

Interim report by the Works Committee of the Edinburgh and District Water Trustees.

Contributors

Edinburgh and District Water Trust.
Royal College of Physicians of Edinburgh

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INTERIM REPORT BY THE WORKS COMMITTEE OF THE
EDINBURGH AND DISTRICT WATER TRUSTEES.

28th November 1870.

OF this date a letter, signed "Physician," appeared in the 11th Nov. *Scotsman* newspaper, impugning the quality of the water of 1870. St Mary's Loch, and predicting various injurious results to the communities of Edinburgh, Leith, and Portobello from the use of water drawn from that source. This letter was followed of this date by another letter bearing the same signature, 14th Nov. and in which the objections of the writer to the water of St Mary's Loch for town supply were reiterated and extended.

The unconcealed hostility of purpose which pervaded both of these letters, deprived them of all claim to consideration as the opinions of a citizen animated, as the writer professed to be, by a pure spirit of zeal for the public interest. Nor did it need much acquaintance with the subjects on which the writer professed to offer an opinion to see, not only that he looked at the subject from a wholly erroneous standpoint, but that his science was as faulty as his knowledge of the facts upon which he ventured to speak. At the same time the Committee were not ignorant that an attempt was being industriously made to prejudice the public mind against the St Mary's Loch Scheme by objections such as were advanced in the letters of the "Physician." It therefore appeared to the Committee that these documents afforded a legitimate opportunity for dealing with and confuting the objections which they contained, and which might impose upon, and give some uneasiness to, persons not acquainted with the subject.

A copy of these letters, with the Report of the Committee, dated 26th October last, having appended Dr Frankland's analysis of the water of St Mary's Loch, the Talla and the Heriot, and his reports dated 5th, 6th, and 14th October were accordingly furnished to each of Dr Frankland, Dr Alexander Wood, and Dr Littlejohn, and they were requested to favour the Trustees with their views as to the "Physician's" objections to the water of St Mary's Loch, and as to the suitability of that water for the supply of Edinburgh, Leith, and Portobello.

It was considered desirable that each of these gentlemen should be asked to give an independent report, without communication each with the other of any kind, and the reports now submitted have been accordingly so prepared. It may be added that none of these gentlemen has had any communication with the members of the Works Committee or with each other; that they have not seen each others reports; and that the instructions under which they have all acted were in effect those which are contained in Mr Marwick's letter to Dr Frankland, which was in the following terms:—

EDINBURGH AND DISTRICT WATER TRUST,
CITY CHAMBERS, EDINBURGH, 16th November 1870.

DEAR DR FRANKLAND,

I enclose a print of a Report which the Works Committee of the Edinburgh and District Water Trust have made to the Trustees. You will observe from it that the Trustees have resolved to go to Parliament this year for an additional supply of water from St Mary's Loch, and the requisite notices are now being given with that view.

On the publication of the Parliamentary notice, a lengthy letter, from a gentleman who subscribes himself "Physician," appeared in the *Scotsman* newspaper, reflecting upon the quality of the water of St Mary's Loch as unfit for town supply. I enclose a copy of that letter, cut out of the newspaper dated 7th November (but which appeared on 11th November), and also a second letter from the same "Physician," dated 12th November (but which appeared on 14th November), and I am to ask you to favour me with your views, in detail, as to the statements contained in these letters.

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Obviously the quality of the water is the *first* consideration; an adequate supply of the best obtainable water is the *second*; and the matter of cost is the *third*, though in every view a most important consideration. This is the order in which the Trustees have dealt with the several considerations above indicated. But if the "Physician" be anything like correct in his statements the Trustees have gone wrong in the very first and cardinal matter of the *quality* of the water which they propose to introduce. It is the last thing the Trustees would think of to "shirk" the objection which has thus been stated, and you will give them a frank and unbiassed judgment on the question which has thus been raised.

Will you be so good as return me the newspaper slips along with your observations. The Trustees are to meet on Friday, but I presume I may not expect to hear from you in time to report your letter to that meeting.

Yours faithfully,

J. D. MARWICK.

The Committee regret exceedingly the great expense to which the Communities are put in obtaining such reports. But the responsibility for this must rest with those whose misrepresentations it is the duty of the Trustees to prevent as far as possible from prejudicing the public mind.

If anything further were necessary to show how completely the opinions of "Physician" and those who hold his views are opposed to the science of the present day, the report of the Royal Commissioners on the water supply of the metropolis and other large towns, presided over by the Duke of Richmond, and presented to both Houses of Parliament in 1869, should be conclusive.

DAVID LEWIS, *Convener*.



I.—REPORT BY DR FRANKLAND.

ROYAL COLLEGE OF CHEMISTRY,
315 Oxford Street, London, W.,
Nov. 21st, 1870.

SIR,

I HAVE read in the *Scotsman* of the 11th and 14th inst., two letters, signed "A Physician," in which the writer expresses himself opposed to the introduction of the St Mary's Loch water into Edinburgh on the following grounds:—

1st, Because it is not spring water.

2d, Because it is soft water, and therefore unwholesome.

Whilst fully recognising the importance of a consideration of the points thus raised by "A Physician," I cannot but express my regret at the spirit which pervades his letter. The writer appears to assume that the Town Council are blindly prejudiced in favour of the St Mary's Loch scheme, and are determined at all hazards to force it upon the community. He says, "It is thus by no means easy to determine the process by which the Town Council have reached the conclusion which they desire to force upon a too supine community; and it becomes even painful, in as far as it might lapse into a consideration of possible motives, to pursue the inquiry." I have but little personal acquaintance with the Town Council of Edinburgh, but with reference to this water scheme, I cannot too strongly express my conviction that these unworthy reflections are peculiarly inapplicable to that body, for in all my interviews with them and their officers no attempt whatever has been made to influence my judgment in favour of any one of these schemes. I have been left to pursue my investigations in the most free and unfettered manner, and every one with whom I came in contact seemed to be actuated only by the desire to secure for Edinburgh the best available supply, whatever its source might be.

With several of the reasons upon which "A Physician" grounds his first objection I cordially agree. *Ceteris paribus*, I prefer for the supply of a town the water of deep-seated springs to lake water, and lake water to river water.

Spring water, as he rightly contends, preserves a more uniform temperature during the whole year; having percolated through a great thickness of earth or rock it does not require artificial filtration, and it is almost invariably more free from organic matter than either of the other descriptions of water. Spring water is therefore more palatable—in summer on account of its low temperature, and at all seasons by reason of its brilliancy and freedom from colour and organic matter. But it is exceedingly difficult to obtain spring water of unimpeachable quality and in sufficient quantity for the supply of a city like Edinburgh, since such water is obviously liable to be contaminated with certain impurities which are often present in the soils through which it percolates. Thus spring water is generally hard, and it not unfrequently contains the washings of highly manured fields, as is the case, for instance, with the Comiston water at present supplied, although in small proportion, to Edinburgh. This water is gathered from several springs rising in the midst of highly cultivated fields, to which, amongst other things, Edinburgh night-soil is sometimes applied. That a population should wash its excrements with its drinking water is an arrangement which “A Physician” would doubtless condemn both in the interests of the public health and of common decency; nevertheless the Comiston water is “sapid, sparkling, and aerated,” and is, I believe, a favourite drinking water in Edinburgh—so little can popular instinct be trusted in these matters.

“A Physician” does not clearly indicate the source or sources to which he would have the Water Trust go for their supply of spring water, but I gather from his remarks that he considers the Talla or the Heriot would be a suitable source. The spring waters which fed these rivers at the time my samples were taken for analysis, were of excellent quality, and either of them would form a most desirable supply for Edinburgh; but if “A Physician” had regarded these sources from an engineering point of view, such as even an outsider may obtain, he would have seen that to render either of these rivers available for the supply of the city, it would have to be impounded in a storage reservoir, and would thus become, to all intents and purposes, lake water. Moreover, as I have already pointed out to you in my Report, the condition of these rivers, at the

time of my visit of inspection, was very exceptional, a long continued drought having dried up all surface drainage, and left nothing but spring water to feed them; but from the character of the ground around them, I have no doubt that, after heavy rain, these rivers are filled with water of a very different quality (indeed I was informed, on good authority, that it is on such occasions frequently muddy and coffee coloured). Instead of clear, colourless, and tasteless spring water, they would then yield a turbid, brownish, peat-flavoured beverage. Such flood waters lose much of their objectionable qualities by storage in large lakes, especially if these be deep natural lakes with pebbly beaches. The water of such lakes is also likely to be of more uniform quality than that stored in smaller and shallower artificial reservoirs, the soft beaches of which, unless protected at great expense, are constantly being lashed into mud by the waves breaking upon them. On these grounds, and also because the samples of St Mary's Loch water were likely to represent, more nearly than the river samples, the average quality of the supply from this source, I came to the conclusion that the St Mary's Loch scheme was preferable to the Talla or Heriot scheme, although the water of these rivers was, at the time the samples were taken, of markedly superior quality. In truth, the ultimate decision of the Edinburgh and District Water Trustees must have been rendered difficult by a veritable *embarras des richesses*, as the quality of each of the samples is excellent for every domestic purpose, including drinking.

Whilst I thus agree in principle with "A Physician's" first ground of objection to the water of St Mary's Loch, I entirely dissent from his second—that it is soft and *therefore unwholesome*. The question of the comparative wholesomeness of soft and hard waters has of late years received the earnest attention of our highest medical and chemical authorities, and whilst, on the one hand, opinions have differed considerably as to the wholesomeness of hard water, on the other there has been and now is an almost complete unanimity as regards the wholesomeness of soft water.

During the recent sittings of the Rivers Commission in Scotland, the almost unanimous testimony of the medical officers of the chief Scotch cities and towns has been in favour of soft and opposed to hard water. The Board of Health also

collected evidence on this point some years ago, and expressed their opinion "that the presence of lime and other mineral matter deteriorates the wholesomeness and value of waters for the purposes of drinking." In his evidence before the recent Royal Commission on Water Supply, Dr Lyon Playfair considers the substitution of soft for hard water in towns to be a hygienic improvement; but with regard to hard water he says, "I do not think that mere hardness is of much importance as to health; in extreme cases I would consider a hard water injurious to health. In some cases hard water might prove injurious, as in calcareous affections and in dyspepsia."

Dr Parkes, F.R.S., Professor of Military Hygiene in the Army Medical School at Netley, who has had great experience on the effect of water upon the health of our troops, gave evidence before the same Commission as follows:—"The carbonate of lime waters appear in some cases certainly to produce some effect upon health, for instance, dyspepsia, and they do not agree with some class of persons, whereas to others they appear to be quite harmless. In Germany especially, there is a very strong opinion in certain parts that the phosphate of lime calculi, and calculi generally, are more common in districts where the inhabitants use very hard waters, but in this country the evidence is so far negative. I think that 16 or 20 degrees of hardness would be certainly prejudicial. I think that very probably it might disagree with a great many persons. *In all cases we would prefer a soft water if it were possible to obtain it.* I think the hardness should not exceed 10 or 12 degrees, if possible. At the same time I should wish to state that one would prefer water free from that even, if it were possible to get it. *Question.*—Have you known any instances where troops have been located in districts where they have been using water of a moderate degree of hardness, and have suffered when they have been removed to a district where the water was soft? *Answer.*—I have never seen any reports of that kind. *Question.*—Are you aware whether a certain quantity of carbonate of lime may not in many cases be rather beneficial than otherwise to health? *Answer.*—I think that is again very doubtful. The fact is, that almost all kinds of food contain enough lime for the supply of the body."

Mr Simon, F.R.S., the Medical Officer of the Privy Council,

said before the same Commission—"I do not think that the question of a few grains of lime in a gallon of water can be regarded as a very important sanitary question. *Question.*—For drinking purposes, probably a little hardness would add to its life and pleasantness to the taste? *Answer.*—I would not quite say that; I have found soft waters, or at all events, hard water artificially softened, very agreeable. As regards drinking purposes, I am not sure of any important difference, but am inclined to prefer the soft water. As regards health, my bias is in favour of soft water, but I cannot say that I think the case established against hard water that it acts injuriously on health,"

Sir Benjamin Brodie, F.R.S., said that he had no reason to think that the use of soft or hard water, as a drinking water, produces any difference of effect upon health.

The late W. A. Miller, M.D., F.R.S., Professor of Chemistry at King's College, stated that so far as observation goes, he thought it a matter of indifference whether hard or soft water be drunk.

Dr Angus Smith, F.R.S., says—"I should think that the tallest people I have seen in Great Britain are to be met in soft water districts; for instance, in Cumberland and, probably, in Aberdeen. I may say that the tallest people I have seen in Great Britain are in Aberdeen, which is a very soft water district."

It was certainly not without careful consideration of this subject that the medical officers in Her Majesty's service sanctioned the use of distilled water, absolutely free from lime, for drinking purposes in the navy.

I might easily greatly extend this list of authorities, but a sufficient number have been quoted to show that, whilst there is a difference of opinion as regards the salubrity of hard water, there is a singular unanimity amongst some of our highest medical and chemical authorities as to the wholesomeness of soft; it is, therefore, not to be wondered at that "A Physician" should have been driven to seek for authorities abroad. With one exception—that of Professor Johnston, whose opinion, given more than a quarter of a century ago, is now somewhat antiquated—all his evidence in favour of hard water is derived from Continental sources. Admiring, as I do, the vigorous manner in which scientific research generally is prosecuted in Germany and France, and feeling strongly the comparative inactivity which has prevailed in this country as regards scien-

tific discovery for many years past, I shall not be deemed prejudiced when I say that, in respect of that section of sanitary science which is devoted to town drainage and water supply, our Continental brethren are at least a quarter of a century behind us. They are only now beginning to imitate, in their large cities, sanitary works of this description which have been executed here, even in most of our small towns, long ago. Many of the Continental authorities cited by "A Physician" are men of the highest culture in abstract science; but, in regard to water supply, they have not had the advantage of the great experience enjoyed by our own medical officers and chemists; and it is, therefore, in no way derogatory to them if their opinions on these matters are regarded as formed upon a narrower basis of facts than our own.

But why need "A Physician" travel abroad for his illustrations when Scotland ought to furnish him with abundance of evidence of the baneful effects of soft water? The following list contains the names of some of the chief cities and towns of Scotland with the hardness of the water with which they are respectively supplied; and, for comparison, the hardness of St Mary's Loch water is added:—

	Hardness in 100,000 parts.
St Mary's Loch (at foot),	... 2·16
Glasgow (Loch Katrine), ...	... 0·88
Selkirk, ...	... 3·41
Peebles, ...	... 4·04
Paisley, ...	... 4·16
Greenock, ...	... 1·91
Aberdeen, ...	... 2·03
Perth, ...	... 2·92

If the theory of "A Physician" were correct, the people of Perth and Aberdeen, who have been, for a long series of years, imbibing such remarkably soft water, ought to exhibit a marked deficiency of lime; but in my recent visits to those towns I neither saw any symptoms of such deficiency nor heard any complaints from the Medical Officers of Health who were interrogated as to the sanitary condition of the people. Surely "A Physician" of three-score years and ten, who has evidently paid considerable attention to the public health, could have found no difficulty in tracing the dire effects which he attributes to

soft water in the rickety children and small-boned adults of these towns if his suppositions were correct ; but the fact is, that the amount of lime consumed in our food is always in excess of that required for the wants of the system, since a considerable quantity is always expelled in the urine, and there is no such thing as effete lime. This being the case, there would be nothing improbable in the supposition that hard water, instead of being acceptable to nature, may impose an additional burthen upon her by compelling her to get rid of a surplus quantity. And with regard to rickets, that disease, as "A Physician" doubtless knows, has nothing to do with a deficient supply of lime to the system, for Lehmann has shown that it consists in the non-assimilation or abnormal expulsion of lime from the system—the urine of rickety children containing considerably more lime than that of healthy ones. I am not prepared to dispute the statement that a broken limb will set more quickly under the administration of carbonate of lime to the sufferer ; but it would surely be better to administer the proper quantity to the patient alone, rather than to compel a whole community to take the medicine.

"A Physician" objects to the form of my analytical results ; but had he followed the modern developments of water analysis he would have been aware that chemists, instead of estimating such saline constituents as chlorides of potassium and sodium and sulphates of potash and soda, the relative quantities of which in any moderately-pure water have no bearing whatever upon its suitability for domestic supply, now prefer to expend their labour upon the determination of those constituents which either constitute organic impurities or disclose the previous history of the water as regards its association with objectionable matters, such as sewage or putrifying animal substances. Unless "A Physician" is a homœopathist he could not possibly have any interest in harmless saline substances which, exclusive of carbonate of lime, are contained in the St Mary's Loch water only in the proportion of at most 1·4 grain to the imperial gallon. I would now only add that the water of St Mary's Loch is well ærated and free from that vapidness which "A Physician" fears.

With regard to the water fleas, I need hardly say that these are perfectly harmless insects. I have rarely found

them absent from lake and impounded waters in summer, and they would almost certainly be present in the impounded water of the Talla or Heriot; nevertheless I quite agree with "A Physician" that it is desirable that these insects should be removed from the water before its delivery to consumers. Their removal from my samples was effected, before analysis, by straining through cotton gauze; on the large scale it may be performed by straining through fine wire gauze, or passage through a stratum of gravel, but I greatly prefer filtration through sand, which not only removes all suspended matters, but also diminishes considerably the amount of peaty matter held in solution. In connection with the filtration of such waters, I will here quote the remarks contained in the first report of the Rivers Pollution Commission, published at the commencement of the present year. Speaking of the Manchester water supply, which is very similar both as regards source and quality to that which you would obtain from St. Mary's Loch, they say, "The position of the gathering ground and reservoirs is such as to preclude the possibility of excremental pollution, and consequently the water is not filtered before delivery. Nevertheless, even in the case of a water of such undoubted purity, we would recommend filtration, since the best waters from gathering grounds are liable at times to be turbid, and although turbidity in these cases has not the significance which it possesses when the muddy water is derived from sources exposed to excremental pollution, yet the use, for drinking purposes, of water containing suspended matters is reasonably objected to by consumers, and may even drive them, in some instance, to the use of clear and sparkling water derived from dangerous sources."

In conclusion, then, I can only repeat the opinion to which my analysis and an inspection of the gathering grounds have led me, viz., that, after efficient straining or filtration, the water of St Mary's Loch will, in every respect, be well adapted for the supply of Edinburgh, and will, if so used, constitute one of the best water supplies in the United Kingdom.

I am, Sir, your obedient servant,

E. FRANKLAND.

II.—REPORT BY DR. ALEXANDER WOOD.

EDINBURGH, 19th NOVEMBER 1870.

To J. D. MARWICK, Esq., City-Clerk.

MY DEAR SIR,

I have to acknowledge receipt of your letter of 16th instant, a pamphlet entitled "Interim Report by the Works Committee of the Edinburgh and District Water Trustees," dated 26th October last, a copy of the *Scotsman* newspaper of Friday, November 11th, 1870, containing a letter, occupying two columns and a half of that newspaper, headed "Quality of St Mary's Loch Water," and signed "A Physician;" also copy of the *Scotsman* newspaper of date 14th November, containing another letter with the same heading and signature, and you request me "for the information of the Trustees, to favour you with my views in regard to the water, as reported on by Dr Frankland, and also my opinion on the objections stated to it by 'A Physician.'"

In the remarks I shall make on these documents I shall adopt the familiar style of a letter, rather than the baldness of a mere scientific Report. I do this because it will enable me better to explain to non-scientific readers the various points which I am required to bring before them.

With the attacks on the Town Council, and the calculations as to the probable expense of the St Mary's Loch Water Scheme, with which "A Physician" commences his letter, I have nothing to do, further than to remark that they seem to me to invalidate altogether his assumed cha-

racter of an impartial observer, actuated only by zeal for the citizens in undertaking the laborious duty which he imposed on himself.

The first remark made by "A Physician," lying within his proper province and mine, is the exception he takes to the testimony of Dr Frankland and Dr Macadam, on the ground "that both of these" (gentlemen) "are merely chemists, and have no title to speak as physicians or physiologists." The report states that the Committee sought the opinion of Dr Frankland as the very highest authority on such a question, by the advice of the Professor of Chemistry in the University of Edinburgh, and I think most people who know anything of the subject will endorse his recommendation.

It is the province of the chemist to ascertain the various purposes to which water is applied in a town, and the various qualities of water which can best subserve these purposes, and then by applying his analytical skill to such specimens of water as may be submitted to his judgment, to determine how far they fulfil the required conditions. This Dr Frankland has very fully and clearly done in the report which you have sent to me; and if the physician who has ventured to impugn his opinion be really entitled by his superior knowledge to do so, it is greatly to be regretted that, instead of writing anonymously, he had not favoured the public with his name, that it might have had due weight in this important enquiry.

"A Physician" speaks of "lake water as mawkish, unaerated, of unstable temperature, and prone to be loaded with rotten vegetable organisms." I presume that all physicians, from the time of Celsus downwards have agreed with that Father of Medicine in the comparison which he thus makes of the different qualities of water. "*Aqua levissima pluvialis est; deinde fontana; tum ex flumine; tum ex puteo; post hæc ex nive aut glacie; gravior his ex lacu; gravissima ex palude.*" It is therefore to be regretted that engineers have not yet devised a satisfactory method of bringing water from springs directly to the mouths of the thirsty inhabitants of large towns,

but are obliged to have recourse to contrivances for storing it. "A Physician" has neglected to show that the artificial lake into which Mr Leslie proposed to receive and detain the Heriot waters would not transmit them to us as mawkish, as un-aerated, of as unstable temperature, and as prone to be loaded with rotten vegetable organisms as St Mary's Loch, or any natural loch in the kingdom.

On the superiority of a natural reservoir to an artificial one, all are agreed. Mr Bateman says (p. 18 of Interim Report by the Special Committee of the Corporations of Edinburgh, Leith, and Portobello, dated 24th October 1868):—"St Mary's Loch certainly appears a very desirable source of supply. Any natural lake in which the water is good, and which can be converted by artificial works at its outlet to purposes of water supply, is preferable to artificial reservoirs, which require time to construct, and which may be liable to other objections. Again, the same gentleman states (p. 32 of Report dated 4th February 1869):—"There is this great advantage, however, in the St Mary's Loch scheme over the others, that you have to incur very small outlay to obtain the amount of storage required, and that the natural beach which the Loch itself now possesses will preserve the water from all injury and discoloration which would attend it if stored in large artificial reservoirs with clay or gravelly slopes, rising or falling according to the state of the weather, and exposing fresh surfaces for abrasion by the action of the wind." Mr Gale says (Interim Report, dated 26th October 1870, p. 19), "Water drawn from artificial reservoirs, subject to considerable fluctuations in level, will always be less pure than that drawn from a natural loch." Dr Frankland says (*Ibid.*, p. 27), "The advantages of a natural loch with a pebbly beach over an artificial reservoir are great," &c.

You may remember that in the evidence I gave in 1869 before the Committee of the House of Lords, I spoke of the frequent yellow colour and loaded character of the Edinburgh water—a part of my evidence which was impugned by the other side. However, when Mr Leslie, the engineer

of the Water Company, was called on their behalf, he fully corroborated my statement, and explained the frequent pollution of our drinking water by the effect produced by wind or rain in agitating the surface of the artificial ponds, and causing the contained water to act on the puddled banks. This, to a large extent, you will escape, by resorting to a natural rather than an artificial reservoir for your supply. No proper comparison can therefore be made between the *spring* water of the Talla or the Heriot and the *lake* water of St Mary's; indeed, as regards the former, Dr Frankland, in a passage which "A Physician" does not quote, says, "It owes a good deal of its superiority to filtration through a porous stratum which would be submerged in the proposed reservoir, and would then cease to have any effect on the water" (Interim Report, p. 27).

"A Physician," quotes, with approbation, a sentence from Professor Wanklyn, in which he expresses a hope "that he will see the time when our towns, ceasing to be supplied with the waters of rivers or lakes, will derive their drinking-water from deep springs."

Attempts in this direction have not proved so successful as to lead us to set a great value on the advice of Wanklyn, or of the "Physician" who endorses it. Bischof, in his 'Chemical Geology,' says of deep springs, that the temperature of the water is usually high in proportion to the depth of the spring, while "A Physician" very properly highly values cool water. Besides, we learn from the same authority that these deep springs extract more from the rocks and are richer in mineral constituents than those nearer the surface. I doubt if even "A Physician's" love for saline impregnation would cause him to regard this as an advantage. In proof of this statement, I may add that water from some of our deepest sources, as the Artesian Well at Grenelle, is often so charged with saline matters as to be perfectly undrinkable.

In fact the character of the water depends much more on the strata through which it passes than on the depth from where it is taken.

In his second letter "Physician" makes very merry over the "water fleas" which Dr Frankland removed from the St Mary's Loch water before analysing it. Surely it must be assumed ignorance on the part of so learned a "Physician" to conceal that an artificial lake, such as must be made to store the waters of the Heriot or the Talla, is quite as likely to teem with insect life as the natural loch which he condemns.

The great point, however, which a "Physician" seeks to make against the St Mary's scheme in his letter, is the alleged absence in the St Mary's Loch water of certain salts of lime which are essential to the necessary hardness and solidity of the bony framework of our body. It is scarcely possible to deal seriously with this statement, or by argument to convince the old ladies whom it has terrified that there is small risk that the boys of the next generation by drinking the waters of St Mary's Loch will be found lying like jelly fish at the tops of the closes devoid of shape and form, instead of as at present driving their hoops against our legs and their "shinties" into our eyes.

Town water is chiefly required for four purposes

1. Drinking.
2. Cooking.
3. Washing.
4. Manufacturing.

"A Physician" assumes that the first of these is the most important, and in some respects it is. Water, however, may be quite wholesome although not very palatable, and we have it on undoubted evidence, which I do not quote because I do not think it necessary to parade authorities on every occasion, that water so loaded with nitrites as to be almost poisonous was clear, cool, sparkling, and agreeable to the taste so as to be sought after by persons from a distance for these qualities. No one will assert that there is anything necessarily present in soft water to make it injurious; and as to those salts, the absence of which a "Physician" so much deprecates, I shall

have something to say immediately. It will be admitted that for cooking, soft water is very superior; and it is surely of some consequence to the poor especially that their food should be presented to them as well cooked and with as little expenditure of time and fuel in the cooking as possible;* and the same holds good in regard to washing, and economy in the use of soap. Soft water is also superior to hard for all manufacturing purposes, except brewing, where the presence of salts of lime, especially the sulphate, is of great importance. In his second letter "A Physician" says—"Am I in error in believing that brewing is the chief manufacturing operation in Edinburgh, and certainly that which uses the largest quantity of water?" I suspect if "A Physician" were to push his inquiries a little further he would find *first*, that there is no water available for Edinburgh supply that would be really useful for brewing pale ale, except that contained in the private wells of the brewers; *second*, that were such water available it would be most unsuitable for either drinking or domestic use; *third*, that it would very soon render useless the self-feeding boilers, now so common, by the copious salts of lime which, when boiled, it would deposit.

The Edinburgh breweries are all situated in one district, or rather in one line, by reason of the hard water which is got there; and the public water, when used by them at all, is employed for washing, not for brewing.

I have thus shown that for most purposes, except drinking, a soft water is superior to hard.

The subject of drinking water must however be considered at greater length by reason of the stress "A Physician" lays on it.

It has been calculated that an adult human being consumes about three-fourths of a ton of water annually. The duty which this water discharges is threefold.

* The evidence of so practical and experienced a "Chef" as the late M. Soyer given before the General Board of Health on the saving of food effected by cooking with soft water is very interesting. The general result was that two-thirds of any food cooked in soft water produced as great a result as three-thirds in hard.

1. It removes effete solid matter in solution by the secretions.
2. It maintains equilibrium in the animal temperature by its evaporation.
3. It supplies some of the fluid which enters so largely into the composition of all the tissues of the body, and also introduces, in solution or otherwise, a certain portion of those saline matters which minister to its growth.

For the first of these duties it has to exert a considerable solvent power, and the purer it is the greater its solvent power must be; and it is also plain that the purer the water the more readily will it be vaporised so as to effect the second object of its introduction into the body.

In regard to the third, or the introduction into the body of certain salts, and notably of those of lime, "A Physician" greatly over-estimates its power. Carbonate of lime is only held in solution by water containing an excess of carbonic acid, which makes a very sparkling and clear water, but decidedly hard. On parting with its excess of carbonic acid the lime becomes insoluble, and in that state cannot be so readily conveyed by the blood to those parts where it is needed, as when it is presented held in solution by the albuminous ingredients of our food. Nor, though the water from granite or millstone grit, and hard oolite rocks, is nearly free from lime, do we find that the inhabitants of these regions suffer from any softness of the bony structure.

The idea which forms the main object of "A Physician's" letter is very contemptuously dismissed by the Duke of Richmond's Commission, which reported in 1869. This is all the more remarkable as there existed an evident bias in that Commission to uphold the advantages of hard water, and they would therefore gladly have availed themselves of such an argument, had they thought it contained a single grain of truth.

They report as follows—

"Some eminent chemists" (not physiologists or physicians) "have contended that a moderate quantity of carbonate of lime is not only harmless, but that it is actually useful in supplying

material for the bones of man and animals. Considering, however, the much larger quantities of carbonate of lime taken in our solid food, such an additional source of supply would seem to be unnecessary."

This is really the fact, it is not to the water we drink that we are mainly indebted for earthy salts. Except chloride of sodium (common salt), the other salts, including those of lime, occur naturally in sufficient quantity in most of the articles which are used as food. Thus, in the typically perfect foods presented by nature to the young of various animals, and which contain all that is necessary for the growth of the body, as milk and the egg, a due proportion of the lime salts is found ; and the casein of milk possesses a power, which water has not, of holding phosphate of lime in solution, which necessarily facilitates its conveyance to those parts of the frame where it is required, especially during the period of growth. It is a curious fact, that the bones of the bird are supplied with the material for their formation, not by water, but by the oxygen passing through the pores of the shell of the egg uniting with the free phosphorus in the yolk, to form phosphoric acid, and this again uniting with the lime of the shell to form phosphate of lime.

It is no use for "Physician" to quote the casual expressions of various authors as to the value of the lime salts in water. It is demonstrable that all which a safe-drinking water contains would go but a small length in furnishing the supply which the system demands, and that it must therefore be obtained from other sources. Thus Dr Smith, Medical-officer to the Poor-law Board, says (*Practical Dietary*, page 29):—

"Phosphorus, in combination with *lime*, magnesia, soda, potash, &c., is found in most animal and vegetable foods."

Dr Golding Bird, an author whose authority no physician will undervalue, says :—"To show how readily the supply of earthy phosphates* is derived from without, I have calculated from the best authorities the quantity of these salts which exist in an ounce of eleven different articles of food :—

* Phosphate of ammonia, ammonio-phosphate of soda, phosphate of lime, ammonio-phosphate of magnesia.

Articles of Food.	Phosphates in one ounce.	Authority.
Pease (<i>Pisum Sativum</i>)	9.26 gr.	Braconnot.
Maise (<i>Zea Mais</i>)	7.2 "	Gorham.
French Bean (<i>Phaseolus Vulgaris</i>)	4.7 "	Braconnot.
Wheat (<i>Triticum Hybernum</i>)	4.7 "	Liebig.
Beans (<i>Vicia Faba</i>)	4.7 "	Einhoff.
Potatoes (<i>Solanum Tuberosum</i>)	2.35 "	Liebig.
Rice (<i>Oryza Sativa</i>)	1.92 "	Braconnot.
Milk	1.2 "	Liebig.
Artichoke (<i>Helianthus Tuberosus</i>)	0.96 "	Payer and Braconnot.
Vetchling (<i>Lathyrus Tuberosus</i>)	0.756 "	Do.
Beef	0.33 "	Liebig.

In the blood, phosphate of lime is held in solution by the albuminous fluids; and the softening of the osseous tissue which "A Physician" predicts as the consequence of the use of the pure water with which Glasgow is now, and Edinburgh is about to be, supplied, arises, not from the absence of the lime-salt in the water, but from some pathological cause within the body itself interfering with the nutrition of the bone. In fact, learned as "A Physician" is, he is mistaken as to the nature of the disease which he employs to terrify us.

Mark also the inconsistency of "A Physician." He blames you for being guided by the opinions of "mere chemists" in judging of the suitability of water for domestic use, and yet, ignoring the facts which have been collected by Miescher, Gluge, Muller, Owen-Rees, and a host of physicians and pathologists, he prefers to them, in a question of pure pathology, an array of French chemists, who have not the information essential to constitute them authorities on such a subject. Till I read the letter of "A Physician," I thought that every tyro in medicine was informed that the softening of the bones in this disease he refers to was caused not by deficiency of bone-earth, but by its unnatural absorption and removal by another channel. I have no wish to parade authorities, I shall give but three:—1st. A practical Surgeon; 2d. A learned Physician; 3d. A Chemist who has made the chemistry of the human body his especial study.

Mr Solly, the eminent Surgeon of St Thomas' Hospital, writes,—“In this disease the absorbent vessels are unnaturally excited, and the earthy matter of the bone is absorbed and thrown out by the kidneys in the urine,” to such an extent that calculus of lime salts is formed in the kidney.

Dr Copland, the learned author of the Dictionary of Medicine, says, “Several earthy preparations, have been recommended with the view of furnishing the materials for the re-ossification of the bones. But, *as the disease is not so much the result of any deficiency of the elements of bone in the nutriment*, as in the failure of the organic, nervous, or vital energy.”

Franz Simon, in his *Animal Chemistry*, says that, in this disease, “The phosphates *exceed* the physiological average. . . . This extraordinary and morbidly increased capacity of the kidneys, for the removal from the blood of those salts which are so essential for the structure of the osseous tissue, and the consequent tendency to the formation of calculi in Rachitic children, is regarded by Walther as a vicarious act of the kidneys in connection with the formation of bone.”

Besides, the water of St Mary's Loch is not destitute of lime salts. Its hardness, according to Dr Frankland, is 2·28 ; the Talla is the same ; the Heriot is 4·29 ; while Loch Katrine is only ·88.

As “A Physician” seems, to a certain though very limited extent, to use the illogical argument that the salts of lime being in certain waters, they must be there for some use, and therefore for the particular use which he seeks to assign to them the following extract from the work of Bischof, already referred to, may comfort him by showing what they actually do. I earnestly hope, however, he will not use it as the means of a fresh alarm to our citizens. It is possible that if the City sewage water derived from St Mary's Loch and sent into the sea contains less lime than that of Crawley, the oyster scalps—the property of the city—may suffer, and an argument on this head would not be so easily answered, nor a panic arising from it so soon allayed, as that founded on the softened bones of young Edinburgh.

The passage is as follows :—

“It is interesting to observe that the substance (carbonate of lime) present in these rivers in the largest quantity, is precisely that which we know with certainty to be continually abstracted from sea water by shell fish. If it is assumed that the mean quantity of carbonate of lime in the Rhine is 9·46, then according to Hagen’s estimate of the quantity of its water flowing at Emmerick, it will be found that the quantity of carbonate of lime annually carried into the sea by this river is sufficient for the formation of the shells of 332,539 millions of oysters of the usual size.”

While I believe that no one of the various sources of supply of water which have been proposed for Edinburgh, contain a sufficient quantity of the salts of lime to make them injurious as drinking waters, it would be much easier to demonstrate the bad effects of too much than of too little of that ingredient. Dr Paris, an acknowledged authority on diet, says that hard water “has certainly a tendency to produce disease in the spleen of certain animals, especially sheep,” and Dr Cleghorn informs us that this is found to be the case among the flocks on the eastern side of the Island of Minorca. A water sufficiently charged with sulphate of lime to make it available for brewing, is an unwholesome water for drinking, producing, in those unaccustomed to its use, indigestion, constipation, alternating with diarrhœa, and often serious arrest of the urinary secretion, and is utterly unfit for boiling food or for washing.

The Selenitic well waters of Paris very generally injure strangers; and Parent Duchatelet and Pinel have both traced the occurrence of persistent diarrhœa in two of the Parisian asylums for the insane to the use of water containing sulphate of lime.

Every groom knows that a horse’s coat will become rough by giving it hard water to drink; and Rossignol (*Traité d’Hygiène Militaire*) gives facts showing that to the same cause was to be assigned the production of bony exostoses (splints) on horses, which ceased to grow on the substitution of soft water,—perhaps too strong a corroboration of Agassiz’s

opinion that the drinking of water in limestone regions enlarges the skeleton. Professor Gamgee tells us that sheep are also peculiarly affected with calculus in limestone districts—an effect which many authors contend extends also to man.

The old opinion that goitre and cretenism are produced by drinking snow water is now abandoned; and since the re-researches of M. Grange, Dr McClellan, and others, the prevalence of the salts of lime and magnesia in the water used for drinking has been suspected as the cause. I am aware that M. St. Lager has combated this opinion, but I do not think he has succeeded in refuting it.

I have given these illustrations, however, not so much because I put faith in them, as to show how easy it would be to get up a case on the other side, as strong, if not stronger, against water containing the salts of lime, as “A Physician” has done against softer water. But the fact is, the whole subject has been so thoroughly investigated very recently by the Royal Commission appointed in April 1867 to enquire into the water supply of the metropolis and other large towns, and which reported on the 9th June 1869, that it seems presumptuous in any “Physician” to advance views which have been completely refuted, although previously to the Report of that Commission they had occasioned a good deal of controversy.

The General Board of Health which at that time assumed authority on all matters of a sanitary nature, issued a Report in May 1850 which contained this remarkable passage, “We advise that Thames water, and other water of like quality, as to hardness, be as early as practicable abandoned.” The same year, in consequence of a proposal to bring a fresh supply of water into London from the chalk near Watford, Government appointed three eminent chemists (the late Professors Graham and Miller and Dr Hofmann) to report on the quality of the existing and proposed supply, and also on the dictum of the Board of Health. The report of this chemical Commission was given in June 1851.

While the Board of Health had expressed an opinion “that the presence of lime and other mineral matter deteriorates the

wholesomeness and value of waters for the purposes of drinking," the Chemical Commission says no reasonable doubt can be entertained of its salubrity. The shallow well waters of London vary from thirty-two to eighty degrees of hardness, yet these waters have never been pronounced unwholesome. The Duke of Richmond's Commission (1869) took very full evidence on the subject. Among the witnesses examined—Mr Bateman, Mr Hawksley, Mr Rawlinson, Dr Letheby, Dr Lyon Playfair, M.P., Dr Parkes, Mr Simon, Dr Frankland, Dr Odling, Sir Benjamin Brodie, Dr Miller, Dr Angus Smith—a very general opinion seemed to prevail that the quality of the water as to hardness or softness within moderate limits did not at all affect the health.

When, however, they came to consider their relative advantages for culinary purposes, the preference was given decidedly to soft water. The Chemical Commission reports, "The hardness of water forms an objection to its use both in cooking and washing. Mr Rawlinson considers there would be great economy in household purposes by the use of soft water. Dr Miller speaks of its tendency to cause incrustations in kitchen boilers."

The Chemical Commission are also strong on this. They say, "It is in the more careful washing for the middle and upper classes that the advantages of soft water become fully sensible." Again, in the same report it is observed, "In the washing of the person the saving of soap by the use of soft water is most obvious. For baths soft water is most agreeable and beneficial, and might contribute greatly to their more general use. Its superior efficiency to hard water in washing floors and walls is calculated also to promote a greater cleanliness in the dwellings of all classes." The Report then goes on to show the saving of labour and of soap in using soft water, and the possibility with soft water of dispensing with the use of soda, which is very desirable, from its injurious action on the colours of certain prints, and the permanent yellow tinge and weakness of fibre which it may occasion even in white linens when exposed to heat before the soda is entirely washed out, as in ironing.

The superiority of soft to hard water for all manufacturing purposes except the production of pale ale is so universally admitted as to require no comment. Mr Bateman estimates, on data which he gives, the annual saving in Glasgow by the introduction of Loch Katrine water to be £36,000.

The only other part of the letter of "A Physician" which seems to require notice is his assertion that the present scarcity of water, "while it may have produced a little inconvenience, has been in no way detrimental to health," a position which he attempts to prove by the statement that the mortality for the week ending October 22d, 1870, was less than that of the corresponding week of 1869. A severer logic would have thought it necessary first to enquire if the other conditions were similar. Have the labours of the Improvement Trust, and of other new sanitary agencies, had no effect in improving the health of the town?

Mr Simon, the medical officer to the Privy Council, in a more philosophical spirit, observes that the changes induced by insufficiency or impurity of water must not be expected to display themselves in a sudden and violent manner; the results are often gradual, and may elude ordinary observation, yet be not the less real and appreciable by a close enquiry.

The abundant evidence on this subject furnished to the Health of Towns Commission, 1844-5, clearly shows that a deficient supply of water leads to impurities of all kinds,—the person and clothes imperfectly washed, houses and streets uncleaned, sewers unflushed, until the air becomes poisoned with the emanations escaping into it from so many sources; and yet from the same evidence we learn that all this may exist without producing actual disease, but that it induces a state of the system in which the vital powers are lowered, so that if the person is exposed to infection he is more liable to be attacked, and, if attacked, he is less likely to recover.

It was clearly proved before the Committees of both Houses of Parliament on the Edinburgh Water Bill that, whether from deficient supply or imperfect distribution I will not now stay to argue, the people of Edinburgh, especially the poorer

classes, were lamentably ill supplied with water. If the person signing himself "Physician" read the details of that evidence, or if he has visited any of the poor, and seen their distress, I envy not his feelings if he can characterise these sufferings as "some inconvenience but nothing like actual distress." There is reason to fear that the actual disease which he seems to regard as the only test is already upon us, and that ere long the Registrar-General's tables may be turned against him. And yet he weeps over the imaginary soft bones of a coming generation without a tear to spare for the real miseries of the one in which his lot has been cast!

I would have preferred had the style of the "Physician's" letter allowed me to have restricted myself to a simple report on the medical qualities of the water, but I found it impossible to answer your requisition without going somewhat controversially into the arguments of the letter you laid before me to report on; some parts of that letter it is impossible to discuss seriously—ridicule, though no test of truth, is sometimes the best means of combating a particular kind of error.

I shall now submit the conclusions at which I have arrived, viewing the subject dispassionately from the standpoint of a physician.

1. That the Heriot, the Talla, and St Mary's Loch, all afford water of a quality suitable for all the purposes for which it is required in a town.
2. That the Heriot is a better water for general domestic use than the Talla.
3. That the *spring* water of the Heriot and the Talla is superior to the *lake* water of St Mary's.
4. That the construction of the necessary ponds for storing the produce of these springs would go far to deprive them of any superiority which they at present possess, and would certainly render the water supplied from such ponds inferior in some respects to that obtained from the natural lake.
5. That the analysis of the water of St Mary's Loch shows it to contain a sufficient quantity of the salts of lime to

remove all fear of the danger suggested in the letter of a "Physician," especially when the copiousness of the supply of these salts from other sources is considered.

6. That, under these circumstances, it appears to me that the water procurable from any one of the three sources of supply being suitable, the Trustees should be guided in the selection by the questions of quantity, engineering difficulties, and comparative expense, and not by the opinion of any physician.
7. That the present supply of water in Edinburgh is manifestly insufficient, and that the poorer classes especially are not receiving enough to maintain them in a healthy state.
8. That should any epidemic disease appear among us, they will be less able on this account to resist contagion, or to bear up against disease if attacked.

I remain, my dear Sir, faithfully yours,

ALEX^R. WOOD, M.D.

III.—REPORT BY DR. LITTLEJOHN.

EDINBURGH, 26th NOVEMBER 1870.

J. D. MARWICK, ESQ.,

DEAR SIR,

As requested by you I have read the lengthy communication regarding the quality of the water of St Mary's Loch, signed "A Physician," which appeared in the *Scotsman* of the 11th instant, and I proceed to notice the chief objections the writer has to providing Edinburgh with an increased supply of pure water from St Mary's Loch. In reading the letter in question one is struck with the formidable list of authorities adduced in support of the views advanced—authorities, many of them out of date in questions relating to the water supply of large towns, and nearly all of them labouring under the very disqualifications attaching in "Physician's" opinion to Drs Frankland and Macadam being "merely chemists, and having no title to speak as physicians or physiologists." If the letter were intended for popular perusal, surely authorities nearer home, of later date, and more easy of access, might have been named; and if the letter were more particularly intended for a professional audience, the quotations from the Continental authorities should have been carefully given so as to admit of their being verified. In this there could have been no difficulty, since the "Physician," dating, as he does, from Edinburgh, could have had access to any of our public libraries. But under his concealed name it was all the more necessary for

him to advance no statement that was not amply supported by correct references. Had his true name been appended to the letter this might not have been required—his standing in the profession and the character of his previous studies possibly constituting him an authority on the subject. As it is, it is difficult to understand why his name should be withheld. Retired from the profession and occupying, as he intimates, an independent position, "Physician" complains that the water of St Mary's Loch is too pure, and specially that it is dangerously deficient in earthy salts. Now the statement that a pure water is not a wholesome water is opposed to the best and most recent authorities on the subject of water supply. I shall take two which should have been referred to by "Physician." They are easy of access, they are the latest publications in this country on Public Health, and have again and again been appealed to in questions of the kind. I allude to Professor Parkes' work on Hygiene and to Professor Mapother's Lectures on Public Health. Dr Parkes (3d edition 1870, p. 83) says—"Although it is not at present possible to assign to every impurity in water its exact share in the production of disease, or to prove the precise influence on the public health of water which is not extremely impure, it appears certain that the health of a community always improves when *an abundant and pure water is given*." The first part of this quotation is a sufficient rebuke to the dogmatism of "Physician" on the supposed baneful influence of water containing a small amount of earthy salts, while the concluding portion is an ample justification of the efforts made by our unenlightened Corporation to secure for the inhabitants the advantages of an unlimited supply of such water as that from St Mary's Loch. Similar objections, on the score of excessive purity, were urged to the introduction of the Loch Katrine water into Glasgow, and the direst results were prophesied. The objections were successfully and convincingly met by the Glasgow authorities, and the anticipated deterioration of the public health has never been detected. Yet "Physician" speaks in magniloquent language of "Glasgow with its lake water of almost nullity of impregnation having still (*sic*) to await the lesson it has to learn and the experience it has to record, with as yet no great

encouragement to cheer it on in the vastest and boldest physiological experiment on the health of a population that any place or time has heretofore witnessed." If "Physician" had referred to the works in our own language which I have already mentioned, he would have found evidence that the Loch Katrine water had already produced good results ; and, as yet, neither the Registrar General nor any of the numerous medical men in the metropolis of the west have notified the appearance of the formidable diseases put down by "Physician" as, in his opinion, dependent on the use of water of great purity. There has been ample time for their occurrence, for, since 1859, this pure water has been supplied in the greatest abundance to the citizens of Glasgow, and, certainly by this time, had such diseases as rickets, &c., been the invariable result of the use of pure water, their appearance in an unusual degree must have attracted attention. But is "Physician" too far removed from the sources of ordinary, not to speak of professional information, not to have been aware that Glasgow, since the introduction of the Loch Katrine water, has passed unscathed through an epidemic visitation of cholera, while Edinburgh, under the care of the late water company, has had to acknowledge a large mortality ?

In Dr Parkes' work, there is a chapter devoted to a consideration of the diseases which have been traced to the use of impure water, but there is no mention of diseases caused by the use of pure water. Surely, if any reliable facts could have been appealed to on the subject of the use of pure water as a source of disease, they would have been found duly chronicled in this, the standard work on Hygiene.

"Of late years," says Dr Parkes, p. 65, "an opinion has been expressed that the amount of the mineral substances is of little consequence. This can be true only in a limited sense ; there are some mineral substances, such as sodium, chloride, or carbonate, or calcium carbonate, which, *within certain limits, appear to do no harm*. But in the case of other minerals, such as calcium and magnesium sulphates, and chlorides, and calcium nitrate, there can be little doubt that their use is injurious to many persons."

The list of the diseases due to the use of impure water as

given by Dr Parkes, is truly a formidable one, and it contains several that have been traced to the saline constituents which "Physician" so much desiderates in the water from St Mary's Loch, and the absence of which from the Loch Katrine water has already produced the best results in Glasgow.

Dr Parkes, p. 66, writes, "Dr Sutherland found the hard water of the red sandstone rocks which was formerly much used in Liverpool to have a decided effect in producing constipation, lessening the secretions, and causing visceral obstructions; *and in Glasgow, the substitution of soft for hard water lessened, according to Dr Leech, the prevalence of dyspeptic complaints,*" and Dr Mapother, (second edition, 1867), pp. 111, 112,—"The effects of calcareous salts in water are difficult to recognise, as they are insidious, and take a long period for their development; but a peculiar form of dyspepsia is often assignable to this cause, as well as diarrhoea and subsequent dysentery. *These diseases have become much less frequent in Glasgow since the very pure water supply from Loch Katrine.*"

In all scrophulous diseases, the digestive organs are affected, and while nothing can be stated with absolute certainty on the subject, with such facts before us, there is as much reason to dread the free use of water with a large per centage of saline impregnation, as of water, which, from its purity, cannot be regarded as hard. "Physician" apparently forgets that the water we drink is one of the least important means of supplying the system with saline materials, and that it is in our food that the largest supply reaches the blood, and by that channel all the tissues of the body which demand such constituents. Luckily, the food of our poor, and of our labouring population is singularly rich in these, and not the slightest fear need be felt in the event of the introduction of the water from St Mary's Loch, that scrophulous diseases, well described by "Physician" as "the scourge in our dense populations," will undergo an appreciable increase. Much rather may we not confidently expect that with the introduction of an *abundant* supply of *pure* water, the general health of the community will undergo a marked improvement, and that more especially, with an increased water supply, taken in connec-

tion with the great scheme of city improvement so successfully commenced, the prevalence of scrophulous diseases among the children of our poor population may be effectually checked. Our "Physician" makes merry on the subject of the economical benefit arising from the use of pure water; but in the case of a poor population, this becomes a matter of great importance. Dr Mapother says, p. 99, that "the water with which Dublin will be supplied from the Vartry will be so much softer than that now used, that the daily quantity distributed to the inhabitants will contain ten tons less of lime salts. This will lead to a great economy of soap, for it is calculated that the interest of the cost of the Glasgow water works is repaid by the saving in this particular, and each Dublin citizen will save one penny per week in washing, and something more in the economy of tea, when the supply of soft Vartry water is accomplished." He adds (p. 95), "The advantages of a soft water are briefly, that it is more economical, by the saving of water and soap in ablution and washing of clothes, and it saves fuel by boiling at a lower temperature, and by forming no crust, which must weaken the heating power of the fire. Much labour is required for removing this incrustation. Soft water is more suited for most culinary purposes." This last point is one of much importance to our Scotch populations who live so much on broth, and boiled meat, and who, in their standard diet of porridge, use of course a large proportion of water.

"Physician" allows that the water supply for the present and previous years has been deficient, and admits that "some inconvenience" may have been felt in consequence, but he denies that there has been "actual distress," and certainly any "increased disease and mortality." It is no doubt an easy and a pleasant thing for him in his study chair to give us such comforting assurance, but one naturally asks on what kind of evidence has he arrived at these conclusions? Has he satisfied himself by visitation among our sick poor, or by conference with our Parochial Medical Officers whose duties lead them into the poorest districts of our city? or incapacitated perhaps by age and infirmity from leaving the precincts of his study, has he perused the evidence tendered on these

very points by some of the most eminent members of his profession and possibly of "Physician's" own College, should his position in the profession have justified his election as a Fellow? The late Sir J. Y. Simpson, Dr Moir, Vice-President of the College of Physicians, and Dr Alex. Wood, member of the General Medical Council of Education, visited the poorest districts of the city, and assured themselves, by actual inspection and interrogation, not only of the existence of a deficient water supply, but of the sufferings, not to speak of the "inconvenience," felt by the inhabitants in consequence. Surely it was the duty of any one prepared to write so dogmatically on the subject of our water supply to have read the medical and other evidence adduced by the Corporation before the Committee of the House of Lords, and which told so convincingly on the Committee that the question of the deficient water supply was at once settled in favour of the promoters of the Bill to acquire the works, &c., of the late Water Company. But "Physician" says the mortality is actually less this year than what it was last year, and as the scarcity of water has been greater this summer than last, it was to have been expected that there should have been a corresponding increase in the mortality. This apparent discrepancy admits, however, of an easy explanation. In 1869, in addition to a very large and unusual mortality from consumption and other diseases of the chest owing to atmospheric variations, scarlet fever and hooping cough were epidemic, and there can be little doubt that the mortality from scarlet fever was largely increased in consequence of the scarcity of water. Ablutions and baths are of importance in the treatment of this disease, and to secure others from the risk of infection it is of great consequence that the supply of water be abundant so as to admit of the washing and renewal of the body and bed clothes. This year, on the other hand, neither scarlatina nor hooping cough has raged in an epidemic form, and the mortality from chest diseases has fallen to its usual standard.

Throughout his letter "Physician" refers only to the drinking properties of water, and apparently forgets the other and important ones it subserves for domestic purposes. Now the scarcity in Edinburgh during the last two summers has never

amounted to a famine so that the thirst of the inhabitants could not be assuaged, but it has, I maintain, been dangerously deficient for other and necessary purposes, and I cannot do better in bringing these comments to a close than by citing the testimony of Professor Parkes as to the consequences of an *insufficient supply of water*. "The consequences either of a short supply for domestic purposes, or of difficulty in removing water which has been used, are very similar. On this point, much valuable information was collected by the Health of Town's Commission in this invaluable Report. It was then shown that want of water leads to impurities of all kinds; the person and clothes are not washed, or are washed repeatedly in the same water; cooking water is used scantily or more than once; habitations become dirty, streets are not cleaned, sewers become clogged; and in these various ways a want of water produces uncleanness of the very air itself."

"The result of such a state of things is a general lowered state of health among the population; it has been thought also that some skin diseases, scabies, and the epiphytic affections especially—and ophthalmia in some cases, are thus propagated. It has also appeared to me that the remarkable cessation of spotted typhus among the civilised and cleanly nations is in part owing, not merely to better ventilation, but to more frequent and thorough washing of clothes. The deficiency of water leading to insufficient cleaning of sewers has a great effect on the spread of typhoid and of choleraic diarrhoea; and cases have been known in which outbreaks of the latter disease have been averted by a heavy fall of rain." (p. 63.)

The water of St Mary's Loch is a very pure, and, in my opinion, a wholesome water. It is remarkably free from organic contamination—the importance of which in the production of disease has only been satisfactorily established of late years, and while on a par in this respect with the Loch Katrine water, it possesses this advantage that its proportion of saline ingredients is larger, and therefore that it is still less likely to act injuriously on the leaden pipes used in its transmission, or on the cisterns in which it must be stored

by the inhabitants. Its waters are not stagnant. They present a large surface to the pure air of a strictly pastoral region, and while several streamlets enter it, the Yarrow leaves it. As engineers and chemists have again and again pointed out, it possesses as a natural reservoir, great advantages over all artificial collections of water secured by earthy embankments, such as are contemplated in all the other proposed schemes, and from the slight variations in the level of its surface in the driest seasons, it also contrasts favourably with natural reservoirs such as those of our present water supply, which have been empty for months, and exposed to the disintegrating action of the air and sun.

In the foregoing comments I have carefully abstained from following "Physician" in his purely technical discussions which are only of professional interest, and which like many of his other statements are open to the grave objection that they do not represent the science of the present day. I have appealed to ordinary sources of information which are to be found in the library of every intelligent physician who lays claim to the character of a sanitary reformer. Stronger facts might have been adduced, and more convincing arguments quoted from our Parliamentary Blue-books and other volumes which could only be consulted with some difficulty by the non-professional reader. My aim has been to make such quotations from undoubted authorities, as must carry conviction to any unprejudiced mind.

HENRY D. LITTLEJOHN, M.D.,

Medical Officer of Health.