfil their purpose but imperfectly, and are themselves not free from evil. Is it rash to affirm that the future practice of surgery will be most successful when it is carried on, not where antiseptics are most largely used, but under conditions least in need of antiseptics? Nay, is not this so now?

The study of blood-poisoning, the attention which of late has been directed from all sides on this great subject must prove of advantage to surgery in another way. For some time past, and to the prejudice of our profession, a wall of partition between medicine and natural science has been gradually built up. Physicians and surgeons finding enough, and more than enough, to do in their own immediate work, have of late years passed by the study of natural science, even that branch of it which most immediately concerns them—physiology or biology—with hardly a glance. And the loss from this, which was formerly allowed to be considerable, comes now to be actually questioned in some quarters as a fact. Nay, those who have never made any effort to find opportunity for this pursuit are wont to assert boldly the uselessness of it, and speak of it plainly as waste of time. The study of blood-poisoning in its pre-

sent form has effected for us in our profession this great good. It has led us back into paths which have been too long untrodden, and forced upon many of us, in a most attractive way, some little knowledge at least of the first principles and leading facts of biology. It has, at all events, in great measure imposed silence on those who have been accustomed to talk loudly of what they call practical work, and to meet every inquiry not likely to pay with the vulgar version of *cui bono*? And while, on the one hand, we have been thus forcibly reminded that surgery can never, without degradation, be divorced from physiology; on the other, this fertile field has proved to be common ground on which natural philosophers and surgeons may with mutual advantage, and in furtherance of the same immediate result, work together. It is true enough that no progress of any kind can be made in natural science without advantages in which medicine and surgery must always largely share; but still it is something just now to have a subject like the present one, in which the truth is made so plain upon the tables that he may run that readeth.

And it may be remarked that surgery, while it works in this direction, fulfils its highest purpose, for it aims at the prevention of disease. Heretofore our art has not escaped the reproach that, whatever it may have effected in the way of relief or cure, it has done little or nothing in the work of prevention. But what shall be said of the progress which has been made in averting the occurrence of blood-poisoning; in preventing the most fatal of all affections, which waits alike upon accidental wounds and the surgeon's own work? In accomplishing so much, it has not only thrown light over one of the darkest regions of pathology, but also, by reflection, on the laws which govern health and life.

ADDRESS ON PUBLIC MEDICINE,

BY

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PREVENTATIVE OR STATE MEDICINE.

WITHOUT wasting your time in apology or preface, allow me to introduce State Medicine, past, present, and future, dwelling specially on the two first as the subject of my remarks at this time. Up till a comparatively recent date, the public mind, both professional and lay, seemed thoroughly impressed with the idea that the whole function of medical men began and ended with the treatment, and if possible the cure, of the sick. This led to a twofold evil; it first produced too strong a belief in drugs, and tended to make the profession degenerate into a mere trade, the success of which greatly depended on the quantity of drugs the unfortunate patient could be got to swallow. The second evil was the neglect which it occasioned of all preventative medicine. It is gradually dawning on the present age that medical science can possibly do a little more; and that, in addition to the treatment of disease, something may be done towards its prevention. Hence we have what is supposed to be a new department of medical science; namely, preventative or State medicine. I use the word "supposed" advisedly, because I hold that State medicine as a very important branch of the medical profession is not new, but reaches back into times of the most remote antiquity, and was then probably better understood and more thoroughly carried out than any other branch of the healing art. If you will turn to the thirteenth chapter of Leviticus, you will there find a medical officer of health endowed with absolute authority to separate the sick from the healthy, and also to isolate infected persons so completely as to prevent the disease from spreading further. Due provision is made that the isolated patient be inspected from time to time, so that, in case of recovery, or of the disease assuming a non-infective type, he might be set at liberty. No doubt, science has made great progress since the time of the Mosaic dispensation; but if we are ever to get quit of zymotic diseases, it will be by adopting the laws of Moses in regard to them—rigorously separating the sick from the healthy. Let us hope the time is not far distant when every medical officer shall be endowed with the same stringent powers as were possessed in the time of Moses, who, we must not forget, in what he did for Israel, acted directly under the Divine authority and guidance, as well as being learned in all the learning of the Egyptians, at that time the most cultivated race in the world.

No doubt, under the general term leprosy, many diseases would be included; possibly all affecting the skin might be so; and hence the humane provision that, after a time of probation and repeated inspection, some were restored to society. It is foreign to my subject to enlarge on this topic—interesting though it is—or to try to trace out the various diseases, such as cancer, leprosy, elephantiasis, etc., which are described in Leviticus. I shall confine myself to the evidence we have in favour of the antiquity of State Medicine, and that the most learned body in the community acted as medical officers of health. It is quite evident that different diseases were dealt with. In verses second and third of the chapter above referred to, leprosy or some other infectious disease is indicated. Verse fourth describes a doubtful disease, or at least one without all the symptoms of leprosy; and accordingly the medical officer shuts the patient up for seven days. At the end of that time, he is again inspected, and rules are given whereby he may be set free if it be safe to do so. But if, on the other hand, the disease should be found to have spread, he is pronounced “utterly unclean”; and his complete isolation is strictly enjoined in verses 44 and 45, and succeeding verses: “Without the camp shall his habitation be.” We do not hear of leprosy till after the exodus from Egypt, and some have supposed that the prevalence of this disease was the cause of the expulsion. Everywhere in Jewish history the leper was considered ceremonially unclean; he was isolated from all intercourse with his fellow men, and he was punished with eighty stripes if he approached the mountain of the temple. The law for the leper was: “His clothes shall be rent, and his head bare; and he shall put a covering upon his upper lip, and shall cry, Unclean, unclean.” (*Leviticus*, xiii, 45.)

Various speculations have been indulged in as to what is meant by the plague of leprosy in garments; and it has been supposed by some to be simply their being saturated by the discharge from the open sores of persons diseased with leprosy. An attentive perusal of the whole passage, however (verses 47 to 59), shows that it must have been something which spread into and destroyed the garment, which could not have been done by any known discharge from a sore. But whatever it may have been, the orders in regard to it were equally stringent. After milder means to check its progress have failed, the medical officer uses the most powerful disinfectant we possess, viz., fire. The edict goes forth, “It shall be burned in the fire”. “Thou shalt burn that wherein the plague is with fire.”

It is still more difficult to understand what could constitute leprosy in a house. Some have imagined it to have been merely the emanations from the sick, and think the cleansing much of the same nature as the repapering of a room in modern times after infectious disease; but the passage does not favour such an interpretation, and even the “dry rot” of our own day fails to explain it, as the leprosy was in the plaster and stones of the infected house. We should incline to believe that some sort of fungous growth was indicated; but whatever uncertainty may remain as to the nature of the outbreak, there is none as to the steps to be taken immediately in regard to it. The house was to be emptied and given in charge of the sanitary inspector, and by him shut up for seven days. At the end of that time, if the appearance had spread, he commanded that they take away the stones in which the plague was, and cast them into an unclean place without the city. Fresh stones and mortar were then supplied, and the house was again shut up; if the leprosy appeared again, it was to be destroyed utterly, and the materials removed to an unclean place without the city.

It was not among the Jews merely that lepers were thus treated. In the middle ages, in other countries, they were obliged to live apart from the general community, and if they went abroad they had to intimate their presence in various ways; sometimes by rent clothes and a cry of “Unclean, unclean”; sometimes by using clappers to signify their approach, or as in some countries by wearing two bands of white wool (no doubt thus symbolising the nature of their disease), one on the head and the other on the breast. So anxious were communities to carry out preventative medicine in the most complete manner, and avoid all possibility of contagion, that the lepers were interred in separate burying-places. Strange to say, sufferers from this disease became dead, in the eye of the law, as soon as the disease was fully developed; they could not hold property, nor inherit it, nor dispose of it; in short, they lost all rights of citizenship. Not content with this, in the middle ages, the church went through the ceremonial of a leper's funeral by a special service, which was retained in the French ritual till a comparatively recent date. The priest, wearing his stole, and holding up the crucifix, sprinkled the leper with holy water, and conducted him to church, singing the usual burial verses as they went along. In the church, his clothes were removed, a funeral pall thrown over him, and the mass was celebrated, with the full service for the burial of the dead. He was again sprinkled with holy water, clothed in a leper's dress, and conveyed to a leper hospital, where the priest, to typify his burial,

sprinkled him with earth, and warned him never to appear otherwise than barefooted and wearing his black garment, never to enter a church or any place where corn was ground or bread baked, never even to approach a well or fountain.

It has been supposed that leprosy in Europe was spread by the return of the Crusaders; but there is not sufficient evidence of this, though no doubt it overran Europe about that time, and invaded even the most northern countries; and we can form some idea of its prevalence when we are told that in the thirteenth century there were upwards of two thousand leper hospitals in France. When the first hospital was founded in Scotland I cannot tell; but at Prestwich there was one, which if not founded by King Robert the Bruce, was at least amply endowed by him. It is still a matter of dispute whether or not the king himself was a leper. In the year 1350, we learn that the Lady of Lochow built a leper house at the Gorbals of Glasgow; but some hospitals were founded much earlier, even more than two hundred years before the Glasgow institution. Of course, these hospitals were not like modern hospitals, numbering their inmates by hundreds; but still so general was this disease in the kingdom, and so much was the necessity of isolation considered a duty and a safeguard to the community, that there were about one hundred leper hospitals in England and Scotland, which were under strict regulations, while the most stringent rules were also enacted to prevent the sick from mixing with the well. In some, under certain precautions, the inmates, on particular days, were allowed to leave, to buy provisions; while, in others, they were punishable by death if they left the hospital; and to emphasise this regulation a gallows was erected in front of the leper house. With regard to the Glasgow house, in the burgh records for 1573, we find that the then magistrates ordered four persons supposed to be lepers “to be viseit, and gif they be found so, to be secludit of the town in the Hospital at the Brigend”.

In the Parliament held at Perth in 1427, the following is a clause from an Act then passed: “Item that na lipper folke sit to thig (beg) neither in kirk nor kirk-zaird nor other places within the burrowes, but at their own hospital, and at the port of the towne, and other places outwith the Burrowes.” The Act afterwards tells us who were then the sanitary inspectors. The third clause is as follows: “That the Bishoppes, officialles, and deanes inquire diligentlie in their visitation of ilk Paroch Kirk gif one be smitted with lipper, and gif any sic (such) be found in that they be delivered to the King if they be Seculares, and gif they be Clerkes to their Bishoppes, and that the burgeses qu keepie this statute under the paine intimit in the statute of Beggars..... and quhat leprous that keepis not this statute, that he be banished for ever off that Burgh quhair he disobeyis and in likewise to landwart.” After the Reformation, the kirk sessions took upon themselves the duty of looking after lepers. Of their dealings with them, records may be found in their minutes of meetings.

Some of the hospitals had ample endowments; but most of them had but scanty permanent support, and derived a precarious income from alms, which were sometimes deposited by passers-by, they being invited to do so by one or other of the inmates soliciting them by loud cries. Occasionally, the lepers were allowed to beg in person (with this protection to the public, that they were obliged to use a clapper to warn people to keep from contact with their person). Another curious source of support was from confiscated food. The Scotch Parliament in 1366 enacted: “Gif ony man brings to the markit corrupt swine or salmond to be sauld, they sall be taken by the baillies, and incontinent without any question, sall be sent to the leper folke, and gif there be no leper folke, they sall be destroyed alluterlie.” This shows also that there were inspectors of food in those days.

The regulations for the separation of the plague-stricken were quite as complete and stringent. The sick and their families were obliged to remove out of town. Their friends, under the charge of an officer, could visit them after eleven o'clock, and anyone going before that hour was liable to death. The houses were cleaned, and the clothing of the infected was boiled in the open air. The parties who discharged those duties, and those who were employed as bearers of the dead, were obliged to wear a grey gown, with a white St. Andrew's cross before and behind; the bier was covered with a black cloth with a white St. Andrew's cross. A bell was also attached to it, so that it might ring as it passed along, to warn any person to get out of its way. In September 1584, the authorities of Aberdeen built ports to prevent the entrance of people who might bring the infection. This does not appear to have been successful, for we find that in May next year the magistrates erected gibbets, “ane at the nearest cross, ane other at the brig of Dee, and the third at the haven mouth, that in case any infectit person arrive or repair by sea or land to this burgh, or in case any indweller of this burgh receive, house, or harbour, or give meat or drink to the infectit person or persons, the man to be hangit, and the woman to be drownit”. As recently as 1645, two lads who had received change at a public-house

which was shut up on account of the plague, were next day separated from the family and shut up for a fortnight, their food, etc., being handed in to them. The pocket with the change was cast into the fire. There are many other curious regulations to be found both in Imperial and Burgh laws. I have merely cited the foregoing to show the antiquity of preventative medicine.

Having seen how strict and severe, we might almost say how brutal, were the laws of early times, it becomes an interesting question how all regulations as to preventative measures were allowed to lapse, and not applied to other diseases, such as small-pox, the most obvious as well as the most repelling of our zymotics. It has been imagined that the Reformation might have had some influence on this, but there is no evidence of its being so, and we have already seen that in Scotland the kirk sessions took charge of the leper hospitals. In the minutes of the Kirk Session of Walls in Shetland, there is a record, under date March 17th, 1742, of a resolution to hold a day of thanksgiving for the extinction of leprosy, and the last mention of leprosy in the same session books is in 1776, where there is an order to separate a leper, and to provide food, which was to be brought daily. It may possibly have been the growth of civil liberty which rendered people impatient of any interference with their domestic concerns, while another reason may be that some zymotics have no outward visible eruption, while in others it is so slight as not to be recognised by the public at large.

It is still difficult to get some people to believe that like produces like, not merely in ordinary organic life, but also in the region of epidemic disease. Formerly these diseases were attributed to the direct will of the Almighty, the appearance of comets or other physical phenomena, the conjunction of certain planets, or some other astrologer's nonsense. Possibly also, as regards some zymotics, they had taken such hold of the community before they were publicly recognised, that it was in vain to attempt to stop their progress. We need not inquire further into the reason why, but simply accept the fact obvious to all, that till quite recent times no attempt has been made to stay the progress of modern zymotics or improve the health of the community.

This brings us to the consideration of the results that have been achieved by the labours of the sanitarian, and to do this in the most impartial and fullest manner possible I proceed to analyse the whole of the Registrar-General's returns. In No. 8, page 38 of Mr. Simon's Reports to the Privy Council, there is a table of all the deaths up to that date. I have brought the table down to the present time, and have somewhat changed it, for, while the original is merely a table of gross results, I have made a table of the proportion of deaths in each million of the population at the respective dates, and also given the population for each year. I also endeavour to bring some of the results before you in the form of diagrams.

TABLE showing the Number of Deaths per Annum in England and Wales, from certain Zymotic Diseases separately, and from other Causes taken together, for each Million of Living Population—1838-71.

Year.	Population.	Dths. per Annum for each Million of Living Populatio.									
		Croup.	Diphtheria.	Dysentery, Diarrhoea, and Cholera.	Scarlatina.	Fevers.	Measles.	Whooping-cough.	Small-pox.	Total from these Causes.	Total from other Causes.
1838.....	15,287,699	292	..	225	380	1228	426	596	664	3919	18,502,22,421
1839.....	15,514,255	270	..	225	605	1010	705	526	589	3720	18,130,21,850
1840.....	15,730,813	270	..	305	1260	1092	593	390	663	4303	18,562,22,865
1841.....	15,929,492	238	..	264	889	932	433	508	400	3426	18,160,21,586
1842.....	16,130,326	249	..	472	794	1004	542	502	168	3482	18,186,21,668
1847.....	17,150,018	194	..	911	857	1807	507	540	246	4868	19,814,24,682
1848.....	17,356,882	217	..	899	1181	1270	396	395	398	4539	18,497,23,036
1849.....	17,504,656	230	..	1422	746	1045	311	547	265	7136	17,962,25,098
1850.....	17,773,324	243	..	810	752	865	398	437	263	3525	17,236,20,761
1851.....	17,982,849	232	2	1004	756	997	521	440	389	4109	17,879,21,988
1852.....	18,193,206	223	4	1196	1034	1025	321	441	402	4423	17,955,22,378
1853.....	18,404,368	199	2	1114	851	1008	266	609	171	4021	18,859,22,880
1854.....	18,616,310	215	11	1226	984	1015	498	525	151	5445	18,078,21,523
1855.....	18,829,000	235	10	799	910	875	390	541	134	3659	18,950,22,609
1856.....	19,042,412	273	12	836	732	850	374	484	119	3407	17,100,20,507
1857.....	19,256,516	274	16	1248	723	988	310	526	204	4015	17,786,21,801
1858.....	19,471,291	319	248	822	1309	918	476	598	332	4703	18,390,23,093
1859.....	19,686,701	286	487	1046	1011	807	485	456	195	4487	17,903,22,390
1860.....	19,902,713	221	262	562	486	654	480	430	138	3012	18,227,21,239
1861.....	20,119,314	218	225	1044	451	767	450	612	66	3615	18,012,21,627
1862.....	20,352,140	278	241	622	729	920	482	603	80	3677	17,774,21,451
1863.....	20,590,356	338	316	816	1480	875	551	548	290	4887	18,137,23,013
1864.....	20,834,496	325	262	881	1426	965	400	411	369	4714	19,072,23,784
1865.....	21,085,139	281	197	1228	839	1092	406	410	304	4476	18,866,23,460
1866.....	21,342,864	242	141	11529	547	939	513	739	142	4600	18,866,23,460
1867.....	21,608,286	203	120	1006	569	781	305	550	116	3447	18,354,21,801
1868.....	21,882,059	205	138	1482	1001	900	531	422	94	4568	17,396,21,964
1869.....	22,164,847	202	118	969	1247	829	465	495	71	4194	18,131,22,325
1870.....	22,457,366	191	120	1211	1449	798	336	530	116	4560	18,387,22,947
1871.....	22,712,266	181	111	1136	818	695	409	456	101	4643	18,026,22,669
1872.....	23,057,835	158	93	1033	517	611	369	598	827	4048	17,291,21,339
1873.....	23,356,414	183	108	995	563	583	317	412	91	3079	18,008,21,087
1874.....	23,653,959	212	151	951	1054	584	518	438	91	3787	18,477,22,264
1875.....	23,944,459	190	143	1056	855	548	258	596	49	3496	19,326,22,822
1876.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1877.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1878.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1879.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1880.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1881.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1882.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1883.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1884.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1885.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1886.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1887.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1888.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1889.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1890.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1891.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1892.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1893.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1894.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1895.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1896.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1897.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1898.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1899.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131
1900.....	24,150,571	174	130	953	699	447	412	437	100	3178	17,953,21,131

* Details for 1843, 1844, 1845, and 1846, not in Registrar-General's returns.

† Including an epidemic of Asiatic cholera, general in 1849 and 1854, partial in 1866.

TABLE II.—Deaths from Fevers, 1869-76, per Million of Population.

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
Typhus.....	193	146	121	81	70	75	63	49
Typhoid.....	390	387	371	379	376	375	372	311
Simple continued...	245	261	201	149	134	132	110	83

For reasons which will be stated hereafter, I have added a separate column for croup, and to save tedious details, I have placed at the bottom of the table the average for each five years, and for facility of reference have numbered these first, second, etc., quinquennium.

I shall not trouble you with observations on each year, but shall rather dwell on some leading features which are represented in the diagrams. You will observe that there is not a single death from

diphtheria registered till 1851, when we find two deaths per million of the population. It did not spread rapidly, for in 1857 there are only sixteen deaths in the same. It then rises very suddenly, and reaches its maximum in 1859, when there were as many as four hundred and

eighty-seven deaths per million of the population. Since then, it has fluctuated greatly, but has only once been under one hundred deaths *per annum* for every million of the population. I have no doubt it will occur to many of you, possibly to most of our younger members, that, although there were no cases of diphtheria registered before 1851, still deaths from it did occur previously to that, but were registered by some other name.*

The disease most likely to be confounded with diphtheria is, of course, *croup*. If, before the appearance of diphtheria as a cause of death in the returns, it had helped to swell the number of the deaths from croup, then, as soon as it became a considerable figure in the Registrar's returns, there should have been a fall in the croup column. To ascertain whether this was the case, I procured a table of the deaths from that disease, and now show you in a diagram all the deaths both from croup and diphtheria. We generally find that when the death-rate from diphtheria is high, the death-rate from croup is high also; and I think it is not unfair to conclude that many of these last were in reality deaths from diphtheria.

I now crave your attention to the *diarrhoeal* group, the table in regard to which brings out singular results. Beginning with the small number of 225 deaths per million in 1838, we find that they amount to 472 in the last year (viz., 1842) of the first quinquennium. It would be tedious to go over the table year by year; you will see the progress of these diseases in the diagram, and you must bear in mind that the years 1849, 1854, and 1866 are exceptional, each of them having been marked by an outbreak of cholera. I ask you to compare the first five years with the two last completed periods of like duration. You will find that the average for the first five years, viz., 1838-1842 was 298; for the five years 1867-1871, it was 1,161; and for the last completed five years 1872-1876, 998. In none of these periods was there the disturbing element of epidemic cholera. It is not a little surprising to find that in the second last period there were nearly four times as many deaths from this group as in the first period, and that even in the last quinquennium there were more than three times as many deaths from the diarrhoeal group as in the first period of five years.

If we consider the other zymotics mentioned in the table, we shall in some of them be able to trace the benefits resulting from the labours of the sanitarian. First comes small-pox, the deaths from which vary from a maximum of 1,064 per million of the population in the first year, viz., 1838, to a minimum of 40 in 1875. If we look to the quinquennium, we find that the fourth is the lowest, 1857-61, with 187, and the first is the highest, viz., 577, while in the last quinquennium the deaths are 232. It is to be hoped that, as vaccination and revaccination are more stringently carried out, there will be a great diminution in the deaths from this disease. It is most desirable that the prejudices against vaccination should be removed, and possibly this might be greatly helped by the use of animal instead of human vaccine.

highest, viz., 1,053 and 1,197 respectively, while the last is by far the lowest, viz., 555, and there can be no doubt that this great improvement is owing to what sanitarians have effected.

Better house-accommodation and the supervision of medical officers of health have tended in a most marked manner to diminish typhus, which prevailed during the first two periods. This is made plain when we look to the relative prevalence of fevers, since in 1869 they were divided into three groups. We find that typhus falls from a death-rate of 193 that year to 49 in the last year, viz., 1876.

Typhoid does not show so well, but the maximum is still in the first year, and the minimum in the last; the numbers for each individual year being 1869, 390; 1870, 387; 1871, 371; 1872, 379; 1873, 376; 1874, 375; 1875, 372; and 1876, 311.

Simple continued fever gives almost as favourable results as typhus, the maximum in 1869 being 245, and the minimum in 1876 being 83. Allow me to direct your attention to the totals of the zymotics mentioned in the table, which you will find lowest in the first and last quinquenniums. If, again, you look to the total deaths per million of the population, you will observe that the last quinquennium is the lowest, viz., 21.729; the fourth is next, viz., 22.030; and next to it the first, viz., 22.078.

One other fact is brought out by the study of these returns, viz., how very little change has taken place in the death-rates during all these years. This fact has been noticed by actuaries, and Mr. A. H. Bailey, one of the Vice-Presidents of the Institute of Actuaries, thus writes: "Mortality.—In discussing this well-worn theme, the first feeling must be one of disappointment. An impression prevails, among medical men especially, that the duration of life is extending, and that it will be yet further advanced by sanitary improvements. Is there any evidence of this? There has now been a systematic registration of deaths in this country for forty years, and censuses have been periodically taken. During these forty years, large sums of money have been expended in sanitary improvements, and what has been the effect on the mortality of the population? Discarding individual years, in which there had been fluctuations in both directions from various causes, it happens curiously enough that in each of the three decennial periods 1841-50, 1851-60, and 1861-70, the rate of mortality has been identical, namely, 22.35 per 1,000" (*Journal of the Institute of Actuaries*, July 1878, vol. xxi, p. 120).

We now turn our attention to the future of State Medicine, and would observe that the standard to be aimed at should be both practical and attainable. I have been in the habit of saying that we should never rest contented till our towns are as healthy as rural districts. The healthiest district over a series of years is Glendale in the north of Northumberland, in which the death-rate is but 15; and if we had this death-rate all over the kingdom the result would be a diminution of nearly one-third of all the deaths. In the pursuit of this aim, let us inquire whether we can draw any lessons from the Registrar-General's returns.

The first facts that strike us are the increase in the diarrhoeal group, the addition of a new zymotic, viz., diphtheria, which does not appear till 1851,* and the small diminution of typhoid in the fever group.

If we bear in mind that these are excremental pollution diseases, I believe we shall find the reason of this increase in the fact that we have been careless in the disposal of our excreta, and have been drinking water and breathing air contaminated by it in a state of decomposition.†

When I first turned my attention to public health, I had the most

* In regard to this, Mr. Simon asks "Why diphtheria, which scarcely had had a place in history till it overran Europe in the sixteenth century, and which since then had but rarely been spoken of, has for the last ten years been an important disease in England?" (Eighth Report, page 37, year 1865.)

† I wish to quote a single paragraph from Mr. Simon's second report to the Privy Council, page 64, in which he confirms Dr. Greenhow's report, and says: "And in this respect one paragraph from the following paper—a paragraph which expresses the most definite result of Dr. Greenhow's observations in all the diarrhoeal districts, and which accords with all the best experience previously obtained in other like investigations—deserves to be well remembered. 'The excess of mortality has in all places been coincident with one or other of two definite local circumstances—(a) the tainting of the atmosphere with the products of organic decomposition, especially of human excrement; or (b) the habitual drinking of impure water.'"

Scarlet Fever.—The deaths from this disease vary considerably in the individual years, but not to such an extent if we look to the averages for five years. It is very satisfactory to observe that the last quinquennium has the lowest mortality, viz., 738 in the million of population.

Measles.—The highest mortality from this disease occurs in the first quinquennium, and is 540; the lowest, viz., 370, is in the third; and in the last the number is very little higher, being 375.

Whooping-cough varies less than any of the other zymotics, the maximum death-rate being 542 in the fifth quinquennium, and the minimum 472 in the second.

Fevers vary greatly; the first and second quinquenniums are the

* I may be excused if I notice shortly my first introduction to diphtheria. I had heard of it under the name of the Boulogne sore-throat, and had a vivid impression of the sensation occasioned by the death of Gilbert à Beckett, a London police magistrate, from diphtheria; but it was not till after twelve years' experience as a practitioner that I saw my first case. In November 1857, in visiting one of the then largest houses in Glasgow (which is now the Hall of the Faculty of Physicians and Surgeons), after seeing my patient, the lady of the house asked me to see her little boy, telling me at the same time that there was not much the matter. A bright little fellow of seven trotted into the room, who certainly did not appear to be ill. By the peculiarity of his cough, however, I was led to look into his throat, and there saw what I had never seen before, and what none of us ever see now without grave anxiety as to the result.

perfect faith in water carriage for the removal of the refuse of communities, but investigation, experiment, and experience have obliged me to change my opinion.

My first investigations referred to decayed soil-pipes, and from observation and analysis I was led to conclude that the decay was produced by gas. I shall not enter into detail on this subject, but merely mention one point of practical importance, that pipes open at the top to the external air last longer than those which are closed.* (Figures 1, 2, 3, and 4 represent specimens of decayed soil-pipes.)

Fig. 1.—Pipe removed from a house where there was typhoid. Two months before, it was taken out, the watercloset had been renewed, but the plumber had failed to detect the state of this pipe.

Fig. 2.—Soil-pipe laid open, in which, so numerous were the perforations that very little of the lead required to be cut. The sides *a, a, a, a*, are irregular owing to these perforations, and they may also be seen over the whitish part. The spaces between *a a* and *d d* are the parts of the soil-pipe covered with the whitish deposit spoken of in the paper. The part within the *b*'s is the lower segment of the pipe over which the sewage flowed. It is quite sound—not in the least decayed or worn.

Fig. 5.

* For full details, see the *Social Science Transactions*, 1874, and *Edinburgh Medical Journal*, February, 1874.

It was many years after my conviction that the pipes were destroyed by gas before I could satisfactorily explain how it got into them. I knew that there is always decomposition going on in most traps, but the quantity of gas generated there did not appear to me sufficient to

Fig. 3.—Pipe from Edinburgh. The solder has not decayed.

Fig. 4.—Main descending soil-pipe, showing the perforations.

account for this action on all lead pipes that had been long enough in use. Tension in sewers occasionally overcoming the traps, being only an accident, could not be an important factor in a constant result. After much consideration, I was helped to a solution of my difficulty by Graham's experiments on the diffusion of gases. I argued that if these diffuse so readily through gases, they might probably do the same through water; and thus, after first being absorbed on the sewer side of the trap, they might be discharged on the house side of the same. I experimented on the subject as follows. A bent tube such as the annexed (Fig. 5) was used—*a* representing house side of trap or soil-pipe; *b*, sewer side of same pipe; *c, c, c, c*, level of water in trap; *d*, small vessel or test-tube, from which the gas was evolved; *e*, position of the test employed; *f*, position of tube subsequently added to ventilate the trap.

In the first experiment, a small glass tube was placed at *d*, containing solution of ammonia; in fifteen minutes, it passed up the tube, through the water, and discharged the acid, with which litmus paper had been reddened, suspended at *e*. In another experiment, instead of litmus paper at *e*, a small test-tube containing a little Nessler solution was introduced; in half an hour, the reaction of ammonia was very distinctly visible. The tube was left suspended by metal wire all night, and in the morning the wire was eaten through, and the test-tube had fallen to

the bottom. An objection was taken to these experiments, because ammonia is lighter than air, and has a strong affinity for water. Other gases heavier than air were then tried; the results were much the same, as will be seen from the table now given.

Gas.	Sp. Gr.	Source.	Test.	Time for Reaction to show.
Ammonia	.50	Solution.	Litmus.	15 minutes.
"	.50		Nessler.	30 minutes. Ate through a small wire in less than 24 hours.
Sulphurous acid	2.25	"	Litmus.	1 hour.
Sulphuretted hydrogen.	1.25		Lead paper.	3 to 4 hours.
Chlorine	2.50		Iodide of starch paper.	4 hours.
"	2.50	"	Litmus water in trap.	Began to show in a few minutes. In half-an-hour the whole was bleached.
Carbonic acid	1.50		Lime water in trap.	1½ hours.
"	1.50		Litmus suspended at 2.	3 hours.

Against these experiments, it was urged that the result would be different if the trap were ventilated. To meet this objection, they were repeated with the trap somewhat modified by the introduction of a ventilating pipe, which is represented by the dotted lines in the figure. The results were much the same, except that the reaction was a little longer in showing itself. Mr. M'Tear, F.C.S., repeated these experiments with larger tubes, with similar results. He found that the gases passed in a peculiar mode through the water; he says: "A curious fact, and yet one quite to be expected, is here shown, viz., that light gases pass through by the top of the bends, and heavy gases at the bottom; also, that the gas does not saturate the water in the trap by any means, but that it first saturates the surface next the vapour, then the gas seems to sink down in a fine stream, and gradually travels through the liquid to the other side, when it again spreads out and begins to diffuse both into the atmosphere above it, and downwards through the water in the trap; in fact, the most apt illustration of the general appearance is the gradual dispersion of a so-called smoke ring from the funnel of a locomotive."

Another point I had to consider was the behaviour, if we may so term it, of water and excretal matter. If the kidney and bowel secretions are kept separate, decomposition goes on very slowly; if they are mixed, it is more rapid, and if water be added it is much accelerated. It is a popular opinion that water is a purifier, but in regard to these matters it is a mere shunter. It merely removes the nuisance from my door to deposit it somewhere else; it conveys organic refuse, but does not destroy it; it merely carries the nuisance from the city to make it a source of pollution in the river. Chemical science tells us that water of itself and by itself has no purifying power; if you could shut up pure water and pure filth (if we may use such a term), they would remain the same for all time, the only purifying element in the water being the small modicum of air dissolved in it. In a shallow brawling stream, this exercises a considerable power, as the water is constantly being re-aerated, but very slight in a deep sluggish stream, and hence the ready pollution of our rivers by organic refuse. I hope I shall not be misunderstood and considered as in any way defending the abounding abominations of the old privy system, when I say that the change to water-carriage was adopted without sufficient investigation, and with no adequate conception of the results which would follow. The system was hailed as a great boon both to comfort and decency, and it was at that time supposed that if these offensive matters were once out of sight there was an end of them, and no evil consequences were dreaded.

But another most cogent reason against passing these offensive matters into our rivers or the sea, is the consideration that such a course is directly opposed to the laws of Nature, in the economy of which there is no such thing as waste. Earth is the original mother of all organised matter, and her law of rotation seems to be first plants, from which animals draw their support. What is given off from animals should be restored to the earth again. We know that the carbonic acid so freely given off by animals is at once utilised for the growth of plants; but I believe if it had been left to our own disposal, the whole world would have been asphyxiated long ago. The other excretions of animals are equally necessary for the growth of the vegetable world. After years of further study and investigation, I can only adhere to my opinion expressed many years ago, that "if it is true that organic poisons producing disease may pass from sewage; if it is true that cholera, diphtheria, typhoid fever, and diarrhoea are traceable to taking into our systems by air or water the results of decomposition of human excreta; if it is

true that these diseases, and others from the same causes, swell our death-rate and carry off some of the most valuable of our population, then, gentlemen, I affirm that the only true sanitary solution of our difficulties is, that all excreta shall either be returned to the earth or subjected to chemical action, rendering decomposition impossible: and I am furthermore sure that if a tithe of the time, skill, and ingenuity, and one-thousandth part of the money that have been devoted to water-carriage had been spent in investigations in this direction, the problem of the sewage question would have been solved long ago".

There is not time to go into details on other matters which have an important bearing on the future health of the community; I must, therefore, content myself with a bare enumeration of some of them. The most important is the appointment of a minister of health, who ought to be non-political—i.e. not removable with each change of government. Next in importance is the registration of disease, especially of all contagious diseases. This would be followed by the separation of the sick from the well, and the surveillance of the latter for a longer or shorter period, according to the nature of the case. Another point which I am inclined to consider as of almost equal importance with the two foregoing is, that the medical officers of health should devote the whole of their time to the duties of their office, and have no entanglement of private practice. A number of minor provisions must be made, amongst which may be mentioned proper inspection of food, dairies, shops in which food is sold, separation of them from dwellings, supervision of all places in which people are congregated, whether for work, education, or domestic life. In a word, we must not rest till our whole population have restored to them the birthright of our common humanity—viz., pure air, pure water, and sunlight free from smoke and noxious vapours. These may not all be attainable at once; but I am confident, from what I know of the noble band of men engaged in the different branches of public health, that there will soon be a considerable amelioration in the condition of the people. Our own profession has never been behindhand in unselfish labour and in personal sacrifice for the good of our fellow-men, and we can proudly look back and acknowledge that we inherit this, with other equally priceless gifts, from the great founder of our art, who, when ambassadors were sent with the most lavish offers to tempt him to the Persian court, answered:

"Go tell your Sire, the Persian King,
That dazzling proffers here you vainly bring.
What are the pride and pomp of state,
Pages around and slaves within the gate,
To him who bends the weary knee
Before the shrine of meek philosophy,
And strives to fill up life's contracted span
With kindest offices to fellow-man?"

AN ADDRESS

DELIVERED AT THE OPENING OF

THE SECTION OF MEDICINE,

*At the Annual Meeting of the British Medical Association,
in Cork, August 1879.*

By ANDREW CLARK, M.D., F.R.C.P.,

Physician to the London Hospital; President of the Section.

MEDICAL EDUCATION—PRESENT STATE OF THERAPEUTICS—PROSPECTS OF EXPERIMENTAL INQUIRY.

It has been the practice of the previous occupants of this chair to open the proceedings of the Section by a general address. Usage has transfigured this practice into a rule, and now with very limited time at our disposal and important subjects pressing for discussion and promising in manifold ways to repay it, I am constrained by the forces of custom and expectation to make sacrifice of some precious time at the shrine of this Procrustean tyranny.

When I examine the addresses of my predecessors, I find them occupied in setting forth the dignity of medicine, the greatness of her achievements, her increasing services to mankind, the spirit in which she is to be cultivated, and the self-sacrifice demanded of her cultivators. They are all stately hymns of praise. There is not in one of them a hint of imperfection or a thought of wrong. What completion, what perfection, what greatness has this medicine! How good a thing it is to be numbered, however humbly, in her ranks! There we can rejoice in the thoughts of the furthering of knowledge and in the doing of good. There our satisfactions need have no check from doubts, from reproaches, or from fears. There is our Utopia. Come let us extol and give thanks.

And who, understanding the difficulties, the responsibilities, and the