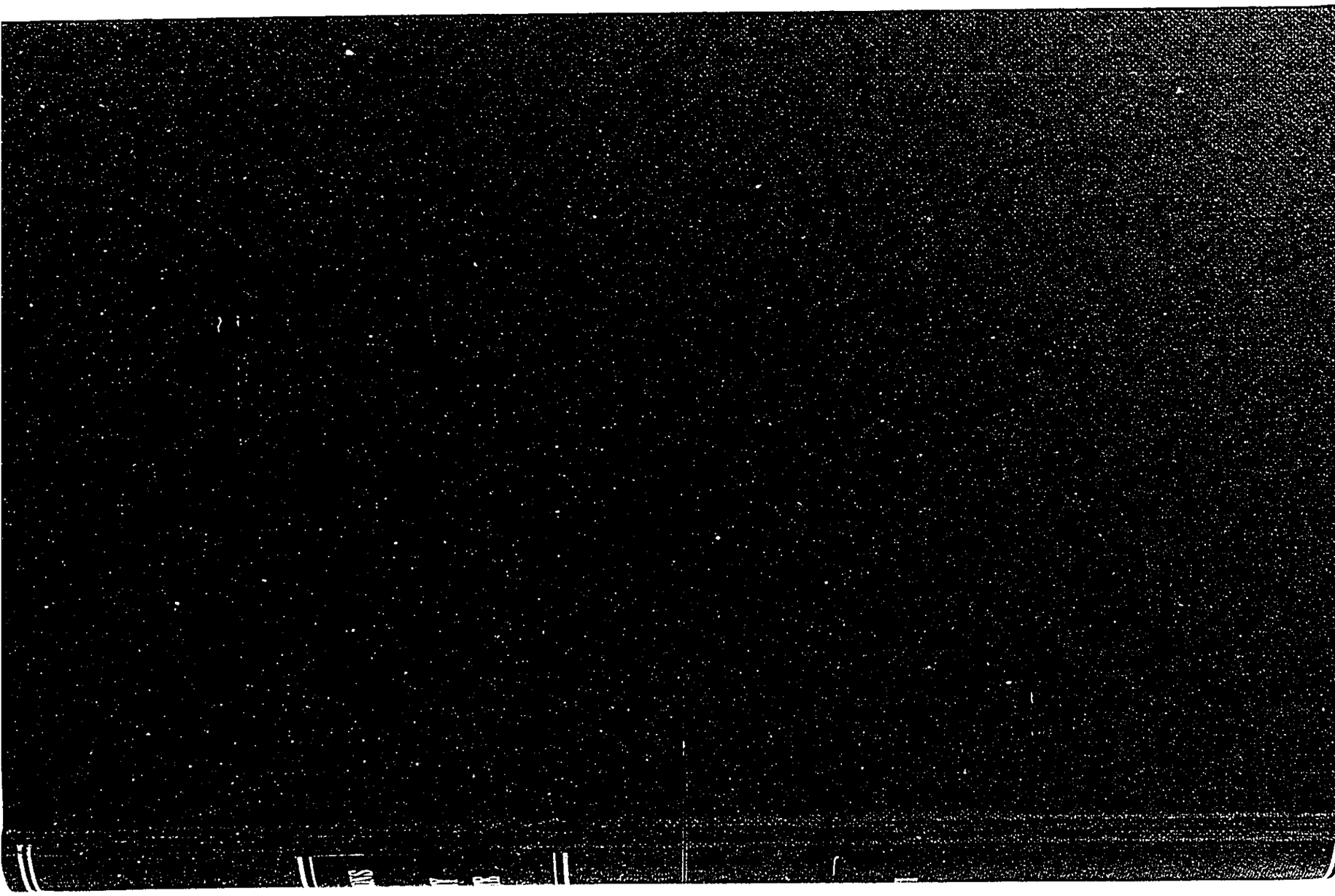


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1885–6.

TRANSACTIONS

OF THE

Sanitary Institute of Great Britain.

VOLUME VII.

CONGRESS AT LEICESTER.

1885-6.

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1886.

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Sanitary Institute of Great Britain.

FORMATION OF THE INSTITUTE.

THE increasing importance attached to Sanitary Science and the recognised position it was assuming in the public mind, appeared to the promoters of the Sanitary Institute fully to justify the formation of a National Society, the object of which should be to devote itself *exclusively* to the advancement of all subjects bearing upon Public Health. In furtherance of the object, a meeting was held at St. James's Hall, on the 13th of July, 1876, at which His Grace the Duke of Northumberland presided, when it was unanimously resolved:—

First—"That in the opinion of this meeting the sanitary condition of this country is still very unsatisfactory, and that further legislation is necessary with a view to its improvement; and that for the purpose of collecting and imparting information upon all matters connected with the subject of 'Public Health' a Society be now formed, to be styled 'The Sanitary Institute of Great Britain.'"

Second—"That the gentlemen whose names are appended be requested to act as a Committee (with power to add to their number) for the purpose of carrying out the previous resolution and of reporting to an adjourned public meeting to be held during the second week in October next."*

The Committee appointed to report upon the subject considered it would add greatly to the usefulness of the Institute if Mayors of Boroughs, Chairmen of Local Boards, Sanitary Authorities, Medical Officers of Health, and all who have to administer the Public Health Acts, would associate themselves with the Institute, either in their individual or corporate capacity, and take part in its proceedings. By thus bringing their united knowledge and experience to bear upon Sanitary matters, the laws relating to the same would become better known and be more efficiently administered.

BASIS OF THE CONSTITUTION OF THE INSTITUTE.

SECTION I.

Charter of Incorporation, Membership, and Government of the Institute.

As soon as practicable a Charter of Incorporation shall be obtained, as it will facilitate some portions of the work of the Institute, more especially the examinations as set forth in Section II. Until a Charter

* An adjourned public meeting was held on the 14th of March, 1877, when the report was unanimously adopted and a Council subsequently appointed to carry it into effect.

is obtained, the examinations shall be continued as heretofore, and a Register of persons certificated as competent to act as Local Surveyors and Inspectors of Nuisances shall be formed.

The Institute shall consist of Fellows, Members, Associates, and Subscribers.

Fellows shall be elected by ballot by the Council, and shall include scientific men of eminence, persons of distinction as Legislators or Administrators, and others, who have done noteworthy Sanitary work.

Fellows are only elected from among the Members, and they must have been Members for at least one year before they are eligible for election as Fellows.

All Fellows shall pay a fee of Ten Guineas on taking up the Fellowship, and such fee shall entitle the Fellow to all the privileges and advantages of the Institute for life without further payment.

Any person proposed by three Fellows or Members, shall be eligible for election as a Member of the Institute.

Members shall be elected by ballot by the Council, and shall be eligible to serve on the Council, and to vote at all Elections and Meetings of the Institute. The admission Fee payable by a Member shall be Three Guineas, and the Annual Subscription Two Guineas.

Medical Officers of Health and Medical Men holding Certificates in Sanitary Science from any University or Medical Corporation shall be entitled to be enrolled as Members of the Institute without Admission Fee.

Members desirous of becoming Life Members may do so on payment of Ten Guineas in lieu of the Annual Subscription.

All persons who have passed the Examination and received the Certificate for Local Surveyor from the Institute, shall, by virtue of having so passed, become Members of the Institute upon the payment of Five Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

Any one proposed by two persons, either Fellows, Members, or Associates of the Institute, shall be eligible to be elected as an Associate of the Institute, the election to be by ballot by the Council. The Admission Fee payable by Associates shall be Two Guineas, and the Annual Subscription One Guinea.

All persons who have passed the Examination and received the Certificate for Inspector of Nuisances from the Institute, shall, by virtue of having so passed, become Associates of the Institute upon the payment of Three Guineas (without Annual Subscription), in addition to the fee paid for the Examination.

Persons of either sex, interested in the advancement of Sanitary Science, shall be entitled to be enrolled as subscribers on payment of One Guinea annually.

Donors of Ten Guineas and upwards shall be entitled to be enrolled as "Life Subscribers," with all the privileges and advantages of Annual Subscribers without further payment.

Fellows, Members, Associates, and Subscribers shall be entitled to attend and to take part in the discussions at all meetings and Congresses of the Institute, and shall have free admission to any

Conversazione given by the Institute and Exhibitions of Sanitary Appliances held in connection with the Institute as long as they continue to pay their Subscription.

Holders of Half-Guinea Congress Tickets are entitled to the use of the Reception Room in the town of meeting, to admission to the Presidential and other Addresses, to all the Meetings, to the Exhibition of the Institute, and to any Conversazione given by the Institute.

The Institute shall be governed by a President, Vice-Presidents, and a Council of Twenty-four, consisting of Fellows and Members of the Institute, of whom not less than two-thirds shall be Fellows. The Council shall be chosen by the Fellows and Members. One-fourth of the Council shall retire annually, and shall not be eligible for re-election for one year.

The first President of the Institute shall be His Grace the Duke of Northumberland. Future Presidents and Vice-Presidents shall be elected by the Council. The Council shall have the power of electing Honorary Members of the Institute, Honorary Foreign Associates, and Corresponding Members of the Council.

Section II.

Objects of the Institute.

To devote itself to the advancement of Sanitary Science and the diffusion of knowledge relating thereto.

To examine and to grant Certificates of Competence to Local Surveyors and Inspectors of Nuisances, and to persons desirous of becoming such or of obtaining the Certificate. The Examinations shall be held at such times and in such places as the Council may direct.

A Board of Examiners shall be appointed by the Council; such Board shall consist of gentlemen representing Medical, Chemical, and Sanitary Science, Engineering, Architecture, and Sanitary Jurisprudence.

The Examination for Local Surveyors shall include a competent knowledge of the Statute relating to Sanitary Authorities, of Sanitary Science and Construction, and of Engineering.

The Examination for Inspectors of Nuisances shall comprise the elements of Sanitary Science, together with Sanitary Construction and the Statutes relating to the prevention of disease and the suppression of nuisances injurious to health.

Fees shall be charged for the Examinations, and a Certificate of Competence, signed by the Examiners, shall be granted to successful candidates, entitling them to be designated as "Certificated by the Sanitary Institute of Great Britain."

A Congress shall be held by the Institute for the consideration of subjects relating to Hygiene at such times and places as the Council may direct.

Exhibitions of Sanitary Apparatus and Appliances shall be held from time to time as the Council may direct.

Fellows, Members, Associates, and Subscribers shall have the right of Free Admission to the Exhibitions of the Institute whenever they are open. All fees payable by Exhibitors and the Public shall be fixed by the Council and belong to the Institute.

A Catalogue shall be published under the direction of the Council as a permanent record of the Exhibitions.

The Institute shall take such steps as may be within its power to obtain a complete registration of sickness, especially of preventable diseases.

The Institute shall endeavour to secure the services of medical men and others specially qualified to give lectures on subjects relating to the prevention and spread of disease.

The Institute shall encourage the formation of classes for technical instruction in Sanitary Science in such a way as may seem advisable to the Council.

A Library shall be formed in connection with the Institute.

ANNUAL REPORT OF THE COUNCIL

FOR 1884-5.

Since the establishment of the Institute in 1876, Sanitary Science has been making steady and, latterly, rapid strides; and is now generally recognized as one of the most important subjects of the day. The Council cannot but feel that this is in a measure due to the efforts made by the Sanitary Institute and kindred societies to awaken public interest, and diffuse Sanitary knowledge throughout the country. The gigantic scale of the International Health Exhibition last year is a standing proof of the rapid progress of this comparatively new science.

This is the Eighth Report that the Council have had the pleasure of laying before the members, and it is with much satisfaction they note that the Institute is keeping pace with the Science which it is, and has been, so instrumental in promoting.

A comparison of the cash statement with the similar ones made in previous years, shows a very considerable increase in the regular income of the Institute from Fees and Subscriptions. The expenditure, although necessarily increasing with the growth of the Institute, has not increased in the same proportion, and the Council have consequently been able to make a vote towards the completion of the valuable experiments which are being carried out by the Cowl Committee. These experiments will be referred to in a subsequent portion of the Report. The large expense connected with the Examinations is partly due to the issue of Circulars to the Local Sanitary Authorities.

The Congress was held in Dublin, and it is worthy of note that in two consecutive years the meetings of the Institute have been held, the one in the largest commercial city of Scotland, and the other in the capital of Ireland.

The invitation to Dublin was forwarded by Lord Brabazon, and signed by representatives of all the leading Societies, and by most of the prominent and influential residents in the city.

The Congress commenced on September 30th, and was presided over by Sir Robert Rawlinson, C.B. An account of the meetings, with the various papers and discussions, will be published in Volume VI. of the Transactions of the Institute.

His Excellency Earl Spencer, K.G., Lord Lieutenant of Ireland, honoured the Annual Dinner by his presence, and the Countess Spencer showed her interest in the proceedings by attending one of the Sectional meetings.

Interesting Excursions were made at the close of the business of the Congress.

Very spacious and well-arranged premises were provided at Balls Bridge for the Exhibition, and although its distance from the city made it necessary to provide special attractions, the number of visitors was considerably larger than at any other Exhibition of the Institute, 35,000 persons passing the turnstiles during the nineteen days it was open. There were 134 Exhibitors and 900 Exhibits. The Judges awarded 1 Silver Medal presented by the Exeter Gas Company, 13 Bronze Medals, 11 Special Certificates, and 64 Certificates—the Special Certificates being awarded to articles which had received Medals at previous Exhibitions of the Institute. 39 Exhibits were deferred for further practical trial and testing; the result of these trials will be reported at the Anniversary Meeting in July, when all the Medals and Certificates will be presented. The proceeds of one evening, for which a special Fête was arranged, were devoted to the Dublin Hospitals; the total amount raised being £430.

During the past year the Examinations have shown even more rapid increase than other sections of the Institute, and the Council are encouraged to find that this work is bearing good fruit. The number of candidates presenting themselves for Examination was more than double the number in any previous year.

The Examinations have been brought more prominently into notice

by a Circular signed by Lord Fortescue, and sent to nearly 2,000 Local Authorities through England, Scotland, and Ireland, calling their attention to the value of the Certificate granted at the Examination, as a reliable guide to local authorities in the selection of candidates.

The Examinations were held in June and November. In June, 23 candidates presented themselves; 6 for Certificates as Local Surveyors, and 17 for Certificates as Inspectors of Nuisances. 4 candidates were certificated as competent to discharge the duties of Local Surveyors, and 15 as competent to discharge those of Inspectors of Nuisances. At the Examination in November, 27 candidates presented themselves; 8 for Local Surveyors, and 19 for Inspectors of Nuisances. 3 candidates were certificated as competent to discharge the duties of Local Surveyors, and 12 as competent to discharge those of Inspectors of Nuisances.

The feasibility of some co-operation with the Association of Public Sanitary Inspectors, with a view of practically enlisting the interests of that Association with the work of the Examinations, is being carefully considered by the Council.

It is with much regret that the Council have to report the death of Dr. W. J. Collins, who was among the first Members of the Institute, having joined at its commencement, in 1876.

Since the last Annual Meeting there have been elected 5 Fellows, 18 Members, 5 Associates, and 2 Subscribers. The numbers on the roll of the Institute were, at the end of 1884, 95 Fellows, 204 Members, 37 Associates, 19 Subscribers, and 30 Honorary Foreign Associates: total, 385.

The retiring members of Council are Dr. G. D'Arcy Adams; Dr. T. W. Grimshaw; Dr. Charles Kelly; Rowland Plumbe, F.R.I.B.A.; E. C. Robins, F.S.A.; Edward Vigers, A.R.I.B.A. The following gentlemen are nominated for election at the Annual Meeting to fill the vacancies thus created:—A. Wynter Blyth, M.R.C.S.; Dr. T. Orme Dudfield; Prof. T. Hayter Lewis, F.R.I.B.A.; Magnus Ohren, A.M.INST.C.E.; Henry C. Stephens, F.C.S.; and J. Edward Lingard, A.M.INST.C.E.

The Committee appointed by the Council to carry out further experiments on Cowls and other automatic means of ventilation, reported to the Council that they had completed their experiments on

the anemometers and air meters, but were in want of funds to carry out the experiments on Cowls.

The Council resolved to grant £150 to the Committee to enable them to complete the tests and experiments on the Cowls.

The Committee thereupon fitted up the necessary appliances at the experimental stage erected at Kew Observatory, and carried out a long and exhaustive series of experiments on various forms of cowls and coverings for ventilating pipes. By this means the Committee have obtained a large amount of valuable data which they are now engaged in tabulating and reducing to form the basis of their report.

The proposed publication of an abstract of the writings of the late Dr. William Farr, which was mentioned in the last report, has met with general favour: 560 persons have sent in their names as subscribers to the work. Owing to the amount of labour involved in selecting and arranging the matter for publication, it will be some months before the copies can be delivered to the subscribers. The price, after the close of the subscription list, will be raised from one guinea to thirty shillings.

In June the Council were asked to co-operate with the Parkes Museum and the Society of Medical Officers of Health in organising a Conference on Domestic Sanitation at the International Health Exhibition. The Chairman of Council (Dr. Alfred Carpenter), Professor W. H. Corfield, and Mr. Ernest Turner, were appointed as delegates from the Institute to a joint Committee of the three Societies to carry out the matter.

The Conference lasted for a week—from the 9th to the 14th of June. An account of the meeting will be published in Vol. VI. of the Transactions of the Institute. All the papers, with the discussions which followed, are printed *in extenso* in Vol. VIII. of the Health Exhibition Literature; they will not, therefore, be reproduced in the Transactions of the Institute.

At the close of the Health Exhibition the Council of the Institute brought under the notice of H.R.H. the Prince of Wales the desirability of forming an amalgamated Health Institute, which, although preserving to a large extent the integrity of the societies working in various branches of sanitation, might combine and centralise their actions.

It was mentioned in the last Report that the Institute had associated their offices with the Parkes Museum; during the year, twelve lectures have been given by that Institution, which the Members of the Sanitary Institute have had the opportunity of attending.

The Members of the Sanitary Institute also have access to the valuable Library of the Museum, which has lately been largely increased by the addition of the Health Section of the Library of the International Health Exhibition.

The Congress and Exhibition this year will be held in Leicester, in accordance with an invitation from the Town Council. The proximity of this town to London renders it very easy of access, and the Council trust that the Members will do their utmost to make the meeting as successful as the preceding ones have been.

SANITARY INSTITUTE OF GREAT BRITAIN.

Abstract of Cash Receipts and Payments for the Year ending December 31st, 1884.

	£ s. d.	£ s. d.
To Balance in hand, Petty Cash, December 31st, 1883:—		15 0 0
„ Fellowship Fees	52 10 0	
„ Admission „	76 13 0	
„ Life Compositions	129 3 0	
		258 6 0
„ Annual Subscriptions	290 17 0	
„ Examinations	137 11 0	
„ Congress	90 13 9	
„ Transactions and other Publications ...	40 10 4	
„ Medals and Certificates	0 10 6	
		560 2 7
„ Dr. Farr's Works...		3 3 0
„ Transfer from Exhibition Account ...		300 0 0
		£1136 11 7

	£ s. d.	£ s. d.
By Balance overdrawn		16 3 2
Office Furniture	2 2 6	
Rent and Taxes	64 7 6	
Salaries and Wages	190 8 6	
Postage, Telegrams, and Carriage	51 4 7	
Incidental Expenses	30 6 3	
Stationery and Printing ...	74 6 11	
Library	1 16 11	
Transactions	15 5 6	
Medals and Certificates	23 7 6	
		453 6 2
Congress	217 1 10	
Examination Expenses	130 3 10	
		347 5 8
„ Cowl Experiments	150 0 0	
„ Dr. Farr's Works	47 16 0	
		197 16 0
„ Balance at Bank December 31st, 1884		122 0 7
		£1136 11 7

EXHIBITION ACCOUNT.

	£ s. d.	£ s. d.
To Balance 1st of January, 1884		503 9 10
„ Receipts		813 4 10
		£1316 14 8
By Expenditure		743 16 6
„ Transfer to General Account		300 0 0
„ Balance at Bank December 31st, 1884		272 18 2
		£1316 14 8

Audited and Confirmed,

MAGNUS OHREN,
ERNEST TURNER, } *Auditors.*

April 23rd, 1885.

ADDRESS

By Dr. Alfred Carpenter,

CHAIRMAN OF COUNCIL.

Read at the Annual Meeting, 1885.

Gentlemen,—It now becomes my duty, as the Chairman of your Council, to make a few observations upon current events. At our last annual meeting I took the liberty of suggesting that the time was at hand for some more defined action to be taken by the promoters of Sanitary Science, so as to endeavour to amalgamate the loose sticks in the sanitary world into one powerful bundle. The suggestion has been taken up in various quarters and favourably considered by your Council, as well as by a number of those who, like us, are more interested in the general welfare of the public than in pushing their own personal claims to office. I hope, therefore, that the day is not far distant when the yearnings of one's heart may be realised by the establishment of an Institute or College of Health under a Royal Charter, having a defined but comprehensive basis; in which we may find all the good belonging to The Sanitary Institute of Great Britain, with the advantages attached to the "Parkes Museum," the National Health Society, the Epidemiological, and the Society of Medical Officers of Health, with similar associations, all meeting in one building, each retaining its own autonomy, providing lectures on a large scale for the instruction of the masses in all those points bearing upon public health which it is so important that the public should be properly instructed in; and also having the direction of enquiries as to the causation and production of enthetic disease, such as have been foreshadowed as proper subjects for endowment at South Kensington. I refer at once to this important point, because since we met at our last annual meeting, the International Health Exhibition has been held at South Kensington, advantage has been taken of a popular desire for instruction in sanitary work, and an immense mass of information upon Health subjects has been put before the public. The caterers for amusement have blended the pennyworth of bread with the gallon of sack, and whilst promoting a good work have done many insanitary acts; probably on the principle that the end justifies the means. Let us earnestly hope that the evil which attended upon the South Kensington assemblies may be evanescent, whilst the good may be permanent, and produce substantial benefit in the future. Indeed, I think it will be so. I have every hope that our Gracious Prince will

himself take care that his name shall not be associated with the South Kensington assemblies for nothing.

It should be known to the members of the Sanitary Institute that as soon as the Exhibition was closed, and it was understood that there would be a considerable balance in the hands of the Prince, as the result of that demonstration; and that it also appearing as if a scramble was to take place for that balance, your Council agreed to some resolutions as to its destination. These were forwarded, as suggestions to the Prince, with a respectful request that a deputation from the Council should have an interview with His Royal Highness, for the purpose of pointing out somewhat in detail the course which your Council thought to be most advantageous to sanitary science, in its apportionment and utilisation.

The engagements of His Royal Highness, and his absence from London for a long period in the autumn of last year, prevented the Prince receiving the suggested deputation, but we were courteously listened to by Mr. Knollys, his Private Secretary; our proposals were heard very patiently, and ultimately put before the Prince as suggestions emanating from a body of gentlemen who did not themselves want to partake of the spoils. We only wished that they should be utilised in the best manner, so as to be devoted to the development of preventive measures, and in antagonism to those which manufacture disease.

It was the impression of most of the members of your Council that an enlargement of the principles upon which the "Parkes Museum" has been founded; by the formation of a Council of Lecturers upon Hygienic subjects, meeting at the Museum—to which should be added a commodious theatre, so that it might be properly utilised for public instruction—together with the endowment of research in connection with causes which set up disease development; would be a worthy field of promise for the utilisation of the funds left in the hands of the Prince. Such funds could not be more appropriately used, and would thus form a substantial basis for the expansion of the future Institute of Health.

The action of this Sanitary Institute of Great Britain, together with that of a considerable number of other spirits moving in various directions, has resulted in a reconsideration and a postponement of the distribution of the balance in the hands of the Prince until after some other exhibitions have been held at South Kensington, by the aid of which that balance may be either increased or frittered away. We believe that the good common sense of the Prince will prevent the latter event from coming to pass. Be it as it may, it is to be hoped that the Institute will not lose sight of the goal to which our

efforts should be continuously directed, and though it may be deferred, we trust that it is only for a definitely short time.

There are two or three subjects which have been much before the Sanitary world during the past year, upon which I shall ask you to allow me to say a word or two before retiring from this chair; one of these has reference to the "Housing of the poor." An application was made by your Council to the Royal Commission which has been appointed to enquire into this subject, suggesting that we should offer some evidence upon the matter, which the Prince of Wales was himself investigating, as Chairman of that Commission. It appeared to your Council that an offer made by so important a body as this Institute should have been at once acceded to by the Commission, without limitation as to direction which their evidence should take; but for some reason, the offer was accepted with such conditions attached to it as led the Council at once to decline to comply with those conditions, and to wait for the development of future events. It is not to be supposed nor suggested for one moment that the Prince of Wales had anything to do with this want of courtesy which was shown to your Council. It was thought by some of your Council that there were important matters connected with the dwellings of the poor, which the Examiners appointed by this Institute could have expatiated upon to the advantage of the Commission, especially as regards the incompetency of many of those men who have to see that the bye-laws of a local authority are properly enforced, and that those bye-laws be also intelligently understood by those who have to enforce them: and still more because they could have shown that the laws of the realm are frequently not enforced when they are antagonistic to the interests of the powers that be, and that energetic officials are not desired. This is but too manifest, by the treatment which an eminent practical sanitarian has recently received at the hands of the St. Pancras Vestry. It is well within the knowledge of members of your Council that there is a considerable defect in these directions; without an intelligent acquaintance with the reasons why this or that law has been enacted, it is quite useless to expect poor dwellings to continue to be healthy, however well they may have been designed in the first instance; an antecedent which is not, however, always forthcoming, and but too often it is all but impossible on present foundations to make them what they should be. The Council would have also put before the Commission evidence as to the perversion which frequently takes place in well considered plans, simply because the sanitary principles upon which those plans have been designed have not been understood by those who have been appointed to carry out the orders of the local authority,

even when it has been to see that its own provisions be complied with. Evidence could also have been adduced as to the way in which sanitary authorities, entrusted with the enforcement of the law, have openly set that law at defiance, and assisted to cause increased overcrowding by the action taken by individual members of the authority in evading the provisions of the clauses as to Lodging Houses, and also of those which apply to certain manufactories, by means of which the evils arising from overcrowding, with all their accompanying mischiefs, have been increased.

They would also have shown that building has been allowed in times past by local authority upon sites and within walls which were utterly unfitted, from preceding use, to be occupied as dwelling-houses; that ventilation was not thought to be necessary for health, and that light was sometimes so shut out that it was utterly impossible for those living in such places to enjoy even a minimum of health; whilst the equally necessary article which is required for existence, viz., water, was sometimes conspicuous by its absence. They would have shown that in some places in the metropolis the allowance for W.C. accommodation is of that character that the requirements of decency cannot possibly be complied with, and as a consequence moral degradation of the very worst kind must and does naturally follow. Members of your Council could have shown that whilst landlords are able to crowd up their dark, unventilated dwellings with double the number of families under one roof as compared with the number of living rooms, that it is utterly impossible for our people to be healthy, either morally or physically, and that it is among those who occupy part of a room, or at most one room only, that the pests of society have their continued development. That on the other hand it is among the occupants of single rooms that the majority of those who transgress the laws of the land continue to reside, and to contaminate the young children with whom they cohabit, causing the latter to follow in their path of vice at even a more rapid pace than the teachers themselves. They would also have shown that the effect is closely related to the proprietorship of houses for the sale of intoxicating liquors, which alone seem to prosper by the ignorance, the filthiness, and brutality of a given neighbourhood. It is the opinion of some of us that the relationship of one-roomed tenements with social degradation, and the close aggregation of public houses and drinking shops in confined areas, are something more than coincident facts. That until some means are forthcoming for the limitation of such houses, immorality, crime, and disease, will go hand in hand together, and the latter will not be materially abated, at least not so

much as earnest Sanatarians know it to be capable of. We know that immorality, crime, and disease are concomitant effects, that they have a distinct relationship one with the other, and that if the causes for their production be left at work, causes which promote any one of the three, the others will continue among us in spite of the enforcement of sanitary law, or in spite of the rigorous execution of penal law, and even the spread of education. We cannot educate the habitual drunkard satisfactorily. He is found among the most intelligent in the land as well as among the most debased—indeed the educated drunkard is the most dangerous. Sanitary progress will, to my mind, be far short of its true position until the proprietors of alcoholic drinking shops are treated in a manner similar to other retailers of poison, that those who sell such shall be made liable at law for some of the consequences which follow upon the abuse of their merchandise. A noted authority upon the Bench has recently come forward in defence of the right to drink. Lord Bramwell has simply put forth arguments in favour of the right which a man has to make a beast of himself, in much the same terms as used to be held fifty years ago in favour of Smithfield Market and all other insanitary surroundings. He has only reiterated, in similar language, the objections which used to be held to sanitary work in general. The Englishman's house was said to be his castle. Law has clearly shown that a man shall not turn his house, or even the surroundings of it, into a nuisance, injuriously affecting the health and comfort of his neighbours. That which is law as to a man's house, must in time apply to the man himself as well as to his domicile; though I hope better results from the spread of true knowledge upon sanitary subjects than from hostile compulsion. I hope more from the teachings of the Sanitary Institute than from legal pressure, except that pressure which arises from local option and obedience to general principles connected with the sale of poisons.

There is another point which may fairly be considered by the Institute, and upon which they ought to be competent to form an opinion, viz., the question of over-pressure in elementary schools. The battle has been fought beyond the boundary of our camp, and yet it is one in which we ought to have a voice and to join issue in the struggle. Whatever tends to raise the brain power of the people or to lessen their constitutional strength, is within our scope, and ought not to be left untouched by our members.

I am not now about to enter into the arena with either Dr. Crichton Browne or Mr. Fitch; opposite as their opinions now appear to be I think that they are both right, and if so, then, to some extent, both are wrong. One thing is manifest, that the

health of the children who frequent elementary schools is decidedly better now than it was a few years ago. Statistics show a lower death-rate among children under 13 years of age, than before the Education Act was passed; proving at any rate that the conditions under which those children live are safer now than they were before that Act became law. Nevertheless, I am with Dr. Crichton Browne on some of his points. I fear that we are aggregating masses of children together and forcing mental work, whilst we are to some extent neglecting that physical education which is equally if not more important for our welfare as a nation. The town populations are increasing, the rural population diminishing. The endurance of the latter under continued muscular strain is much greater than the former. The feet of the town dweller soon blister on a forced march, whilst those of the other scarcely feel the extra rub. It may be that there is a day of trial before us, in which the power to think, which is partially developed by School Board education, will produce for us a nation of cowards, because the larger part are physically weak and are a short-sighted people, instead of such as our great public schools have made our middle and upper classes. I believe that it is the duty of the managers of elementary schools to provide extensive playgrounds, and encourage athletics among both boys and girls, to teach the latter a little more the principles of domestic economy, if we are to counteract the evils which may arise from injudicious or excessive brain work, and the weakened bodily state which overcrowding produces in the animal as well as the vegetable world. It cannot be doubted but that there is an increase of short-sightedness among those who study much, and that which affects the set of muscles regulating the eyeball equally affects other muscles in the body. The spinal weakness upon which Myopia depends will diminish our national steadiness, and may cost us dear in the end. To have to wear spectacles when taking aim with the rifle is not conducive to dexterity in the use of the weapon.

I may mention a fact in connection with this subject which has an important bearing upon the question before us, and which is worthy of deep thought by those who have to assist in the education of the young. The establishment for pauper children at Anerley accommodates some 900 little ones, between the ages of 3 and 15. The Board of Management were much exercised by the unruliness of the children, in the night; they did not sleep well, and as a consequence of wakefulness, they did as boys and girls will do, bolster each other in the dormitories; they damaged pillows, sheets, and night-dresses, in ways which exhausted the ingenuity of a talented and

judicious superintendent, to circumvent. At this juncture it was determined to employ a drill master, at a moderate salary, to drill the children, both boys and girls, and practice them on a regular gymnastic plan. The children enjoyed their fun; they sang songs, and exercised their muscles in concert, with a marvellous dexterity. They wonderfully improved both in the production of sound and the development of figure. But an unexpected event also happened: there was a cessation of disorder in the dormitories, the damage to bed linen ceased, and the slumbers of the children were not disturbed by avalanches of pillows. Their little muscles were tired out before they went to bed, and they no longer let off their unused energy at inconvenient periods. But the act of the managers excited the ire of the guardians of the public purse. It seemed to those lynx-eyed representatives of the overtaxed ratepayer, that the paupers at Anerley were having a luxury which the Guardians could not give their own children. Remonstrance after remonstrance was made, and the managers had to dismiss their drill-master. But what happened? The disorder returned in the dormitories, and the damage inflicted upon pillows and night dresses was far in excess of the cost of the drill-master's salary, let alone the damage which must have ensued to the brains of the little ones whose unused muscular energy was let off when "Nature's sweet restorer" ought to have held them fast in her embraces. This fact was so patent to the managers that they restored the drill-master in spite of the antagonistic influence which came from the different Boards of Guardians who appointed them to office. I recommend this fact to your notice with the hope that the Sanitary Institute of Great Britain will look into the question of elementary education, and not leave it outside the pale of our work. Go into a plantation of young trees, see how they destroy each other if they are not thinned out; the same unhealthy process is at work in overcrowded schools. Look at those plants which are deprived of light, how unable are they to bear the storms which come on at not infrequent intervals. The same result is happening amongst those who are deprived of a fair share of sunlight in the courts and alleys of our towns.

It strikes me as an important point also that the elementary schools should be very frequently supervised by the Medical Officers of Health. Ventilation is provided for by the department when the schools are built, but there is no power to keep them ventilated. Those who happen to go into a large school about half an hour before the work of the day is over will generally experience a proof of vitiated air (by nasal means) which cannot be healthy for children to breathe. The floor space is not anything

like sufficient for the number of children which occupy the building, and it is possible, also, if it be a cold day that the ventilators are closed. The Medical Officers of Health ought to have power to analyse the air of the room from time to time, and to examine the condition of the ventilators, so that the neuralgic state of the master may not lead to the tuberculization of the children. I can hardly pass over the evidence which has been adduced in favour of the coincidence of some forms of tubercular disease, especially Phthisis, with parasitic life. It is said by one class of men that the Tubercle Bacillus, which has been recently shown to be a reality, is the cause of the disease, whilst another class of thinkers urge that it is only a sequence. The fact, however, is thoroughly established that a particular bacillus is found in the sputa of at least one class of phthisical patients, and also in one form of tubercular matter, which has its habitat in the lungs. It seems to be clear that the removal of the bacillus by anti-parasitic means assists to prolong the patient's life, and that the chances of recovery from the effects of tubercle are much assisted by means which destroy the parasitic germs. It may be like to the blight upon flowers. Some say that if plants are healthy they will not be touched by blight, whilst others assert that the blight destroys the health and only kills the more delicate in a more rapid manner. It may be so; I prefer to prevent, when possible, the increase of the disease by destroying the germ. Acting upon that principle, I believe I have saved several from becoming the victims of phthisis. If our elementary schools are allowed to spread the bacillus among those who are brought together in such close proximity as we do so find them in some of the Board Schools, with an individual allowance of 80 cubic feet of air, it may be in the future that whilst the deaths before thirteen years of age are diminished, those which take place in the next decade may be raised to a higher level. At any rate, it is a question which ought to be deeply interesting to our members; and if these general references to these points should cause some among you to take it up more seriously, I shall have gained my point. I thank you for the kind consideration with which I have been treated during my two years of office, and earnestly hope that the progress of the Institute may continue to be even a more forward one in the future than it has been in the past.

NOTE.—Since the above address was delivered, the report of the Royal Commission has been issued. I am rejoiced to find that the points I wished to have brought before the Commission have been brought out by the intellectual men who have formed that body.

A. C.

THE WATER SUPPLY OF ANCIENT ROMAN CITIES.

ADDRESS BY PROFESSOR W. H. CORFIELD, M.A., M.D.

Anniversary Meeting, July 9th, 1885.

As the supply of water to large populations is one of the most important subjects in connection with sanitary matters, and one upon which the health of those populations to a very large extent depends, I have thought that it would not be uninteresting to the members of this Institute were I to give them a short account of some of the more important works carried out for this purpose by the Ancient Romans—the great sanitary engineers of antiquity—more especially as I have had exceptional opportunities of examining many of those great works in Italy, in France, and along the north cost of Africa. Many of them are well known, and have often been described, but others, and those, as we shall see, in many respects by far the most important, have not received the amount of consideration that they deserve.

Of the aqueducts constructed for the supply of Rome itself we have an excellent detailed account in the work of Frontinus, who was the controller of the aqueducts under the Emperor Nerva, and who wrote his admirable work on them about A.D. 97.

It may be interesting in passing to mention that Frontinus was a patrician, who had commanded with distinction in Britain under the Emperor Vespatian, before he was appointed by the Emperor Nerva as controller (or, we should say, surveyor) of the aqueducts. He was also an antiquarian, and in his work he not only describes the aqueducts as they were in his time, but also gives a very interesting history of them.

He begins by telling us that for 441 years after the building of the city, that is to say, before B.C. 312, there was no systematic supply of water to the city; that the water was got direct from the Tiber, from shallow wells, and from natural springs; but that these sources were found no longer to be sufficient, and the construction of the first aqueduct was undertaken during the consulship of Appius Claudius Crassus, from whom it took the name of the Appian aqueduct. This was, as may be expected from its being the first aqueduct, not a very long one; the source was about eight miles to the east of Rome,

and the length of the aqueduct itself rather more than eleven miles, according to Mr. James Parker, to whose paper on the "Water Supply of Ancient Rome," I am indebted for many of the facts concerning the aqueducts of Rome itself. This aqueduct was carried underground throughout its whole length, winding round the heads of the valleys in its course, and not crossing them, supported on arches, after the manner of more recent constructions; it was thus invisible until it got inside the city itself, a very important matter when we consider how liable Rome was, in these early times, to hostile attacks.

It was soon found that more water was required than was brought by this aqueduct, and it was no doubt considered desirable to have tanks at a higher level in the city than those supplied by the Appian aqueduct. It was determined, therefore, to bring water from a greater height and from a greater distance, and the river Anio, above the falls at Tivoli, was selected for this purpose. The second aqueduct, the Anio Vetus, was no less than 42 miles in length, and was, like the Appian, entirely under the surface of the ground, except at its entrance into Rome at a point about 60 feet higher than the level of the Appian aqueduct. Little search has been made for the remains of this aqueduct, and its exact course is not known, but during my examination of the remains of the subsequent aqueducts at a place called the Porta Furba, near Rome, where the ruins of five aqueducts are seen together, and at, or close to, which point the Anio Vetus must also have passed underground, I was rewarded for my search by discovering a hole, something like a fox's hole, leading into the ground, and on clearing away a few loose stones which had apparently been thrown into it, and putting my arm in I found that it led into the specus or channel of an underground aqueduct, and on relating this incident to the late Mr. John Henry Parker, the antiquarian, who was then in Rome, and showing him a sketch of the place, he said that he had no doubt that I had been fortunate enough to discover the exact position of the veritable Anio Vetus at that spot.

These two aqueducts sufficed for the supply of Rome with water for about 120 years, for Frontinus tells us that 127 years after the date at which the construction of Anio Vetus was undertaken, that is to say, the 608th year after the foundation of the city, the increase of the city necessitated a more ample supply of water, and it was determined to bring it from a still greater distance. It was no longer considered necessary to conceal the aqueduct underground during the whole of its course, and so it was in part carried above ground on embankments or supported upon arches of masonry. The water was

brought from some pools in one of the valleys on the eastern side of the Anio, some miles further up than the point from which the Anio Vetus was supplied, and the new aqueduct, which was 54 miles in length, was called the Marcian, after the Prætor Marcius, to whom the work was entrusted. Frontinus also tells us the history of the other six aqueducts which were in existence in his time, viz:—the Tepulan, the Julian, the Virgo, the Alsietine or Augustan, the Claudian, and the Anio Novus; the last two being commenced by the Emperor Caligula, and finished by Claudius, because "seven aqueducts seemed scarcely sufficient for public purposes and private amusements;" but it is not necessary for our purpose to give any detailed account of the course of these aqueducts, it is only necessary to mention one or two very interesting points in connection with them.

In order to allow of the deposit of suspended matters, piscinæ, or settling reservoirs, were constructed in a very ingenious manner. Each had four compartments, two upper and two lower; the water was conducted into one of the upper compartments and from this passed, probably by what we should call a standing waste or overflow pipe, into the one below; from this it passed (probably through a grating) into the third compartment at the same level, and thence rose through a hole in the roof of this compartment into the fourth, which was above it, and in which the water of course attained the same level as in the first compartment, thence passing on along the aqueduct, having deposited a good deal of its suspended matter in the two lower compartments of the piscina. Arrangements were made by which these two lower compartments could be cleaned out from time to time. The specus or channel itself was of course constructed of masonry, generally of blocks of stone cemented together, and it was frequently, though not, it would appear, always, lined with cement inside. It was roofed over, and ventilating shafts were constructed at intervals; in order to encourage the aëration of the water irregularities were occasionally introduced in the bed of the channel.

The water supplied by the different aqueducts was of various qualities; thus, for instance, that of the Alsietine, which was taken from a lake about 18 miles from Rome, was of an inferior quality, and was chiefly used to supply a large naumachia, or reservoir in which imitation sea fights were performed; while on the other hand, the water of the Marcian was very clear and good, and was therefore used for domestic purposes.

Frontinus gives the most accurate details as to the measurements of the amounts of water supplied by the various aqueducts, and the quantities used for different purposes. From these

details Mr. Parker computes the sectional area of the water at about 120 square feet, and says: "We can form some opinion of the vast quantity if we picture to ourselves a stream 20 feet wide, by 6 feet deep, constantly pouring into Rome at a fall six times as rapid as that of the River Thames." He considers that the amount was equivalent to about 332 million gallons a day, or 332 gallons per head per day, assuming the population of the city to be a million.

When we consider that we in London have only 30 gallons a head daily, and that many other towns have less, we get some idea of the profusion with which water was supplied to ancient Rome.

But the remains of Roman aqueducts are not only to be found near Rome. Almost every Roman city, whether in Italy or in the south of France, or along the north coast of Africa, can show the remains of its aqueduct, and almost the only things that are to be seen on the site of Carthage are the remains of the Roman water tanks, and the ruins of the aqueduct which supplied them.

The most beautiful aqueduct bridge in the world, on the course of the aqueduct which supplied the ancient Nemaucus, now Nismes, still stands, and is called from the name of the Department in which it is, the Pont du Gard. It consists of a row of large arches crossing the valley over which the water had to be carried, surmounted by a series of smaller arches, and these again by a third series of still smaller ones, carrying the specus of the aqueduct. This splendid bridge still stands perfect, so that one can walk through the channel along which the water flowed, and it might be again used for its original purpose.

There was, however, one city which, from the fact that a great part of it was situated upon a hill, was more difficult to supply with water than any of the rest, and which, at the same time from its size, its great importance, and the fact that it was the favourite summer residence of several of the Roman Emperors, and notably of Claudius, who was born there, and who had a palace on the top of the hill, must of necessity be supplied with plenty of water, and that too from a considerable height. I refer to Lugdunum (now Lyons), then the capital of Southern Gaul.

A somewhat prolonged residence in this city on two different occasions gave me the opportunity of examining on the spot the remains of the aqueducts constructed there by the ancient Romans, and more especially of the one constructed by the Emperor Claudius, and so, as they are but little known, although by far the most remarkable of the Roman waterworks, I have

thought that it would not be uninteresting to you if I were to give, with the aid of the diagrams I have prepared, a somewhat detailed account of them.

The city of Lugdunum was built by Lucius Munatius Plaucus, by order of the Senate in A.U.C. 711. Augustus went there in A.U.C. 738, and afterwards lived there from 741 to 744. It was he who raised it to a very high rank among Roman cities. It had its Forum near the top of the hill now called Fourvières (probably a corruption of Forum Vetus), an Imperial palace on the summit of the same hill, public baths, an amphitheatre, a circus, and temples.

In order to supply this city with water, standing as it did on the side of a hill at the junction of two great rivers (now Rhone and Soane), it was necessary to search for a source at a sufficient height, and this Plaucus found in the hills of Mont d'Or, near Lyons, where a plentiful supply of water was found at a sufficient height, viz., that of nearly 2000 feet above the sea. From this point an aqueduct, sometimes called from its source the aqueduct of Mont d'Or, and sometimes the aqueduct of Ecully, from the name of a large plain which it crossed, was constructed, or rather two subterranean aqueducts were made and joined together into one, which crossed the plain of Ecully, in a straight line still underground; but the ground around Lyons was not like the Campagna, near Rome, and it was necessary to cross the broad and deep valley now called La Grange Blanche. This, however, did not daunt the Roman engineers: making the aqueduct end in a reservoir on one side of the valley, they carried the water down into the valley, probably by means of lead pipes, in the manner which will be described more at length further on, across the stream at the bottom of the valley by means of an aqueduct bridge 650 feet long, 75 feet high, and 28 feet broad, and up the other side into another reservoir, from which the aqueduct was continued, along the top of a long series of arches, to the reservoir in the city, after a course of about ten miles.

In the time of Augustus, however, it was found that the water brought by this aqueduct was not sufficient, especially in summer, and as there was a large Roman camp, which also required to be supplied with water, situated at a short distance from the city, it was determined to construct a second aqueduct. For this purpose the springs at the head of a small river, called now the Brevenne, were tapped, and conveyed by means of an underground aqueduct (known as the aqueduct of the Brevenne) which wound round the heads of the valleys, and after a course of about 30 miles is believed by some to have arrived at the city, but by others to have stopped at the Roman camp, and to

have been constructed exclusively for its supply. I have here a diagram (after Flachéron) shewing a section of this aqueduct, and this will give a very good general idea of the section of a Roman aqueduct where constructed underground. It will be seen that the specus or channel is 60 centimetres (or nearly 2 feet) wide, and 1 m. 57 c. (or a little over 5 feet) high, and that it is lined with a layer of 3 c. (or nearly 1¼ inches) of cement. It is constructed of quadrangular blocks of stone cemented together, and has an arched stone roof (Fig. 4). It will be noticed also that the angles at the lower part of the channel on each side are filled up with cement; it appears also that this aqueduct crossed a small valley by means of inverted siphons.

But neither of these aqueducts came from a source sufficiently high to supply the imperial palace on the top of Fourvières. Their sources are, in fact, according to Flachéron, at a height of nearly 50 feet below the summit of Fourvières, and it was, therefore, considered necessary by the Emperor Claudius to construct a third aqueduct. The sources of the stream now called the Gier, at the foot of Mont Pila, about a mile and a half above St. Chamond, were chosen for this purpose, and from this point to the summit of Fourvières was constructed by far the most remarkable aqueduct of ancient times, an engineering work which, as will be seen from the following description, partly taken from Montfalcon's history of Lyons, partly from Flachéron's account of this aqueduct, and partly from my own observations on the spot, reflects the greatest possible credit on the Roman engineers, and shows that they were not, as has been frequently supposed by those who have only examined aqueducts at Rome, by any means ignorant of the elementary principles of hydraulics.

To tap the sources of a river at a point over 50 miles from the city, and to bring the water across a most irregular country, crossing ten or twelve valleys, one being over 300 feet deep, and about two-thirds of a mile in width, was no easy task, but that it was performed the remains of the aqueduct at various parts of its course show clearly enough. It commences, as I have said, about a mile and a half from the present St. Chamond, a town on the river Gier, about 16 miles from St. Etienne. Here a dam appears to have been constructed across the bed of the river, forming a lake from which the water entered the channel of the aqueduct, which passed along underground, until it came to a small stream which it crossed by a bridge, long since destroyed. After this it again became subterraneous for a time, and then crossed another stream on a bridge of nine arches, the ruins of some of the columns of which are still to be seen, and from these ruins it would appear that the bridge

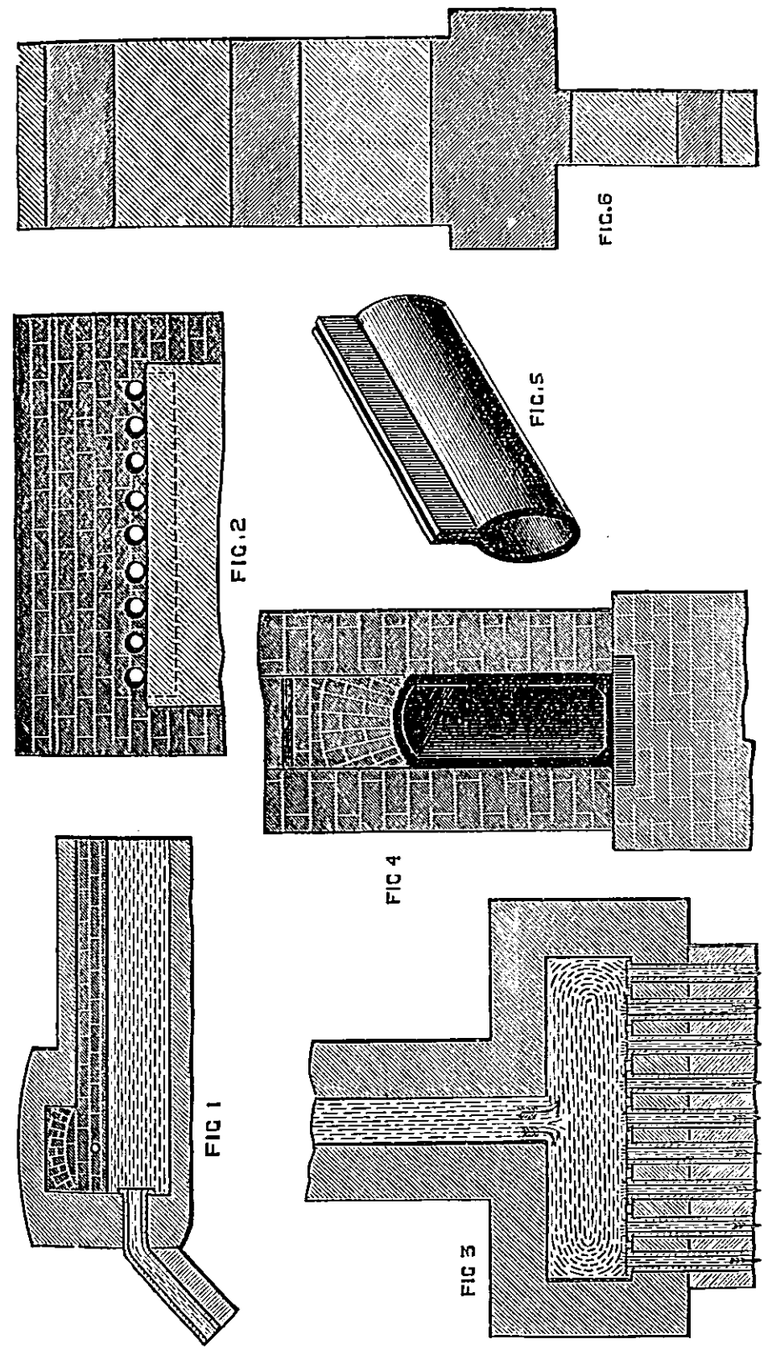


FIG. 1. Section of Outlet Reservoir at Soucieu, with commencement of Siphon.
" 2. Part elevation of Outlet Reservoir at Soucieu, shewing hole for 9 Siphons.
" 3. Plan of Outlet Reservoir at Soucieu.
" 4. Section of Aqueduct of the Brevenne.
" 5. Lead Pipe for distributing water.
" 6. Horizontal Section of Aqueduct Bridge and Outlet Reservoir at Chaponost. *(After Flachéron).*

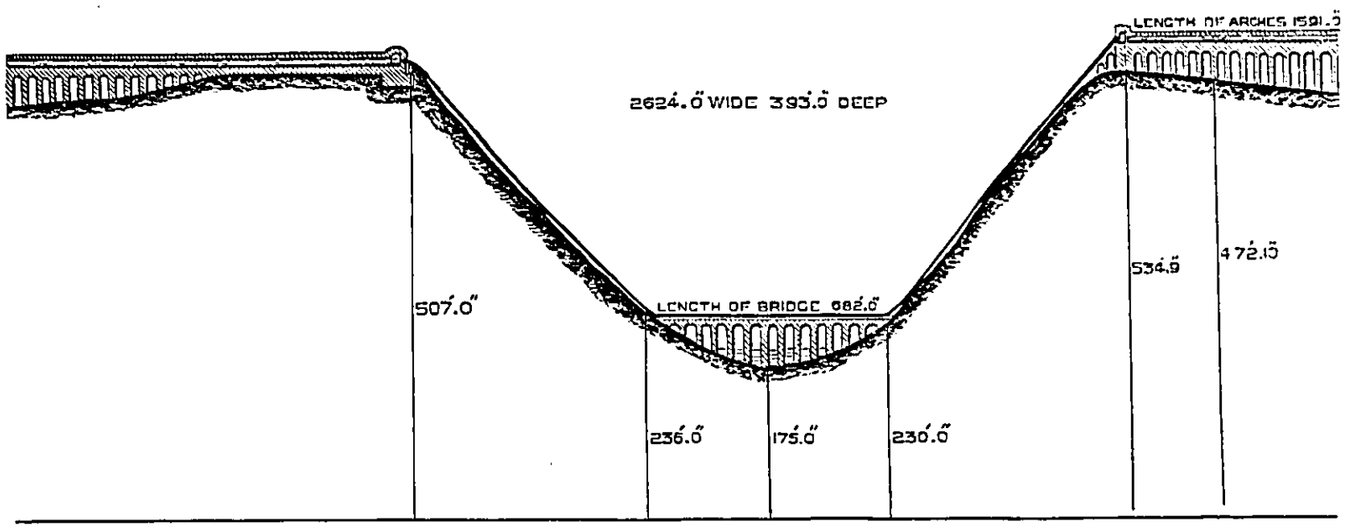
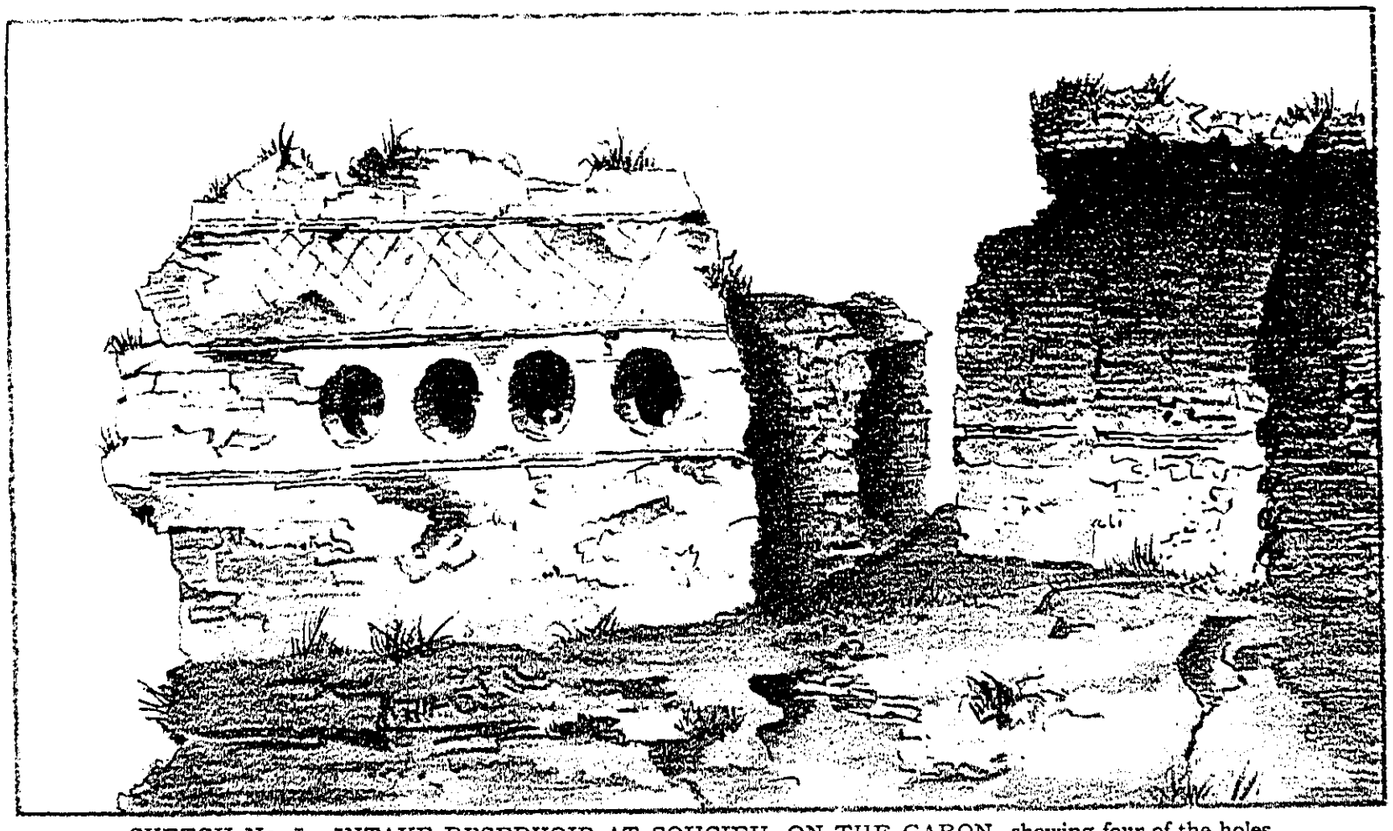
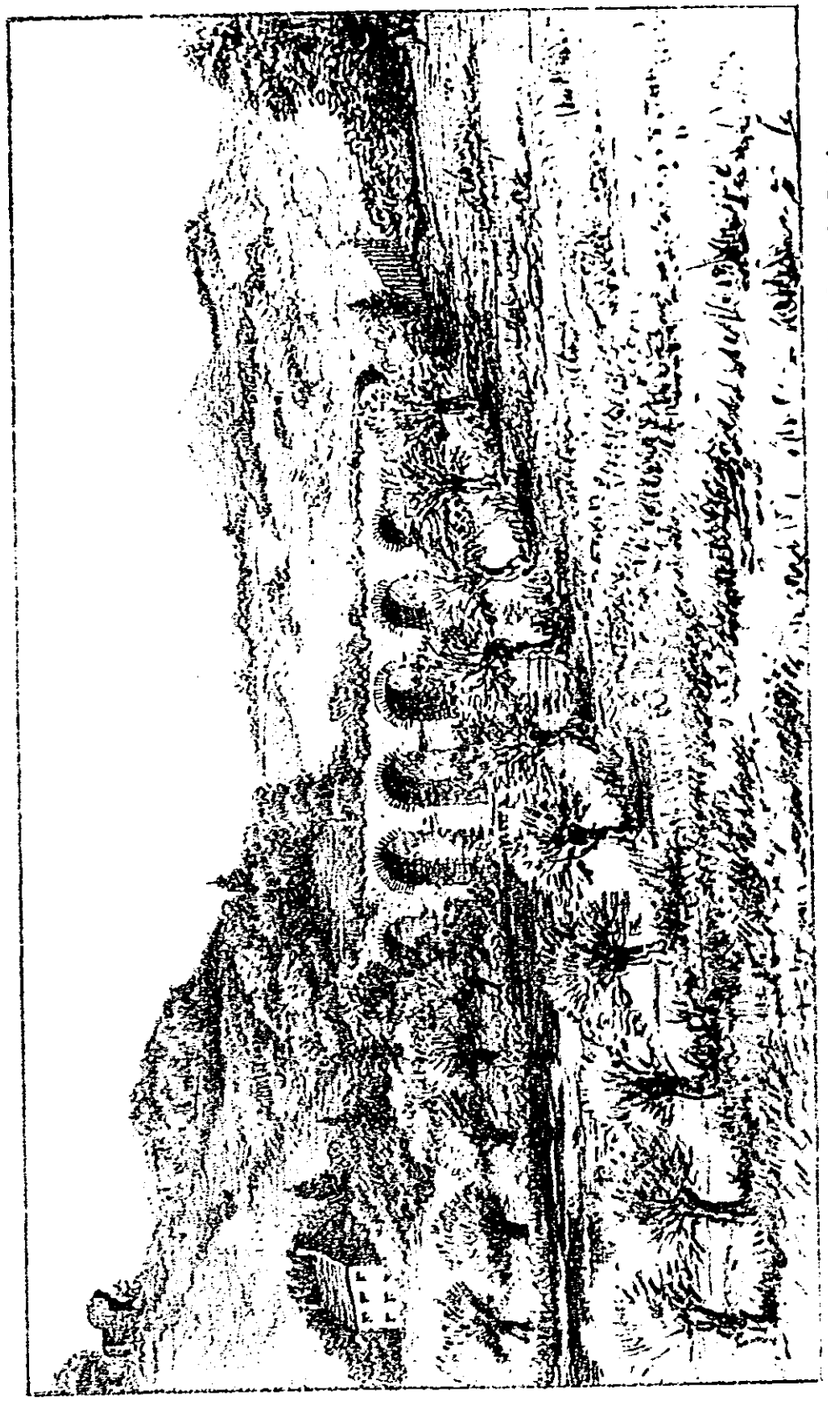


Diagram of Aqueduct Bridge, Reservoirs and Siphons, for crossing the Valley of the Garon. The Outlet Reservoir at Soucieu is on the right, the Intake Reservoir at Brignais on the left hand side. *(After Flachéron).*

N.B.—The vertical scale is three times the horizontal.



SKETCH No. I.—INTAKE RESERVOIR AT SOUCIEU, ON THE GARON, shewing four of the holes by which the siphons started from the reservoir. *(From a Sketch by the Author.)*



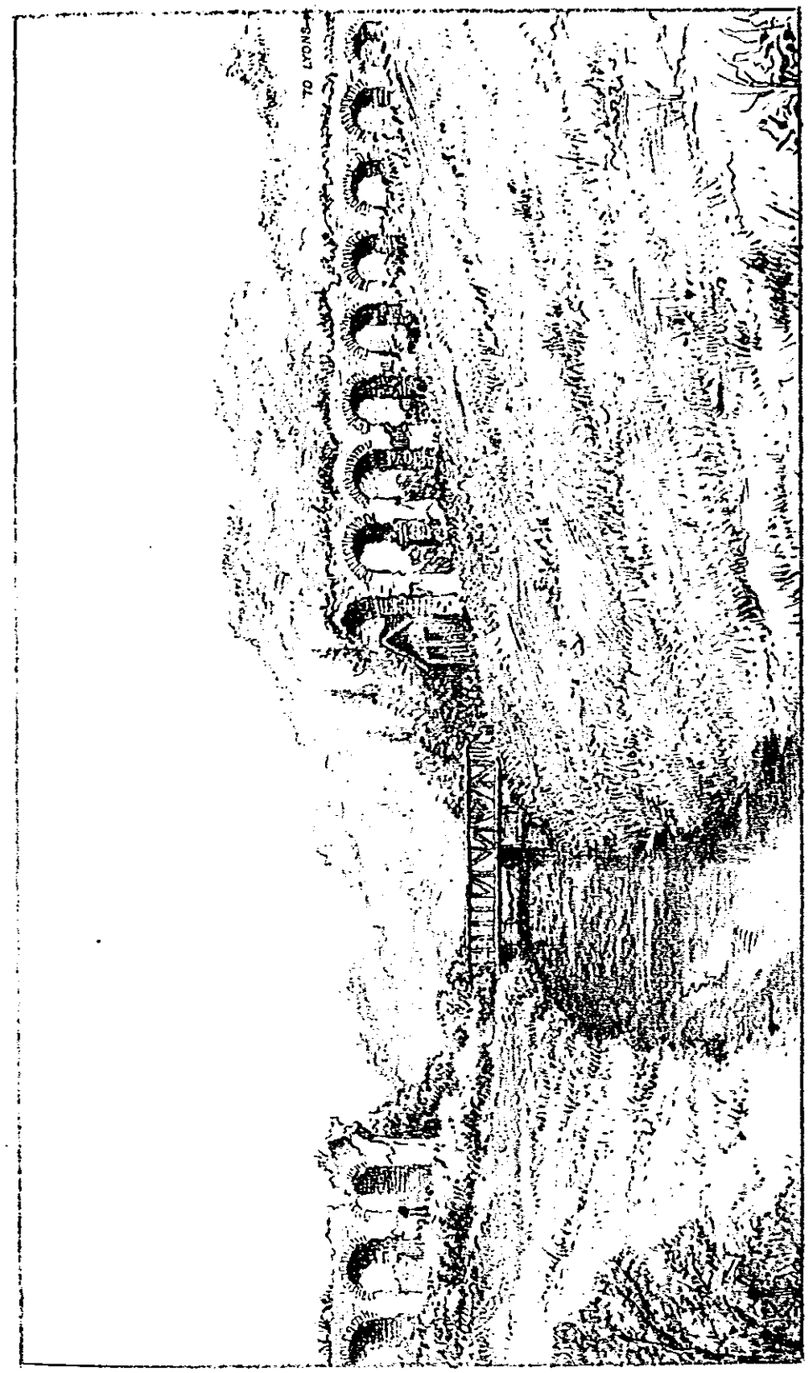
SKETCH No. II.—AQUEDUCT BRIDGE OVER THE GARON.—To carry the Siphons leading from the Intake Reservoir at Soucieu (seen at the top of the Sketch on the left-hand side) to the Outlet Reservoir at Brignais on the other side of the Valley. *(From a Sketch by the Author.)*

had, at some time or another, been destroyed, probably by the stream running under it having become torrential, and subsequently rebuilt; again it became concealed underground, to reappear in crossing a small valley and another small stream, when it was again concealed by the ground, and in one or two places channels were even cut for it through the solid rock, after which it reappeared on the surface at a point where now stands the village of Terre-Noire, and where it was necessary that it should somehow or other cross a broad and deep valley. It ended in a stone outlet-reservoir, from which eight lead pipes descending into the valley were carried across the stream at the bottom on an aqueduct bridge, about 25 feet wide, and supported by twelve or thirteen arches, and then mounted the other side of the valley into an intake-reservoir, of which scarcely any remains are now seen, from which the aqueduct started again, disappearing almost immediately under the surface of the ground to appear again from time to time crossing similar valleys and streams upon bridges, the remains of some of which may still be seen, until it reached Soucieu, on the edge of the valley of the Garon, where are still seen the remains of a splendid bridge, the thirteenth on its course, nearly 1600 feet long, and attaining a height of 56 feet at its highest point above the ground. The object of this bridge was to convey the channel of the aqueduct at a sufficient height into a reservoir on the edge of the valley. The remains of this bridge leave no doubt that it was purposely destroyed by barbarians; some of the arches near the end of it remain, while the rest have been thrown down, some on one side and some on the other; but happily the arches next to the reservoir, at the end of the bridge and on the edge of the valley, remain, and the reservoir itself is still in part intact supported on a huge mass of masonry. Four holes are to be seen in that part of the front of the reservoir which is left, being the holes from which the lead pipes descended into the valley (see sketch No. 1). It would appear from the remains of the reservoir that there must have been nine of these pipes in all. These holes are elliptical in shape, being 12 inches high by $9\frac{1}{2}$ inches wide, and the interior of the reservoir is still seen to be covered with cement. The walls of the reservoir were about 2 feet 7 inches thick, and were strengthened by ties of iron; it had an arched stone roof in which there was an opening for access (Figs. 1, 2, 3). From this the nine lead pipes descended the side of the valley supported on a construction of masonry, crossed the river by an aqueduct bridge and ascended into another reservoir on the other side, as seen in sketch No. 2, entering the reservoir at its upper part just below the spring of the arches of the roof. From this

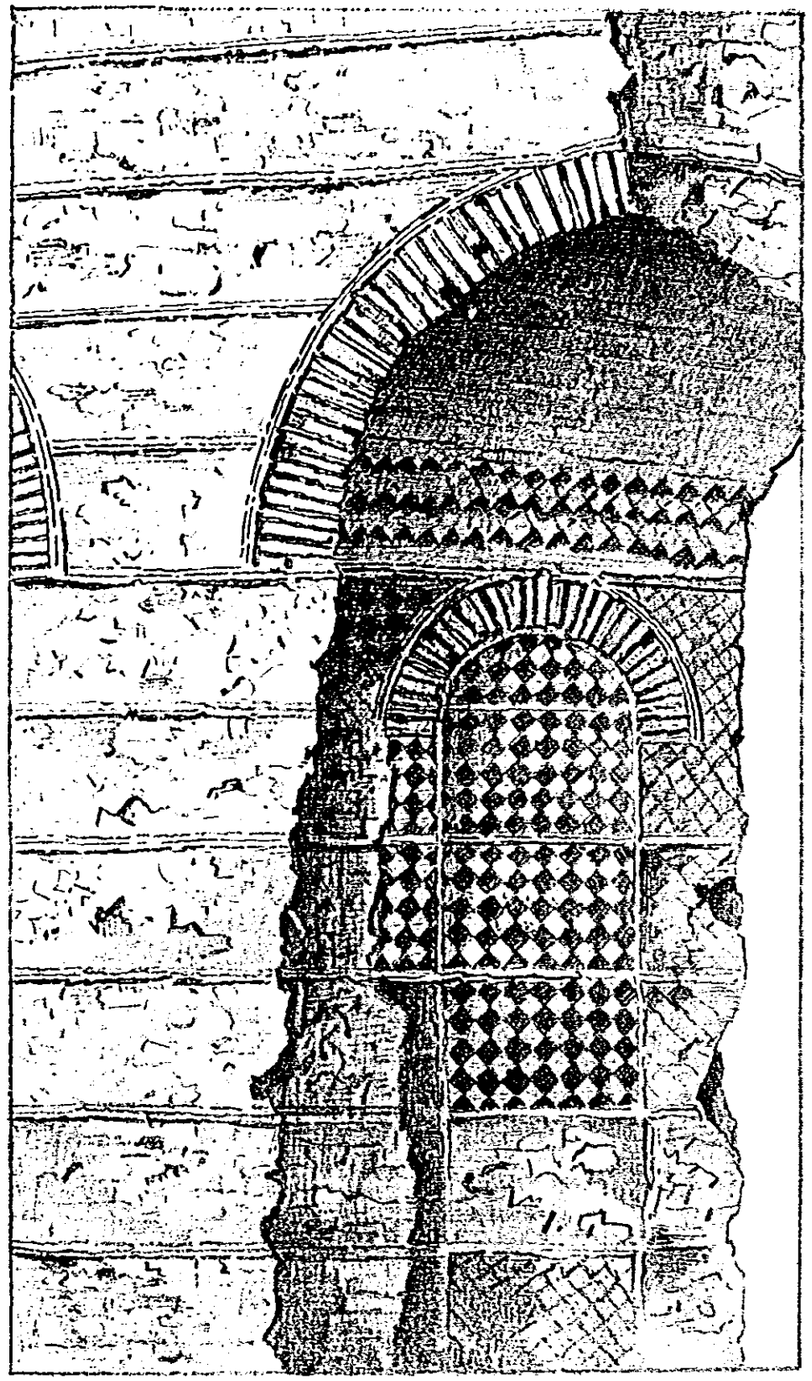
reservoir the aqueduct passed to the next on the edge of the large and deep valley of Bonnan, being underground twice and having three bridges on its course, the last of which, the sixteenth on the course of the aqueduct, ends in a reservoir near Chaponost, on the edge of the valley. Only one of the openings through which the siphons, of which there were probably ten, started from the reservoir is now left.

The bridge across the valley below had thirty arches and was about 880 feet long by 24 feet wide. A number of the arches still remain standing, and, as will be seen by sketch No. 3, in some instances the pillars of the arches were constructed of transverse arches themselves. The work consisted of concrete formed with Roman cement, so hard that it turns the points of pickaxes when employed against it, with layers of flat bricks at regular intervals. The surface of the concrete is covered with small cubical blocks of stone placed so that their diagonals are horizontal and vertical, and forming what is known as *opus reticulatum* (see sketch No. 4). After crossing the bridge the pipes were carried up the other side of the valley into a reservoir, of which little remains, and then the aqueduct was continued to the next valley, passing over three bridges in its course. This valley, that of St. Irenée, is much smaller than either of the others, but nevertheless it was deep enough to necessitate the construction of inverted siphons, of which there were eight.

Leaving the reservoir on the other side of this valley, the aqueduct was carried on a long bridge (the twentieth on its course) which crossed the plateau on the top of Fourvières and opened into a large reservoir, the remains of which are still to be seen on the top of that hill. From this reservoir, which was 77 feet long and 51 feet wide, pipes of lead conveyed the water to the imperial palace and to the other buildings near the top of the hill. Some of these lead pipes were found in a vineyard near the top of Fourvières at the beginning of the eighteenth century, and were described by Colonia in his History of Lyons. They are made of thick sheet lead rolled round so as to form a tube, with the edges of the sheet turned upwards, and applied to one another in such a way as to leave a small space, as shown in Fig. 5, which was probably filled with some kind of cement. These pipes, of which it is said that twenty or thirty, each from 15 to 20 feet long, were found, were marked with the initial letters TI. CL. CAES. (Tiberius Claudius Cæsar) and afford positive evidence that the work was carried out under the Emperor Claudius. Lead pipes, constructed in a similar manner, have also been found at Bath, in this country, in connection with the Roman baths.



SKETCH No. III.—REMAINS OF AQUEDUCT BRIDGE ACROSS THE STREAM IN THE VALLEY OF BONNAN (OR BEAUNAN). The little Wooden Bridge across the Stream is supported by the remains of the Pillars of the Old Aqueduct Bridge. *(From a Sketch by the Author.)*



SKETCH No. IV.—ARCH OF AQUEDUCT BRIDGE AT BONNAN, shewing Opus Reticulatum. The dark Cubes are made of granite gneiss, etc., the light ones of limestone and sandstone; on the latter a white lichen grows, rendering the contrast still more conspicuous. The Arches are made of slabs of gneiss alternated with flat bricks. The layers of flat bricks at regular intervals are also shewn. *(From a Sketch by the Author.)*

It will be seen at once that the great difference between this aqueduct and those near Rome arises from the fact that instead of being carried across a nearly flat country, it was carried across one intersected with deep ravines, and that it was therefore necessary to have recourse to the system of inverted siphons. There can be no doubt that the inverted siphons were made of lead, although no remains of them have been found, for we know that the Romans used lead largely and, as we have seen, pieces of the lead distribution pipes have been found. It is possible, and even likely, that strong cords of hemp were wound round the pipes forming the siphons, as is related by Delorme in describing a similar Roman aqueduct siphon near Constantinople; Delorme also describes, in the aqueduct last mentioned, a pipe for the escape of air from the lowest part of the siphon carried up against a tower which was higher than the aqueduct, and it is certain that there must have been some such contrivance on the siphons of the aqueduct at Lyons. Flachéron supposes that they consisted of small pipes carried from the lowest part of the siphons up along the side of the valley and above the reservoirs, or in some instances, of taps fixed at the lowest part of the siphons. (Professor Hayter Lewis has kindly pointed out to me that Vitruvius describes these air pipes.)

The Romans have been blamed for not using inverted siphons in the aqueducts at Rome, and it has been said that this is a sufficient proof that they did not understand the simplest principles of hydraulics, but the remains of the aqueducts at Lyons, which I have been describing, negative this assumption altogether. The Romans were not so foolish as to construct underground siphons, many miles long, for the supply of Rome, but where it was necessary to construct them for the purpose of crossing deep valleys they did so. The same Emperor Claudius who built the aqueduct at Rome known by his name, built the aqueduct of Mont Pila, at Lyons, and it is quite clear, therefore, that his engineers were practically well acquainted with the principles of hydraulics.

It is thus seen that the Ancient Romans spared no pains to obtain a supply of pure water for their cities, and I think it is high time that we followed their example, and went to the trouble and expense of obtaining drinking water from unimpeachable sources, instead of, as is too often the case, taking water which we know perfectly well has been polluted, and then attempting to purify it for domestic purposes.

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„ III.—G. J. Symons, F.R.S.

EXETER, 1880.

President.

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„ III.—Sir Antonio Brady.

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President.

CAPT. DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S.

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„ III.—Arthur Mitchell, M.A., M.D., LL.D., F.R.S.

GLASGOW, 1883.

President.

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DUBLIN, 1884.

President.

SIR ROBERT RAWLINSON, C.B.

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President.

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CONGRESS AT LEICESTER.

SEPTEMBER, 1885.

PAPERS AND DISCUSSIONS.

CONGRESS AT LEICESTER.

INTRODUCTION.

The Eighth Congress of the Institute was held at Leicester, from September 22nd to 26th, 1885, in accordance with an invitation received from the Town Council.

The buildings devoted to the use of the Congress were conveniently arranged for the meetings. The opening Address by the President, and the Lecture to the Congress were delivered in the Museum Lecture Hall, and the Sectional Meetings were held in the same building.

The Inaugural Address to the Congress was delivered on Tuesday Evening, by the President, Professor F. S. B. F. de Chaumont.

The Lecture to the Congress was delivered on Thursday Evening, by Mr. Ernest Hart, Chairman of the National Health Society.

The papers read at the Congress were divided into three Sections: 1, Sanitary Science and Preventive Medicine; Section 2, Engineering and Architecture; Section 3, Chemistry, Meteorology and Geology; the meetings of Sections 1 and 2 occupying nearly two days each. The leading features of the Sectional meetings are given in the Secretaries' Reports, page 367.

On Tuesday a public Luncheon was provided in the Masonic Hall, Halford Street, presided over by the Mayor, who afterwards opened the Exhibition in the Floral Hall; at the close of which ceremony, visits were paid to Buildings of Archæological interest in Leicester.

A Breakfast was given to the Members of the Congress on Wednesday Morning, by the Leicester Temperance Society, in the Temperance Hall, Granby Street. In the Evening the Mayor gave a Conversazione at the Museum, which was largely attended.

Two interesting Excursions were arranged for Saturday: one to Belvior Castle, and the other to Charnwood Forest, where visitors were entertained at lunch by Messrs. Ellis and Everard.

The Lecture to the Working Classes, by Captain Douglas Galton, was given in the Evening, in the Temperance Hall, Granby Street.

The Exhibition was held in the Floral Hall, Belgrave Gate, which was well situated for the purpose, but a large annex had to be added to it to accommodate all the Exhibits that were sent to the Institute. It was open from Tuesday, September 22nd, to Saturday, October 10th. There were 135 Exhibitors and 1,000 Exhibits. The Judges awarded 5 Silver Medals, presented by the Exeter and Leicester Gas Companies, 29 Bronze Medals of the Institute, 11 Special Certificates, and 81 Certificates. 119 Exhibits were deferred for further Practical Trial, but the awards made for these are included in the figures given above. About 37,000 people visited the Exhibition during the nineteen days that it was open.

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Secretary.

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INAUGURAL ADDRESS.

BY PROF. F. S. B. F. DE CHAUMONT, M.D., F.R.S.,

PRESIDENT OF THE CONGRESS.

IN opening the Eighth Congress of the Sanitary Institute of Great Britain two duties present themselves for fulfilment. In the first place I have to thank the Council of the Institute for placing me in this honourable position, which has heen filled by so distinguished a series of presidents on previous occasions—Richardson, Chadwick, Lord Fortescue, Galton, Humphrey, and Rawlinson. My second duty is, in the name of the Institute, to thank the worshipful the Mayor of Leicester and the Corporation of this ancient borough for their kind invitation to assemble here. We trust that the results of our visit will not be less interesting or less beneficial to this locality than our previous visits to other places have been in the past. The Institute will soon enter upon the tenth year of its existence, and during that period it has made great and important progress. To those who have watched its career it is interesting to see how from small beginnings it has gradually but surely worked itself into a position of prominence and influence in the country. Of course, in its early days it had struggles against opposition, reasoning and unreasoning, carping and ill-natured criticism, and even scornful and contemptuous depreciation. We were called a set of talkers and babblers, venturing to speak, to a public who knew nothing, on subjects of which we knew but little at best. One of our foreign corresponding members remarked on this subject to me on the occasion of our anniversary dinner last July, contrasting the present state of things with that which obtained in the early days of the Institute, when he visited us for the first time, how at that time we had many detractors, and how that some of those who were the least encouraging now see it advantageous to join with us in the good work that we are trying to do. As in every similar case, there were no

doubt mistakes and misfortunes in the beginning, but the ground was entirely new. We were pioneers in a new country, or perhaps, to speak more accurately, we were the first settlers in a country, which had indeed been prospected by other enterprising and intrepid men, but in which no definite settlement had yet been made. It must not be supposed that in saying this I am arrogating to ourselves the honour of founding the science of Hygiene, or of being the first to open up to the people the fountains of health which had lain so long concealed. On the contrary, we freely admit that the search after health, and its literature are the oldest in the world, and on this subject I may refer you to the opening lecture I delivered on the early history of the subject at the Parkes Museum in 1883, published in the *Lancet* of June 9th of that year. But until the Institute was founded in 1876, by a few earnest and far-seeing men, there were no institutions which undertook to bring before the public the vital question of health, both public and domestic. There was indeed the health section of the Social Science Association, and the subject was dealt with, in a more or less casual manner, by other Societies; but there was still room for a special Institution like ours, although the exact scope and definition of its labours were at first uncertain. We did not wish it to be a mere debating Society, or to be an occasion of meeting of experts in the various branches of Hygiene, but to make it a means of bringing the subject home to the community at large, in the hope of interesting each member of it individually in this great question, and of bringing the knowledge already acquired, or that might be progressively acquired in the future, to the amelioration of existing evils, and to the prevention of those which were likely to come. For this purpose it seemed to be a good plan to start a series of Meetings or Congresses, in different parts of the kingdom that might be willing to invite us to visit them, and hear what we had to say. In the year of our foundation, 1876, a Congress of Hygiene of an International character took place at Brussels, in connection with an exhibition of Sanitary and Life-Saving Appliances, on the invitation of the present King of the Belgians. With the exception of one which had taken place in the same City in 1853, under the auspices of the late King Leopold I., that of 1876 was the first Congress of the kind on record, the interval of nearly quarter of a century between them, having been a period of wars of the most severe and bloody character, quite inimical apparently to the more peaceful pursuits of the health and well-being of mankind. But, barren as that interval was of Hygienic Congresses, and fruitful of destructive wars, it was by no means a period of

Hygienic inaction; on the contrary, it was perhaps, the busiest and most eventful, as well as the most usefully productive of any that the world had ever seen. The year 1853 was, perhaps, too soon to interest the community at large, in this or any other country, on the subject of the laws of health. During the quarter of a century that preceded it great efforts had been made, in this country especially, by the work of the Health of Towns Commission and other similar bodies, and a large mass of information and evidence of a very startling character had been brought together; the General Board of Health (with which the name of our venerable friend, Mr. Edward Chadwick, is so honourably associated) had been established, although about again to cease to exist in that particular form. Still the interest of the public could hardly be said to have been sufficiently aroused to the importance of the subject, and when the dreams of the optimists of 1851, who fondly imagined that the Great Exhibition of that year was the beginning of the millenium, were rudely dispelled by the invasion of the Danubian Provinces in 1853, and by the declaration of war against Russia, by this country and France, in the spring of 1854, any one might have been forgiven for thinking that the chances of civil improvements were but small. *Inter arma silent leges*, and when war followed war in quick succession, the Crimean War being followed by the Indian Mutiny, that by the Franco-Austrian War, that again by the Civil War in America, the Danish and German Wars of 1864 and 1866, and finally the death struggle in France in 1870-1, an onlooker might well have imagined that such peaceful and unobtrusive work as the care of the peoples' health might well be forgotten when nation after nation was flying at his neighbour's or his brother's throat. But in the course of this world good often comes of evil, and results are brought about in the most unlikely way. When our army was dying in the snows of the Crimea, or in the crowded hospitals at Scutari, I am sure poor Tommy Atkins, so patient and heroic to the end, never dreamt that his sufferings and death were of more moment to mankind than the overthrow of the proudest throne, for they were to go to the making of an epoch, of a turning point in the health history of the world, to which the most striking and picturesque revolution was a mere transient stage effect. Had not our army perished in the way it did, the true principles of Hygiene might have lain dormant and unfruitful for many a long year, whereas the sacrifice of that unfortunate army has been the means of saving many lives and countless treasure to this and other countries. The various inquiries set on foot culminated in the Royal Commission of 1857, which as it were

brought to a focus the rays of light that up to that time had been somewhat scattered. The "horrible and heart-rending" details of the war were probed to the bottom, and, better and more important still, the whole facts about the life of the soldier were carefully gone into, with a view to the inquiry why he should, at home and in time of peace, die at a rate which was never reached among his civil brethren, except in times of the most virulent epidemic. Those of my own day may say that this is a thrice told tale. True, but it may not be so to the generation that has grown up since that eventful time, and it is indeed connected with so great a triumph of true Hygiene that it can hardly be too often impressed upon the public. The Report of the Royal Commission of 1857 was one of the most remarkable and instructive documents ever furnished to a Government, the investigation being so complete, the inductions so clear, and the predictions as to the future having been so fully justified by subsequent experience. The Commissioners were able to point to certain conditions which they believed to be the causes of the evils complained of, and they further said—"Let them be remedied, and there is no reason why the soldier should not be as healthy as the healthiest in civil life." The recommendations of the Commission were acted upon as rapidly as circumstances permitted, and we are now at a distance of 30 years from the former evil days. What are the facts now? The soldier at that time died at the rate of 18 per 1,000 at home, or, to be a soldier in time of peace was more fatal than to be the inmate of the filthiest and most poverty-stricken parts of our crowded cities. The last return, that of 1883, shows that the death-rate at home is only 6·28, instead of 18, and only 5·28, if we exclude violent deaths—that is, nearly 40 per cent. less than the death-rate of the most healthy districts in England and Wales. Calculating upon 80,000 men, the strength of our home army in 1883, we have 1032 men saved to the State in one year alone—and when we add to this the amount of sickness saved we find that it represents the services of 800 men for a whole year, so that practically a saving of two battalions has been effected. The case may be made even more startling if I state that, at the time I myself entered the army there were dying *of Consumption alone* more men in *two* years than now die from all causes whatsoever in *three!*

The next remarkable war in which we were engaged was the Indian Mutiny, which broke out in the spring of 1857, and found us at grips with both Persia and China. The scenes of that terrible epoch are painful to dwell on, even at this distance of time, and only those who can remember the sensation caused in this country by those events can have any appreciation of the appalling effect they produced. The usefulness or not of the Crimean War has been much discussed, but it was undoubtedly a good thing for us that peace with Russia had been secured a year before the Indian Mutiny, so as to leave us untrammelled in our struggle with the mutineers. The results of that struggle are well known; the rising was quelled, which was indeed a foregone conclusion; the rule of our eastern empire was definitively transferred to the Crown; whilst various changes and re-organisations were made, both civil and military, having for their end the better Government and administration of that vast dependency. But there was another result. The attention of the public was called to the sanitary conditions under which our troops served, and a Royal Commission was appointed to inquire into the matter. The report and evidence was contained in two ponderous tomes, of which a good many copies still exist, although the greater part of the impression was destroyed by fire. There were not wanting good-natured people who hinted that the destruction was not entirely accidental, seeing that the report told too many truths, which it was inconvenient (from the official point of view) that the public should know. We may put such accusations by as being more than absurd, although the truths contained in the report were startling enough. But they had been known and commented upon before by the Medical Staff, too often, however, in vain. The time had now come when nothing could any longer be concealed. The country then learned the price they were paying in European lives for holding India—viz., a death-rate, excluding those killed in action and those who died of wounds, of 69 per 1,000, or a total inefficiency of at least 10 per cent. per annum from death and invaliding, and another 10 per cent., constantly inefficient from sickness, requiring treatment in hospital. Had this existed in the present day the state of things would have been as follows:—The strength of our European army is 56,000; at 69 per 1,000 the deaths would be 3,864, and the annual loss, including invalids, would be 5,600 men, whilst the loss of service from sickness would be equivalent to 5,600 more; total inefficiency, 11,200 per annum. Now, what are the facts? In 1883 the deaths were only 676, or about one-sixth of the above number, and the total losses from death and invaliding, 1,351 instead of 5,600. The number constantly sick was 3,598 instead of 5,600, although in all probability I have under-estimated the older numbers, the returns being somewhat defective. The total inefficiency now is, therefore, barely 5,000, against 11,200, or a clear gain of over 6,000 men per annum. How has this been brought about? Simply by an increased attention to the ordinary principles of hygiene. In former days there

was a convenient popular plan of accounting for disease and mortality by referring everything to the "climate," a plan equally convenient for concealing the neglect and errors of the authorities responsible for the health of the troops, and for excusing and condoning the personal imprudence and excesses of both officers and men. There is a story often told of an Irish M.P., who stated the case in a graphic and forcible way, although with a somewhat egregious bull. He said, "Men go out to India, and eat heartily and drink brandy and water, and get fever and die, and then they write home and say it was the climate that killed them!" The truth is climate was talked about in a more or less glib and dogmatic way, whilst there was hardly a person who could have explained what climate meant if they had been asked to do so. Even to-day most people would be extremely puzzled to give even a plausible definition of it. It is one of the most complex influences in existence. It is made up of questions of temperature, humidity, pressure, velocity and direction of wind, nature of soil, conformation of surface, presence or absence and kind of vegetation, proximity to the sea or to great continents, electrical influences, presence or absence of malaria, and probably scores of other things of an obscure or unknown nature. Its variation is practically infinite, and the integration of its many factors well-nigh impossible. No wonder it was credited with all sorts of malign effects upon the human constitution, all the more believed in because they could not be understood—in fact, it became a fetish, and was worshipped as such. It was one of the great functions of the commission to examine into this mysterious superstition, and once for all to shatter the idol that had done so much evil. The commission showed that so many unhygienic conditions existed that it was idle to talk of the influence of climate until those were dealt with and removed. In fact climate, *plus* all sorts of unhealthy factors, had had its day, and it was high time that hygiene should have hers, and see whether she or climate was to win in the struggle. The result has fully justified the anticipations. India is now more healthy than service at home was thirty years ago, and it has been clearly demonstrated that, other things being equal, climatic influences stand for remarkably little in affecting the health, compared with the inordinate importance attached to it but a short time ago. "Acclimatisation" is shown to be more or less a mere notion, at least in the interpretation hitherto given to it; and it is now recognised that there is hardly a corner of the earth where man cannot maintain health and energy, if his mode of life be conducted on hygienic principles. There are, no doubt, influences of locality, such as malaria,

but even those can be combated, apart from such direct methods as drainage and the like, by cultivating the resisting power of man's own constitution by a course of true hygienic living. In India were found the same evils as at home—unwholesome, badly-ventilated dormitories, unsuitable clothing and unlimited rum, not to speak of impure water, bad conservancy arrangements, and absence of occupation, every factor being aggravated by high temperature and malarious poisoning.

Much of this has now been changed, excepting of course the so-called climatic influences, which remain the same as in 1800, and the result is we have a death-rate of 12 per 1000 (in 1883), instead of 69 as formerly; the average for the last ten years being less than 18, or under the home rate of thirty years ago. There is still much to be done, for even these rates are too high, but the past gives great hope for the future: "There is always "a *yet* in each *hereafter*."

Let me cite another instructive instance, although on a less important scale, I mean the experiences of our troops in the West Indies. Those beautiful islands, which might have been an earthly paradise, were looked upon for years as a perfect charnel-house. To be ordered to the West Indies was a punishment that was little less than sentence of death, for the chances of life were small at the best, and then there was no regular relief of troops as there is at the present time. Fevers, dysentery and other diseases, with periodical outbreaks of yellow fever, and, in later times, of cholera, were among the fatal causes of the exceptional mortality. Here again of course the climate got the chief blame. But what were the real facts? The barracks were placed on unhealthy sites, the accommodation in the dormitories would have been disgraceful even in a cold climate, the rations were almost invariably salt meat, the use of fruits and vegetables was discouraged if not forbidden, the drinking water was often foul and impure, and the rum practically unrestricted. Of the accommodation in barracks I may cite the words of Sir Alex. Tulloch: "A barrack at Tobago, the best in the whole Windward and Leeward command, had the following dimensions in 1826: superficial space per man, 22½ ft.; breadth, 23 ins.; cubic space, 250 ft." "The men," says Dr. Parkes, "slept in hammocks touching each other. In these barracks, crowded as no barracks were even in the coldest climates, there was not a single ventilating opening, except the doors and windows. With this condition of atmosphere, it is impossible not to bring into connection the extraordinary amount of phthisis which prevailed in the soft and equable climate of the West Indies. There was more phthisis than in England, far more than in Canada." Soon after this some improvements took place, and

we find in Dr. Balfour's abstract, published in 1862, a comparative table of death rates, from which it appears that the mean death rate in Jamaica previous to 1836 was 128 per 1000 (rising sometimes to 307), whilst between 1837 and 1855 it had fallen to 50·8, still an inordinate figure, but a great improvement upon former times. In the Windward and Leeward command, the fall had been from 81·5 to 62·5. At present, just thirty years later, the rate is only one-fourth of this improved rate, a mean of 15.76, and an actual ratio in 1883 of only 14·44. Some of the individual items are particularly instructive. Thus *fevers* killed in Jamaica before 1837, no less than 101·9 per 1000, after 1837, only 36·9. In the present day in the West Indies the ratio for ten years, 1873–82, even including yellow fever outbreaks, is 9·30 per 1000 per annum,* and for 1883, only 8.42. Consumption killed 10·4 per 1000 before 1837, and 8·6 after that year; the deaths in 1883 were only 1·2, and the mean of the four previous years only 0·57. Even including invaliding, we have a loss of only 6 in 1883, and under 3 as an average of previous years. The number of troops kept in the West Indies is now small as compared with former years, but the above will show what a modest part so-called "climatic conditions" play as a factor in mortality. Many years ago the present Director-General of the Medical Staff, Sir Thomas Crawford, K.C.B., in a very able paper in Vol. II. of the "Army Medical Reports," drew up a table of disease factors from his experience at Secunderabad, with reference to zymotic diseases, in which he tried to apportion to each its percentage of numerical importance. Thus, taking all the factors together to value 100, those which were due to errors beyond the control of the individual, but remediable by the authorities, were taken to value 35; personal errors under the control of the individual himself, 34; agencies undefined and contingencies, 6; peculiarities of climate, 25; so that 69 per cent. was recognised as distinctly remediable, and only 25 as due to climate. This was quarter of a century ago; I think that in the present day climate would figure for even a smaller amount. It is true that there are some pestilential spots, such as the West Coast of Africa, which are especially dangerous to life, although even there preventive measures are capable of largely mitigating the danger. But, putting these on one side provisionally, we may confidently say that there is not a spot on the globe, where men may not be kept in health and vigour by proper attention to hygiene.

* Omitting 1881, a year of yellow fever epidemic, the average is only 5 per 1000.

These, then, are some of the advantages derived from the dire struggles into which we have been plunged, struggles which taught us lessons by which we have profited in the field, so that the subsequent minor wars we have waged have been carried out with a much smaller expenditure of life and health than has ever before been known in the history of the world.

I have dwelt somewhat upon the military aspect of this great question, partly because I have been myself intimately connected with it for more than thirty years, but still more because of the interest attached to it, both historically and practically. In the public service we have to deal with bodies of men whose history is known, whose ways of life are so far uniform, and who are, therefore, more distinct and definite objects of observation than can be the case in civil life. From the experience thus gained all have profited, as could easily be shown in much more detail than the scope of such an address as the present would properly warrant.

The period that I have been considering between the two Hygienic Congresses at Brussels, in 1853 and 1876, was fruitful of sanitary legislation at home, and in 1875 the Public Health Act was passed, an attempt to consolidate legislation on the subject, which, with all its imperfections, was a successful one, and forms a sound basis for future work. The passing of that important Act made it, on the whole, easier to start an Institution like ours than it could otherwise have been, the more so that its foundation coincided with the second Brussels Congress, destined to be the first of an important series of International Meetings which have since taken place biennially at Paris, Turin, Geneva, and The Hague. We may hope that before many years are over London may be chosen as its place of meeting, the only wonder being that this has not taken place before now, considering the prominent part this country has played in modern sanitation.

Important as such International Congresses are, seeing that they afford opportunities for bringing before the representatives of different countries large questions affecting the sanitation of the world, as well as that of individual states, it was felt that there was still room for more limited meetings at home, by which practical questions might be popularised and the whole system of hygiene made familiar to the people. The subject is one that requires to be presented as often and in as simple a form as possible, so that it may make an impression on the popular mind, in order that legislation may carry it along with it. For it is little or no use legislating too far ahead of the knowledge or feeling of the people. For this purpose our Institute started a series of Autumn Congresses in different

parts of the country, in connection in each case with an Exhibition of Sanitary Appliances, so that practical illustrations might be provided of the principles enunciated at the lectures and addresses or in the sections. Our first Congress was at Leamington in 1877, and that was followed by others at Stafford, Croydon, Exeter, Newcastle, Glasgow, and Dublin. The only blank year was 1881, when the International Medical Congress in London, and the great Medical and Sanitary Exhibition at South Kensington, seemed to render an additional Congress and Exhibition a doubtful success. The fact that the International Health Exhibition of last year in no way interfered with the success of our meeting in Dublin, but rather strengthened it, is, I take it, a proof of the increasing interest in the subject which even in this short interval of time has been evinced. After meeting two years in the sister kingdoms we have now returned to the heart of England itself, where, I doubt not, our labours will be crowned with a success not inferior to that of any former occasion. You will have the advantage of hearing lectures from Mr. Ernest Hart and Captain Douglas Galton, C.B., as well as addresses from the presidents of sections, in which capacity we have had the advantage of securing the services of such men as Professor Ransome, Mr. Gordon Smith, and Dr. Marcet, representative names which would of themselves secure the success of our meeting.

The Institute, however, has not considered that the arrangement of annual meetings like this has been sufficient for the work before it. Meetings and addresses have been given from time to time in London, and we hope that the time is not far distant when something like a school may be established, with a staff of teachers, laboratories, museum, &c. For this purpose it will be necessary to gather together into one centre the scattered efforts which are being made in the same direction, but which are at present, from want of union, somewhat dissipating energy in an unproductive way. Let us take the motto of the kingdom which initiated Hygienic Congresses: "L'Union fait la Force." The Sanitary Institute finds its complement especially in the Parkes Museum, with which it is already in somewhat close connection; and we hope soon to be able to make the union permanent, so that a really great central institution may be formed, which shall be a centre of instruction, and sufficiently powerful to make its views and opinions heard and respected by the State and among the people. In the meantime, the Sanitary Institute is doing an important work in offering certificates of competency, on passing examinations, to those officials who are entrusted with the carrying out of local sanitary work, I mean surveyors and inspectors

of nuisances. It is a remarkable fact that at present there is no official recognition of the competency, or the necessity for the competency, of any of the officers connected with sanitary work. The medical officer of health, the local surveyor, and the inspector of nuisances may, each and all, be appointed without showing any proof of sanitary knowledge, and are indeed sometimes appointed without the possession of it. To remedy this, the universities and other corporations, granting diplomas in medicine, offer certificates of proficiency to medical men who are on the Register and who can pass the prescribed examination. Those certificates are not yet rendered compulsory, but we trust they may be so ere long. Until, however, the Sanitary Institute stepped forward there was no similar means applicable to the local surveyors or inspectors; but now for a number of years past periodical examinations have been held, and the increasing number of candidates has shown the growing appreciation of the value of the certificates offered. As to the necessity of them I can vouch personally, for I have been for a number of years an examiner, both of this Institute, and also of other public bodies granting certificates to medical officers, and in all the different classes of candidates ignorance has been displayed, by some at least, to a degree that would be surprising to those inexperienced in such matters. It is, however, eminently satisfactory to note the progress that is being made, both in the better preparation that the candidates bring to the examinations, and in the fewer numbers that we feel compelled to reject. We earnestly hope that the time is not long distant, when it will be compulsory on all sanitary officials to show undoubted proof of their competency for office, before being entrusted with the health of the people, and the expenditure of their money. There is, however, another point in which reform is required, and that is the appointment and tenure of office of medical officers of health. Whilst we ought to insist upon their giving proofs of their competency, we must make their posts such as would be worth holding by men of special knowledge and training. The present system of uncertain tenure must be abolished, as well as the practice of appointing men in medical practice to small districts at a nominal salary. The country must be divided into large combination districts, so as to be sufficient to occupy the entire available time of a competent medical officer, who should be well paid, and irremovable except by the Local Government Board, on good cause shown and ample inquiry. There is no more reason why the medical officer of health should be under the control of local bodies than the county court judge, or any other similar official. That these and other changes will be brought about in time I

have no doubt, but at present our sanitary work is in a tentative and inchoate state, although progressive experience is gradually showing the direction in which alterations should go. The importance of the Health Department of the State is becoming more and more evident, and the success which has attended its labours up to the present time demonstrates the propriety of advancing its position to that of one of the great Departments of Government. We have even now, in the office of the President of the Local Government Board a *quasi* minister of health, but as sanitary knowlege progresses the position must be vastly increased in power and in importance.

The advantages of *unity* in administration, both as a question of efficiency and of expense, have been much dwelt upon by our friend and veteran sanitarian, Mr. Edwin Chadwick. There can be no question that a more uniform and united system would greatly add to the efficiency and materially diminish the expense of sanitary work. But the apparent outlay is not all, for the indirect expense produced by inefficiency is vastly greater than any direct outlay likely to be incurred, however extravagant. A premature death is reckoned overhead as a loss of £100, and if it is the head of the house and the breadwinner, it is evidently much more. If we double this estimate it will be less than the probable coincident damage, due to the loss of time from the proportionate amount of sickness which each death represents. There are about 750,000 deaths every year in the United Kingdom, about one-half of which are deaths of children, or of persons in the unproductive periods of life, if the remainder, pretty nearly one-third are distinctly preventible. Could those deaths be prevented we should save (on the above calculation) a sum of 25 millions per annum, or little short of the amount we pay yearly for the interest of the National Debt. Other calculations have brought out even higher figures, but they all agree in one thing, viz., that we are, as a nation, paying yearly an enormous sum for our sanitary shortcomings, a sum undoubtedly less than we used to pay, but still very large, a sum, too, that would rapidly increase if our vigilance were in any way relaxed. It is the aim and object of sanitation to reduce and, if possible, to extinguish this gigantic burden, which represents about one-sixteenth of the entire taxable income of the Country. But even this is not all, for besides the immediate losses from sickness and mortality, we have the remoter effects in weakened health and enfeebled offspring, every lowering of the health standard preparing a fertile soil for future disease and the perpetuation of the scourges of humanity. We may, however, take comfort from the good results that have arisen from such united effort as has already been put

forth, and we may congratulate ourselves on the progressing diminishing mortality generally, and the control which has been established over some of our most virulent diseases. Much, of course, is due to the increasing well-being of the poorer classes, in spite of the outcry about depression of trade. Such ebbs and flows are inevitable, but on the whole the people generally, are better off now than they have ever been, at any rate within any period of which we have trustworthy records. It has sometimes been said that the rural population were better off in former times when the population was less. In some particulars this may be the case, but I think on the whole the balance is in favour of the present day. If I should be wrong in this view, then it only strengthens the other part of the argument, viz., that the sanitary efforts of modern time have been even more productive of benefit than they seem to have been at first sight. Our statistics before this century are very imperfect, but it has been shown by comparison of the bills of mortality that the death-rate in the metropolis in the 17th century was between 70 and 80 per 1,000 per annum; in the 18th century it fell to about 50, and towards the end of the century to about 30. At the time of the commencement of systematic registration about 50 years ago, the death-rate was more than 25 per 1,000 (actually 29·55 in 1838, and 25·63 as the average of 5 years, viz., 1838-42), whereas the whole of England was only 22·60 in 1838, and 22·02 of the five years, 1838-42. Quarter of a century later the rates were—for London, 22·6; for England and Wales, 21·7; and the great towns, 23·4. London was therefore healthier than the average of the other great towns, and only 5 per cent. behind all England and Wales, whilst in the earlier period it was 17 per cent. behind, and in 1838, 33 per cent. behind the country generally. In the later returns the figures are even more satisfactory, the London death-rate being only 21, or about the same as that of the country generally. We must remember also that this improvement has taken place with a progressively increasing number of persons in the area concerned, even although the area is also continually extending. In 1831 there were less than 44 persons to an acre in the metropolis, and in 1841 just under 46. In 1883 there were 52·5, and at present probably over 54. In 1883 the area per head was only 92·2 square yards, and the proximity, or distance from person to person, if equally distributed over the area, was $10\frac{1}{4}$ yards, or nearly 31 feet. At the present time it is probably not more than 10 yards or 30 feet. Now, Dr. Farr, has made some remarks on the mean duration of life, which may be useful as a means of comparison. He has shown that the mean duration was very nearly equal to a formula which may be most

simply stated as the sum of two-thirds of the reciprocal of the death-rate, and one-third of the reciprocal of the birth-rate. Stated thus the mean duration of life in England and Wales is now about 41 years, and that of the metropolis is very nearly the same. Of course, a general statement like this includes extremes—for instance, in St. George's-in-the-East, the most crowded district, the mean duration of life is only 28, whilst it is double that in Kensington or Hampstead. Again in Liverpool, our most crowded City, it is 34, and the same in Manchester, whilst it is 48 in Bradford, and 47 at Bristol, and 44 here at Leicester. But to determine the relative healthiness we may apply another test derived also from a formula of Dr. Farr's. If we take the whole of England and Wales we find that there is a little under 1½ acres for each person, which gives a proximity of 91 yards or 273 feet. Then for every other proximity we may find the probable mean duration of life by multiplying the rate for England and Wales by a factor consisting of the proximity of the new district divided by the proximity of England and Wales, the fraction being first raised to the 0·24 power. Now, the rate for all England and Wales being 41, we find that, if conditions were equal, the crowding in our towns and cities would produce the following rates:—

	Proximity	Calculated Mean Duration of Life.	Actual Mean Duration of Life.	Difference.
London	10 yards.	24 years.	41 years.	+ 17 years.
Liverpool	6¾ ...	22 ...	34 ...	+ 12
Manchester	8 ...	23 ...	34 ...	+ 11
Bradford	16½ ...	27 ...	48 ...	+ 21
Bristol	10¾ ...	24½ ...	47 ...	+ 22½
Leicester	11 ...	24¾ ...	44 ...	+ 19¼

and, of course, worse rates in the most crowded parts. Thus in St George's-in-the-East, London, where the proximity is about 5 yards, the rate would be only 20, whereas by the other calculation it is 28, or a balance in its favour of 8 years. We thus see that in spite of many shortcomings, the health of our towns is better than might have been expected from the crowding together of so many people on a limited area. On the other hand, if we were to reverse the formula and calculate out the proportionate duration of life in the whole country from the data of, say, that of London, we should find that it ought to be 69½ years; from the Liverpool data, 63½; from Manchester, 61; from Bradford, 72⅓; from Bristol, 78½; and from Leicester, 73. We should thus be getting very near the rates of Dr. Richardson's Hygeia or Salutland; such rates are not at all impossible, although they may be remote. Thus most sanitarians agree

that the death-rate is capable of being reduced to 15 per 1,000 by the reduction of preventible disease. In that case the mean duration of life would be fifty-four years instead of 41; whilst a reduction to 12 per 1,000 would raise the mean duration of life to 65; 11 would raise it to 70; whilst a ratio of 8 per 1,000—a rate seriously contemplated by Mr. Chadwick—would bring it up to 93, and a fractional amount below 8, would establish the ideal 100 years, which is now held to be the normal life of man. To return, however, to our comparison of the duration of life, we find one or more of several possible inferences: (1) The formula may not be sufficiently general in its application to give trustworthy results; undoubtedly its application is to some extent limited, but still it is an approximation which may be used with some confidence, except in remarkable and improbable extremes. (2) The comparison shows that crowding together in an area, at least within certain limits, is not necessarily a danger *per se*, but only becomes so when accompanied with sanitary neglect. It is so obviously requisite, in a populous area, that sanitary measures should be carried out for the public benefit, that there is better chance of their being so with some stringency than in a scattered district. (3) The greater unity of action and possession of more ample powers in concentrated communities tend markedly to improve sanitary conditions, and this forms a strong argument for making the powers of local authorities equal throughout the country, and for abolishing the distinction between urban and rural districts. On this part of the question, however, I do not propose to dwell further, as I believe this important subject will be brought before you later on by a speaker who is eminently qualified to deal with it, Mr. Ernest Hart.

I have spoken hitherto chiefly of general death-rates, but these, although valuable, are less sure marks of improved sanitation than particular death rates, and more especially those from particular classes. The three most significant are: (1) the deaths of children; (2) the deaths from consumption; and (3) those from zymotic disease. They are the most significant because they are the most preventible by hygienic measures. It will be impossible to do more than say a few words about each. (1) As regards the death rate of young children: the large preponderance of their deaths is still a blot upon our social system, and I am sorry to see that Leicester has an unfortunate notoriety in this direction. For almost all zymotic diseases children form the most sensitive barometers, and they are generally the first to show symptoms of derangement if insanitary conditions are present. One of the most constant of children's disorders is diarrhœa, with which is

associated typhoid fever, often returned formerly as infantile remittent fever. This diarrhœa is partly due to insufficient and improper feeding, but it is also largely dependent upon insanitary conditions connected with bad drainage and impure water supply. As I see from the registrar-general's returns, this cause of mortality is greatly prevalent in Leicester. We shall be interested to know the particulars from those whose local experience may be able to throw light on the subject. Other children's diseases, which are believed to be dependent upon special contagion, such as measles, scarlet fever, whooping-cough, &c., are also greatly influenced by unhygienic conditions, and to some extent their greater or less rapidity of spread is an index of good or bad sanitation, although we may not at present be able to explain many of the apparently capricious phenomena which start up from time to time. Some of those curiosities of infection, as we may call them, are dependent on individual idiosyncrasy, about which at present we are almost entirely ignorant.

(2). The second group of importance is that of consumption, the disease of all others most constantly fatal, if we except diseases of the lungs and air-passages other than consumption; about 18 per cent. of all deaths are due to diseases of the respiratory system generally, and about 10 per cent. to consumption. In later years the ratio has somewhat diminished, and that fairly steadily.

In 1850-4	the consumptive deaths were		12·6	% of	the total deaths.
„ 1855-9	„	„	12·0	„	„
„ 1860-4	„	„	11·5	„	„
„ 1865-9	„	„	11·1	„	„
„ 1870-4	„	„	10·4	„	„
„ 1875-8	„	„	10·0	„	„
In the 25 years 1850-74		„	11·5	„	„
In 1881	„	„	9·6	„	„

From the beginning of this period the proportion has diminished more than one-fifth, or from 12·6 per cent. of total deaths to 9·8 per cent., a diminution actually of 22 per cent., the number of deaths per 1,000 being also smaller. For the twenty years, 1850-69, the average death-rate from consumption was 2·64 per 1,000 living. In the ten years following it was only 2·22, or a diminution about 16 per cent. Now what are the causes of consumption? Three main causes have been assigned, viz.: (1) Hereditary pre-disposition; (2) Faulty nutrition; and (3) Impure air. I do not propose to discuss the *first* cause, partly because it is too difficult a question to treat of in the time at our disposal, and partly because it is less directly

connected with the immediate subject on hand. I would only say that the fact of hereditary pre-disposition is pretty generally recognised, and that it is only by improved sanitary conditions that there seems any chance of mitigating or extinguishing it. Of the *second* cause much has been written; and there can be no doubt of the fact that faulty nutrition is a very important factor. Indeed, one physician attributed consumption to the high price of butter in England, and the success which has attended the administration of additional digestible fat, in the form of cod-liver oil, is a proof so far of the correctness of the opinion. But the most important factor of all is undoubtedly the *third*, namely, impure air, the rebreathing of air already charged with the impurities of respiration and transpiration. Such impurity appears especially to favour the growth of the bacillus which has been shown to be the probable active agent. I think we may therefore justly infer that the diminution in consumptive complaints is due to the improvement in the well-being of the community, and the better housing of the poor. Consumption, however, is a disease of the rich as well as of the poor, and in the case of the former it has been largely favoured, if not caused, by their being too well housed, in the sense that there has been too great a barrier between their living and sleeping rooms and the external air. The best security against the development or propagation of the disease is free ventilation, and the avoidance of course of chilling draughts. On this subject the experience of the army is very instructive. Before the Crimean War the annual death-rate of the army at home was 18 per 1,000, and of these deaths nearly 8 or 44 per cent. were from consumption. But this did not represent all, for some men were invalided, who died as civilians, and if we add these, we should have a loss of at least 100 per cent. more. This would bring the loss up to at least 16 per 1,000 from consumption alone. The data, however, are imperfect. The Royal Commission of 1857 showed clearly that this inordinate amount of disease was due chiefly to the bad ventilation of the dormitories, and steps were taken to remedy this as soon as was practicable. Accordingly, in 1861 the consumptive deaths were only 3·1 per 1,000, and the invaliding about 8 per 1,000, or a total loss of 11 per 1,000. In 1883, our latest information, we find that the deaths were only 1·72, and loss by invaliding 3·47 per 1,000, or a total loss of 4·19 per 1,000. In the same year the total deaths from all causes of disease were only 5·28 per 1,000—one-third less than the deaths from consumption alone thirty years ago. But satisfactory as the results of sanitation have been, we are not at all entitled, nor are we inclined, to rest and be thankful. We have still before us the

fact that our consumptive death-rate among the troops is excessive. I have already shown that the total loss (including deaths and invaliding) amounts to over 4 per 1,000, and accounts for rather more than one-half of the total loss by deaths in the army and invaliding for consumption. Now, in civil life, among men of soldiers' ages, we find that the deaths from consumption are under 3 per 1,000 (2·94) as against over 4 (4·19) in the army, including the invalided in the latter, which in most cases are ultimately deaths. These deaths are included in the civil total, the figures of which are not appreciably altered thereby; but they must be reckoned against the army to make a fair comparison. Now the most unhealthy districts of England show a death-rate (at the ages referred to) of only 5 per 1,000, whilst the most healthy show less than 2. We are therefore losing in the army, from consumption, 115 per cent. more than the healthiest districts of England; we are losing 43 per cent. more than the general average; and we are losing only 16 per cent. less than the most unhealthy districts, the ages and sex being the same in both cases. Nor is this all, for we have losses from diseases of the respiratory system which are largely due to the same causes as consumption, notably, insufficient ventilation. Our ratio of loss and invaliding amounts to 2·2 per 1,000 per annum—a much larger proportion than in civil life. Thus, from consumption and diseases of the respiratory system, we reckon just one-fourth of our total annual loss. Now, I have no hesitation in saying that this is largely due to the insufficiency of ventilation which still exists, and also in part to the insufficiency of the rations issued, particularly to young soldiers. The power of resistance to disease influences is thus diminished, and many men succumb who might undoubtedly be saved. Of course this cannot be remedied without additional outlay, but it would be a wise economy in the long run, and a benefit both to the individual soldier and to the state.

The *third* group of importance is that of *Fevers*. And here we are met with some difficulties in making comparison with the older statistics, in which the different kinds of fevers are less clearly defined. Under this head there are three distinct forms, viz:—Relapsing or Famine fever, Typhus fever, and Enteric or Typhoid fever, besides an anomalous class called Common Continued Fever, which will probably diminish or disappear as diagnosis becomes more accurate. Relapsing fever, the old Synocha, is not common now in this country, depending as it does mainly on actual starvation, but it was very common in former days, and in particular in Ireland during the terrible famine period forty years ago. Typhus fever, also called

spotted fever, putrid fever, jail fever, &c., was only too common when I began to study the profession. It is a disease connected with destitution, crowding together, and dirt. Once started, however, it is capable of being communicated by direct contagion in a very rapid and fatal manner, and this by individuals not themselves the subjects of the disease, as witness the story of the Black Assizes at Oxford. It is looked upon as the most contagious of all known diseases, but fortunately its contagion does not spread far. It is most completely amenable to Hygienic measures, for it is generally sufficient merely to scatter the population and allow free aëration to put a stop to it. Accordingly it has now become very rare in England, although we have occasional small outbreaks in crowded cities, such as Liverpool and Dublin, when there is much poverty and wretchedness. But a much more important disease is Enteric or Typhoid fever, which was up to 40 years ago confounded with Typhus (and is still called Abdominal Typhus on the Continent). By the labours of Stewart, Jenner, and others it was definitively separated, but continued to be merged in the group of fevers by the Registrar-General until the year 1869. This disease, we now know, owes its origin to a very different cause from true Typhus, being a disease connected with bad drainage or insufficient removal of excreta. It turns up in all parts of the world and harasses troops whenever they are gathered together. Its presence is a very sure indicator of insanitary conditions. It attacks the young by preference, although the old are not entirely exempt from it, and it is as much a disease of the palace as of the hovel. If we take the group of continued fevers and compare the statistics at different times we shall find the following results:—

In 1842, taking the male population of England and Wales at the ages of 15 to 35, we find the total deaths to be 8·4 per 1000, the fever deaths 1·09 per 1,000, and the ratio of fever deaths to total 12·4 per cent.

In 1855, the total death-rate was 7·6, the fever deaths 0·675, and the ratio of fever deaths to total 8·9 per cent.

In 1881, the total death-rate was 6·55, the fever deaths 0·356, and the ratio of fever deaths to total 5·1 per cent.

Thus the fever rate in 1855 was 38 per cent. less than in 1842, and that in 1881 was 47 per cent. less than in 1855 and 67 per cent. less than in 1842. The proportion to total deaths was 28 per cent. less in 1855 than 1842, whilst in 1881 it was 43 per cent. less than in 1855, and 67 per cent. less than in 1842. Much of this diminution is no doubt due to diminished Typhus and simple continued fever, the improvement following very much on the same lines as that

which has apparently diminished consumption. But we shall find a sensible diminution in the Enteric rate above, for in 1869, the first year in which it was separated, we find that the deaths were 390 per million living, whereas in 1881 there were only 212, a fall of 46 per cent. or 44 per cent. if we allow for the former erroneous return of cases among children as remittent fever. Now this improvement means emphatically improved drainage and excreta removal, but the fact that we still lose some five or six thousand lives per annum in England and Wales alone, shows how much still remains to be done.

In the army we formerly suffered much from fever even at home; 40 years ago the deaths were 2·4 per 1,000, and they formed 14 per cent. of the total deaths. In 1860 the number fell to about one-fourth, only 0·64 against 2·4, and 6·4 per cent. of the total deaths against 14. In 1883 the numbers had still further fallen to 0·25 per 1,000, (0·24 Enteric), and the ratio to total deaths 4·1 per cent., or taking Enteric alone 3·9 per cent. This compares favourably with the civil returns of males at the same ages, among whom the ratio is 0·301 per 1,000, or 25 per cent. higher than the army ratio. The proportion of fever deaths (Enteric) to total deaths is almost the same, viz:—4·12. Now, this gratifying improvement can be distinctly traced to two main things, viz:—improved drainage and improved water-supply; with these Enteric fever soon disappears. One satisfactory instance I may cite, viz:—that of the Royal Marine Artillery Barracks at Eastney, among the finest in the kingdom. It is 21 years since they were first occupied, during the first 14 of which they were never free from Enteric fever. In 1878 they had a very severe attack, which cost several lives. In conjunction with my former colleague, Professor Macdonald, now Inspector-General of Hospitals and Fleets at Plymouth, I made an inspection of the place, and we found the drains in bad order and totally unventilated, except into the dwellings by the sinks and waste-pipes. We made certain recommendations for remedying the evil, and those recommendations were at once carried out under the direction of Col. Crease. The gratifying result has been that for the last seven years up to the present time there has never been a single case of Enteric fever arising in the barracks, although the disease has been frequently present in the houses around them. The state of the Portsmouth drainage is very bad, but an improved scheme has been decided upon, and when it is carried out I think in all likelihood Enteric fever may disappear as it has already done at Eastney. But in spite of the progress already made Enteric fever still kills about 8,000 persons every year in the United Kingdom, and seriously injures many more, each case of death implying from 8 to 10

attacks, so that there still remains plenty to be done before we get rid of this scourge. Our experience also in recent campaigns shows how quickly the disease declares itself, when a number of men, especially young men, are brought together in circumstances which render good sanitation difficult, as must always be the case in war.

There is another disease, however, which carries to the public mind a much greater dread than even fever, and that is epidemic cholera, which has lately committed such ravages in Spain, and may possibly reach our shores by-and-bye. The terror which cholera inspires is due to the appalling suddenness of its invasion, as well as to its great proportionate mortality. The rate of mortality varies, being very great generally in the early part of an outbreak, and comparatively small towards the close. I have known 22 cases die out of 24 attacks, or 92 per cent., but my experience as a whole has been that about 63 per cent. die, or very nearly two out of three. Others put the rate at less, but up to the last few years it was not reckoned at less than one-half, or 50 per cent. In the recent epidemics in Italy, France, and Spain, and, I think I may also add, in Egypt, the death-rate was much less. Even in Spain it has only been one in three, whilst in France it has been still lower, sometimes only one in six. Whether this has been due to cases being returned as true cholera which would formerly have been called diarrhœa, or to a milder form of the disease, I am unable to say; perhaps both causes may be at work. Even as it is, it is bad enough, and we may get some idea of its ravages in this way. Suppose Spain to have a death-rate (normal) of 22 per 1000, about the average of this country up to recently, then she would have about 1000 deaths a day as the usual death-rate, but she has been losing from 1500 to 2000 lives from cholera alone, and altogether, up to the end of August, some 80,000 persons or more had perished in a population of 16 millions, so that the death-rate was being more than doubled. Our normal death-rate in this country is about 16,000 a week: if cholera prevailed in the same ratio as in Spain we should be losing some 25,000 a week from that cause alone, and the total death-rate would be between 40,000 and 50,000. This naturally leads us to consider what condition we are in to resist this formidable invasion. Cholera has visited Europe six times, including the present epidemic, and in 1832, 1849, 1854, and 1866, it prevailed in this country; but in 1873 and up to the present time in the existing epidemic it has not been able to make good a footing. It is chargeable, during the last 54 years, for the deaths of about 180,000 persons in the United Kingdom, or perhaps 200,000 if we add in the increased diarrhœa which

always accompanies it. This number divided by 54 years gives 3,700 a year. But in those 54 years the deaths from fever were higher in the aggregate, the enteric cases being three to four times as great and the total amount still higher. Even in epidemic years the deaths from fever sometimes equalled those from cholera; for instance, in 1854 there died in England and Wales 20,000 from cholera and 19,000 from fevers, and in 1866 there died 18,000 from cholera and 21,000 from fevers, or, in the two last epidemics the total cholera deaths were 38,000, whilst the total fever deaths were 40,000. Observe, too, that this group of fevers does not include scarlet or other eruptive fevers. Altogether, the deaths from fevers in the United Kingdom during these 54 years cannot have been less than a million and a half, or eight times the mortality due to cholera. We have thus had a constant enemy to deal with, the mere familiarity with which has bred a certain degree of contempt. On the other hand the more impressive onslaught of cholera has roused us from time to time to more vigorous action, to such an extent indeed, that we may say that cholera has been more of a blessing than a curse, and that it has saved many more lives than it has killed. The action which was found necessary on its account has been fruitful in diminishing other diseases favoured or propagated by insanitary conditions. The epidemic in the year 1849 was the most severe wave of cholera that has ever spread over the world, and the mortality of that year was the highest we have ever had. In 1854 the loss was very much less, and in 1866 it was smaller still. In 1873–5 the disease was spread over the continent of Europe, but although frequently introduced into this country, it never managed to find a foothold. And in the present time the disease has existed since 1882 in Egypt, Italy, France, and Spain, but it has not established itself here, in spite of our constant intercourse with those countries. The result is doubly interesting, because it proves on the one hand the utter futility of quarantine by land or sea, a point we have long contended for, and on the other the paramount importance of hygienic measures. Quarantine has never been practised by us since 1832, and even then it was only in a partial way. In other countries where it has been rigidly and vexatiously exercised, it has been quite inadequate to keep out the disease. In fact it has tended to foster it and to increase the danger. The truth is, it is wiser to render the soil sterile to the seed than to try vainly to keep out the seed by clumsy expedients, which are about as efficacious as if a tortoise were set to catch a butterfly. We have wisely in this country devoted our expenditure to internal sanitation, to the provision of pure water and good drainage, and such other

measures of sanitation as have been found practicable. One learned German professor thinks we have gone too far in this direction, and that we should be all the better for a little dirt in our dwellings, with a nice damp basement and a cesspool or two, to which he was inclined to attribute the immunity of some towns in Southern Europe from epidemics. I think, on the whole, however, we shall continue on our own path, remove dirt where we can, and generally wash and be clean. Judging from the past, I think we may have good hope for the future, for we are far better situated for resisting an epidemic than we ever were before. The government organisation for information of the arrival of cases of disease and for inspection is far more complete, whilst the local conditions of our towns and villages, although leaving much to be desired still, are vastly improved since 1866, and even since 1873. It is not well to boast, but I think we may look upon the progress of cholera with calmness, feeling assured that the chances of its spreading among us are but few, not only because we ourselves are better prepared, but also because improvements have been going on in other countries which have usually been the channels through which the disease has filtered towards us. I am also in strong hopes that the present cholera-wave will go far to give a death-blow to the pernicious absurdities of quarantine; in fact, the sitting of the International Conference at Rome in the spring of this year showed that our principles were spreading abroad and that quarantine has received a shake from which it is not likely ever again to recover completely. And even in Spain the government has ordered the abolition of land cordons, although the ignorance and terror of the people and of the provincial governments have in some cases led to disregard of the order.

Some interest has been excited by the asserted success of the process of inoculation as a preventive against cholera, as practised by a Dr. Ferrán. The practice is based on the supposition that the comma-bacillus of Koch is the real cause of cholera, and that by specially cultivating it a mild form of the poison may be obtained, which, when inoculated, confers immunity from the disease. Even if this were considered proved, the way in which the process has been carried out in Spain has not commended itself to the medical profession, no real scientific investigation having been made. But that the comma-bacillus is the real cause of cholera is very far from being proved as yet. There is also another difficulty—viz., that one attack of cholera does not confer immunity from another, although Dr. Cameron, M.P. for Glasgow, has striven to show the contrary in a paper in the *Nineteenth Century* of August last. The prophylactic inoculation, however, is not impossible, provided such immunity can be proved even in a partial way; and this is shown by the

success of many of Pasteur's experiments in other maladies. The theory is that by a process of cultivation a benign form of germ may be obtained which, without producing much disorder, effectually sterilises the blood of the individual towards the real morbific germ. The experience in the case of small-pox showed that even direct inoculation produced a milder form of the disease than when it was taken by infection in the ordinary way. It is possible that the mere passing from person to person may to some extent attenuate a virus, and ultimately lead to the cessation of an outbreak, although there is also the powerful factor of the exhaustion of susceptible victims. The system of small-pox inoculation was certainly a benefit to the individuals, but as furnishing fresh centres of infection it was a doubtful benefit, if not a positive evil, to the community. It is the presence of equally great protective power, combined with the absence of any power to infect short of direct inoculation, that constitutes the great value of vaccination; and Pasteur, in recognition of the value of Jenner's great discovery, has used the word as a general term to express prophylactic inoculation of any kind. I am not going to enlarge upon this subject here, but I hope opportunity may be found to discuss it in the section of preventive medicine. I take, however, this opportunity of making it distinctly understood what my views are—viz., that vaccination is one of the greatest boons ever conferred upon humanity, and in saying this I believe I express the views of the council of this Institute. This town (Leicester) has constituted itself a principal centre of opposition to vaccination, and I believe that you insist that ordinary sanitation is sufficient to prevent small-pox. With special regulations and strict isolation I believe you have been able to keep the town very free from it. I should be but a bad sanitarian if I did not recognise the value of both these measures, but I would point out that you are working now with a population that is for the most part already vaccinated. What it may be when an unvaccinated population has accumulated is a very different thing, and I fear you will have a rude awakening. It is an entire mistake to suppose that a prophylactic measure, such as vaccination, is antagonistic to general hygiene, on the contrary they go hand in hand. We are now too fully convinced of the advantages and paramount importance of general sanitation to be likely to fall so far back into error as to neglect it. The results obtained in the past are but an earnest of what may be done in the future, but our labours must be unremitting, and we must take as our motto—

"Count nothing done while ought remains to do."
Nil actum reputans dum quid superesset agendum.

SECTION I.

SANITARY SCIENCE & PREVENTIVE MEDICINE.

ADDRESS

By Arthur Ransome, M.D., F.R.S.

PRESIDENT OF THE SECTION.

It is desirable that in its brief periodical visits to the principal cities and towns of the country, our Institute should, if possible, leave behind it some abiding and growing influence.

When I was first asked to undertake my present duties, it was my wish to conduce to this end by advocating the establishment in each town visited by the Institute, of some local sanitary association, similar to the one with which I am connected in Manchester, that has now been at work in that city for more than thirty years. If this suggestion were adopted there would then be scattered over the country permanent, and, we may hope, active associations, each of which would carry on the objects of our Institute, and that would prevent our visits from becoming merely a "three days' wonder," and their influence from quickly dying out.

There are probably few places in England that would be so likely as Leicester to benefit from the establishment of such an institution in its midst. From the Registrar-General's last annual return it appears that the mortality in Leicester of infants under five years of age was over 500 per 1000 deaths—more than one-half of the total mortality—and during the month of July the *Sanitary Record** notes no fewer than 100 deaths from diarrhœa, an eminently preventible disease.

Such a fearful mortality as this must be due to something wrong in the place itself. As Mr. Simon remarks:† "Local

* Aug., 1885, p. 72.
† Papers relating to the sanitary state of the people of England, 1858, p. 8.