mainly due to the remaining fragments having a very rich blood supply. It merely remains for us to say a few words on the technique employed at our operations and to give a table of our experiments (see p. 157).

Technique.

Ether has always been used as an anaesthetic. Mice stand it well, and usually run about their cage in a normal manner within an hour of its being stopped. The operations were performed under the strictest aseptic precautions. After sterilizing the skin an incision was made whose length depended on the size of the tumour, well in front of it. On reflecting the skin the tumour, unless it has infiltrated the muscles, adheres to its deep surface. After ligaturing the blood vessels the tumour is removed, together with an elliptical flap of skin to which it adheres. By varying the size of this flap we can remove as widely as is necessary. In such cases in which the operation was purposely made an incomplete one, we cut and shelled the tumour of the skin, and were thus able to leave pieces of it behind in connexion with their blood supply. The wound was closed with silk. No dressings were applied. Primary union resulted in all our cases in which there was no recurrence in the scar itself. Except in one or two of our earliest experiments we have never had any signs of sepsis.

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¹ Bashford, Third Scientific Report of the Imperial Cancer Research Fund, 1908, p. xv. ² Bowen, loc. cit., pp. 146-158.

ON THE INFLUENCE OF CALCAREOUS DRINKING WATER IN HEALTH AND DISEASE.*

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In estimating the various influences which combine to make up the elements of any particular climate, it is reasonable to suppose that the drinking water of a locality may be a matter of considerable moment, and the subject of our discussion to-day is "hard water" wherever it may be found. But the water which most particularly concerns us is that which owes its hardness to the presence of chalk in solution.

The question, then, arises, Is any importance to be attached to that fact, and if so, what, and how much?

Now it does not necessarily follow that opinions held by the public, even if they are ever so widely maintained, are correct. Far from it. But we have to recognise the fact that there are many notions held by the public, notions almost amounting to "fixed ideas," which receive a certain amount of medical support. And it is for us to inquire how far these notions are justified, and what foundations in fact they possess.

The majority of persons are profoundly influenced by climatic conditions. The question is, then, Is the drinking of calcareous water one of them?

A large number of different diseases have been attributed to the influence of chalky drinking water, but those more usually alleged are gout, rheumatism, calculus, constipation, biliousness, dyspepsia, eczema, goitre, and arterio-sclerosis. Let us consider and examine the evidence which can be brought forward to establish the reality of these baneful influences.

IN FAVOUR OF BANEFUL INFLUENCES.

1. First of all there is the undoubted fact that many persons when coming to visit or reside at the towns on the south-east coast do suffer, at any rate at first, from some of the different conditions mentioned, though it remains to be proved that the hard drinking water, rather than other causes, is the reason of this. We shall return to this point later on.

2. Though a number of medical men hold views similar to those of the public, it is difficult to discover how many have spoken with authority on the subject, or how much reason they have given for the faith that is in them, still less have they described the *modus operandi*. From a discussion held by this section in 1907 on the "Influence of Climate in Gout, Rheumatism and Rheumatoid Arthritis," there followed as a main result of the deliberations the opinion that climate had a good deal more to do with the production of these diseases than water. There was a general agreement that warmth, even temperature,

dryness, free ventilation of the district, house construction, the character and habits of the people, were all important matters. Dr. Buckley, who opened the discussion, suspected that the functional disorders of the liver common with people on first coming to the seaside might be the precursor of gout, etc. But these effects are acknowledged to be but temporary. Dr. Buckley, however, said that he was convinced that places where the water was hard and chalky were unfavourable to gout. He apparently based his opinion on the number of patients who go to Buxton for treatment from Folkestone and the neighbouring resorts. There is, however, quite a different explanation than the drinking water of the gout from which these persons suffer.

(a) In the first place, most of these people are not natives of the seaside towns at all, but come to live in them on retirement from more active work. In all probability they acquired their gout long before taking up their residence here, and they, as a rule, probably drink very little, or none, of the local water supply in an un-boiled condition, partaking usually of the aerated or bottled waters at their meals. Moreover, they unfortunately persist in the habits and diets which gave them their gout in the first instance, and which may be expected to bring forth more and more frequent exhibitions of their malady as life advances. Dr. Buckley would find very few, if any, of his patients who were total abstainers, or who imbibed as much as a pint daily of calcareous water.

(b) Sir Hermann Weber, in his *Climatology and Balneology*, says:

It has been suggested that hard drinking water accounts for some of the indigestion and biliousness in visitors to health resorts on the chalk downs of the south coast of England.

He goes on to say that:

There is some evidence that the administration of calcium carbonate (and chalky mineral waters) tends to diminish the amount of uric acid excreted in the urine, and perhaps in some way to lessen its production.

Again he says:

Chalk does not appear in any way to increase the size of urinary concretions. Contrexéville water, which is harder than Bath water, owes most of its repute to its diuretic action.

And:

It is possible the internal employment of calcareous waters might be useful in some cases of chronic and recurrent urticaria, chronic headache, etc.—conditions which are associated with deficient coagulability of the blood.

(c) Nor, if we turn to other authorities, do we find them any more definite. Rumph, for example, states that when much lime is taken with the food some of it remains stored up in the body, and may increase the tendency of calcareous deposits in the cardio-vascular system of old people. Rumph evidently considers this a disadvantage, but on the other hand, if we refer to Sir Clifford Allbutt, we find him of opinion that hard drinking water plays no important part in the causation of arterio-sclerosis. Sir Clifford Allbutt merely regards calcification as a secondary event which does not enter into the process until the lesion is otherwise established. Then, he says, calcification may be some protection to a decaying vessel. In any case, if the degenerative process wants lime, there is plenty to be had both in the body and in the food without calling on the chalk in the water.

(d) The Commission which was appointed by the Home Department in 1851, to investigate the quality of water available for the supply of London, after taking evidence from a large number of medical men and chemists, reported amongst other conclusions as follows:

The only observations from which an interference of the lime in water in deranging the process of digestion and assimilation in susceptible constitutions has been conjecturally inferred, have been made upon water containing much sulphate of lime and magnesia, as the Brighton shallow well water or the hard selenitic water of the new red sandstone, and have no force when applied to the Thames and its kindred waters, as the earths exist in these principally in the form of carbonates.

The objections, then, do not apply to chalky water.

(e) If we turn to books on *materia medica*, we learn that lime salts given in medicinal doses only enter the circulation in very small quantities, and appear in the blood as phosphates. If merely a little enters in this way, how very small a proportion is presumably absorbed from drinking water! Is there any reason for considering it as otherwise than as a negligible quantity? Is there any

* A paper read before a provincial meeting, at Folkestone, of the Section of Balneology and Climatology of the Royal Society of Medicine.

evidence that hard water is useful in any of those conditions for which calcium salts are commonly prescribed with success? Are the diseases for which calcium salts are given rare in communities supplied with hard water? The important part played by lime salts as a constituent of bones has suggested their use as a specific remedy in rickets, fractures, and other diseases of these structures, and medicinal doses of calcium salts are given for these conditions. There is no evidence, however, that calcareous waters are of any service in this respect. Of other diseases for which calcium salts are given the most prominent are menorrhagia, haemophilia, purpura, haemoptysis, and tendencies to capillary haemorrhages in general, urticaria, pruritus, some forms of headache, exophthalmic goitre, and scrofulous glands. It cannot be said that these diseases are rare or do not occur in the health resorts in question. But no medical man practising in these east coast resorts would expect to obtain a curative effect from prescribing even large quantities of water from the main. Undoubtedly, many women who live in the seaside towns of this district suffer more or less at their periods than they do elsewhere, but, as amenorrhoea is also common, it is difficult to imagine that the water supply plays any part in the matter whatever.

(f) A number of cases of goitre are treated annually at the Folkestone Hospital, but it appears that most of them come from the country districts outside the town, away from the hard water supply. Goitre is more often associated with limestone districts. It is prevalent in some areas and absent in others where the conditions appear the same. Melted snow water is supposed commonly to exert more influence in the causation of this disease than any other waters, however hard.

(g) Dr. Mitchell Bruce says that the action of calcium salts on the skin is desiccative and astringent; and this, then, may have some bearing on the causation of eczema—a disease, however, which is uncommon here. There is no doubt that it is possible to cleanse the skin more thoroughly with soft water than with hard, and ladies who reside in these districts mostly use distilled water for washing their hair, as they find that the local hard water causes it to become dry and brittle.

(h) Another interesting fact is that stated by Parkes in his work on hygiene, that coachmen and grooms dislike hard drinking water for horses, and there is a consensus of opinion amongst them that the animals' coats suffer from its use and become harsh and dry instead of sleek and glossy. Horses drink large quantities of water in an unboiled condition. Though this evidence may appear important, yet, as our patients do not drink large quantities of unboiled hard water, its value is somewhat discounted.

(i) If calcium salts do not act directly, can they act indirectly? The experiments of Dr. W. G. Little on the solubility of the various salts of uric acid at the temperature of the body and in saline solutions rather suggest the truth of this. He found that the addition of a small amount of sodium chloride—namely, $\frac{1}{2}$ per cent. to distilled water—increased the solubility of calcium and magnesium biurates, but reduced that of sodium biurate to almost zero. Dr. Little also found that the addition of even small percentages of calcium salts to distilled water had the effect of very much lessening its solvent action on sodium biurate. Dr. Little concluded from these experiments *in vitro* that the formation of deposits and tophi was largely helped by the presence of calcium salts. These experiments made in glass vessels cannot, however, be made to apply to the human economy and its drinking water, the amount of calcium salts imbibed in drinking water being very small compared with the amount of the same salts taken in food.

CONSIDERATIONS AGAINST BANEFUL INFLUENCE.

We see, then, that there is little that is convincing which can be said in favour of the view that chalky drinking water exerts a baneful influence in health or disease.

Now, having considered the evidence in favour of the view that chalky water is pernicious to health, let us briefly review what can be stated on behalf of the opinion that such water is not noxious in its effects.

1. We will begin with Parkes. He says in his book on hygiene that calcium carbonate in drinking water does no harm.

2. Hard water is less easily contaminated with organic matter than soft.

3. As four-fifths of the earth's surface is provided by Nature with hard water, it can hardly be supposed that Nature would have distributed water of this kind with so lavish a hand were it to have a very deleterious effect on mankind.

4. The mortality in Great Britain of the towns supplied with hard water is rather lower than that of towns supplied with soft water. Without attributing the mortality in either place as due to the drinking water, it is nevertheless an interesting fact, as it points to soft water having no great advantage over hard.

5. Many of the mineral waters, such as those of Contrexéville, which are beneficial in gout, contain considerable quantities of carbonate of lime. In fact, carbonate of lime is found in most of the waters at different spas where gout, rheumatism, etc., are successfully treated. On the hypothesis of the noxiousness of calcareous water in gout, how, indeed, is to be explained the disappearance or diminution of tophi (chalk stones) in persons undergoing cures at the various spas? If there is anything in this idea that calcareous water is injurious, we shall, forsooth, have to abandon altogether treatment by mineral waters.

6. The upper and middle classes drink mostly bottled waters at their meals, or water that has been boiled, as in tea or coffee. Can it be said that these classes suffer less from gout, rheumatism, etc., than the lower classes?

Has it ever been proved that the blood of persons habitually drinking hard water shows an increased coagulability as compared with the blood of persons drinking soft water? Has it been noticed that diseases due to increased coagulability, such as thrombus and embolism, are more prevalent at hard water places than at others?

Do the lower classes suffer more in this way than the upper and middle classes? If calcium carbonate is provocative of gout, rheumatism, etc., how can that fact be reconciled with the microbic theory of these diseases? How can be harmonized causes so widely different?

7. As regards calculus: The late Sir Benjamin Ward Richardson was strongly of opinion that hard water had no effect in the production of calculi, thus agreeing with Weber and opposing the popular idea to the contrary.

Recently Dr. Benjamin Moore, in an article in the BRITISH MEDICAL JOURNAL on renal calculi, stated that lime should be withheld from oxalurics on the ground that it would be liable to cause oxalate of lime calculi to form in the urinary passages. Dr. Johnston-Lavis, however, in criticizing this thesis, argued that

No dietary can be planned which would reduce the calcium element so low as to be insufficient to combine with the few centigrams excreted daily even by an advanced oxaluric. Surely if these few milligrams of oxalic acid which are daily excreted are neutralized by the lime salts of our food, any amount of additional lime cannot do further harm.

The problem with oxalurics is not to prevent the introduction of calcium salts, but the absorption of exogenous oxalic acid in foodstuffs. For it is from the perverted metabolism of carbohydrates that the endogenous oxalates are derived.

Dr. Johnston-Lavis affirms that the prevention of the formation of calcium oxalate stones in the urinary passages by means of calcium starvation has been tried and has failed. The waters of Vittel contain a large amount of calcareous matter, and are taken by a large number of visitors suffering from oxaluria every year. The Vittel physicians inform us that almost without exception they find the diurnal amount of oxalates is markedly diminished or very frequently disappears, and that this result is apt to be permanent even though these people are constantly drinking Vittel water and living on a dietary in which lime-bearing food is not excluded.

On the other hand, at the Section of Pharmacology and Therapeutics of the British Medical Association meeting in July, 1910, Professor Hans Meyer of Vienna reported that it had recently been proved that oxalic acid poisoning was due to the withdrawal of the calcium salts from the body. The cardiac depression, the irritability of the sympathetic nervous system, and the general toxic symptoms of oxalic acid poisoning could, he affirmed, be relieved by the administration of calcium salts.

The late Sir John Simon, in giving evidence before the Commission on Water Supply, said there were many

explanations of the alleged prevalence of stone in the bladder in Norfolk—amongst which Norfolk dumplings held a chief place. The assertions became current when Norfolk had a famous lithotomist. It was possible that his reputation, by attracting sufferers into temporary residence in the district, or perhaps his zeal in discovering cases of stone, may have given the district a fictitiously lithogenous character. Or was it something in the shape of the dumpling which suggested a likeness to a calculus?

8. Again, it must be remembered that there is a large population living on chalky water, and if there were any very decided ill effects on their health the fact would be notorious—and we should not be debating it to-day. But, on the contrary, there is evidence pointing to some advantage to the human economy from the ingestion of calcium salts. Dr. Arbour Stephens in February last published an article in which he set forth the view that the lack of calcium salts in the food of troops on active service was a predisposing cause of enteric fever and dysentery. There is no doubt, too, but that hard water is far preferable to soft for growing children.

Birds are notorious calcium eaters. It has never been suggested that they suffer in consequence, unless, indeed, it be the domestic hen, and then only when its dieting has been undertaken by Dr. Chalmers Watson or some other member of this section.

EXPLANATION OF THE ALLEGED BANEFUL EFFECTS.

On what, then, rests the explanation of the baneful influences alleged to be due to hard water? It is said to cause constipation, but Weber says if constipation occurs it is only necessary to drink *more* of this water in order to overcome the constipating tendency; even if constipation is present the kidneys are stimulated. And owing to the increased stimulation the elimination of calcium salts is equally effected. The *materia medica* books tell us that lime salts, and especially chalk, act as depressants to the glands of the gastric mucous membrane, so that their prolonged administration might be supposed in some way to alter nutrition. But this statement alludes to medicinal doses of lime salts or chalk. And appetite, so far from being depressed, is stimulated by sojourn in such places as Folkestone and its sister resorts. It may be that this idea of the harmfulness of chalk first arose from the mistaken notion on the part of the public that tophi (so-called chalk stones) were really composed of chalk (instead, as all the medical world knows, of urate of soda, to which chalk has no relation, being as different as chalk from cheese). Therefore, it is impossible that this popular idea can have any foundation in fact. It is, however, in the so-called "seaside biliousness" that the real origin of the fallacy can be found. Nor is this biliousness to be wondered at. First, consider for a moment how completely visitors to the seaside change their habits. Consider the stimulation of appetite due to the change of air and environment, the increased tissue change, and the augmentation in the amount of exercise—all tending to cause an increased amount of autointoxicative material to enter the blood. When these facts are taken into consideration need one feel any surprise that the excretory organs at first fail to keep pace with the extra work thrown on them—fail, as it were, to keep the balance, and that temporary biliousness results from these causes?

Are we, then, to attribute the ill effects which sometimes seem to synchronize with a visit to the seaside to the hard water? Let us beware of the *post hoc ergo propter hoc* fallacy. It has been shown that there may be a variety of contributory causes to an attack of seaside biliousness and other of the diseases alleged to be due to hard water. In all probability, then, the hard water does not enter into their causation at all. The effects sometimes attendant on a visit to the sea occur equally in those who drink the hard water and in those who do not, a fact which indicates a cause other than the water for these illnesses.

To sum up, then, there is no evidence that hard water has any bad effect; on the contrary, all the evidence is the other way.

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CONGENITAL DEFICIENCY OF SPEECH AREAS.

(CONGENITAL APHASIA?)

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I was consulted some months ago by a mother on account of the inability of her son to talk. She had noticed no other difference in the child from her other children. The father had a slight impediment in his speech, saying "mouf" for "mouth," and such-like. A brother of the father suffered from epileptic fits.

The child, aged 5 years, could not utter a single word. When eight months old he had an attack of bronchitis and bronchopneumonia; he then contracted whooping-cough, and his life was despaired of. The child had rickets, presenting pigeon-breast, Harrison's sulcus, knock knees, and even at 5 the anterior fontanelle was not closed. Convergent squint was present, and was common to the other children. The boy was right-handed, could hear and understand spoken speech. He could run messages to neighbouring shops. He was obedient to his mother. He played with other children, fought, and took his place at table in his own particular chair, and fed himself. I could not get him to speak a word. His sister of 2 years could use many words. The boy had been surrounded by speaking children during his short life. He phoned a sound like "ta!" or "ah!" suggestive of cleft palate, but the tongue and palate were normal. He had just commenced school, and took a great interest in picture-books. He could make crosses and strokes with a pencil. The sound "ta!" did duty for "yes," "thank you," and indeed everything. He understood what was said to him, carrying out his mother's instructions as far as a child of 5 could do. He was fairly well nourished. He was always delighted when I visited the house, and ran to inform his mother, pointing and phoning his only sound.

In the *BRITISH MEDICAL JOURNAL* of May 13th, 1911, Dr. Eva McCall recorded two cases, one of word-blindness and one of word-deafness. It is, I think, unwise to label these cases aphasia.*

True aphasia, according to Byrom Bramwell, is a term applied to derangements of speech resulting from functional disturbance or organic disease of the higher speech mechanisms. Its varieties are:

Motor	Motor vocal aphasia	Cortical
	Motor writing aphasia	Subcortical
Sensory	Auditory aphasia	Cortical
		Subcortical
	Visual (reading) aphasia	Cortical
		Subcortical

By speech is meant vocal speech or its equivalent of educated persons, and does not include defects due to imperfections in end organs, eye and ear.

Congenital cases must be due (1) to lesions—intrauterine or at time of birth—or (2) developmental defects. One or more of the speech areas subsequently to be trained for speech are destroyed or defective. "Congenital deficiency of speech areas" would be a clearer description of the condition, since aphasia carries with it the association of more or less established function of the speech areas, and some subsequent thrombosis, embolism, tumour, haemorrhage, meningitis, etc. Congenital cases appear more likely to be bilateral and developmental in origin. One could scarcely have better ground to work on than that of an infant, to train the right (non-driving) side of the brain to take on the work of the left (driving) side of the brain. It does not do so, however, or the diagnosis would not be made. If the cases above referred to are considered to be true one-sided aphasias, applying Byrom Bramwell's rule they can be classified as follows:

Author's Case.

Boy aged 5. Cannot speak. Can hear and understand spoken speech. Can make crosses with pencil (will read and write) } = Motor vocal aphasia, subcortical variety (way out blocked).

Dr. Eva McCall's Cases.

1. Boy aged 12. Cannot read. Cannot write from dictation. Could write his own name } = Visual aphasia, cortical variety (motor writing aphasia a necessary concomitant).
2. Boy aged 8. Not deaf to sounds. Word-deaf. Able to talk imperfectly. No memory for words } = Auditory aphasia, probably subcortical variety, with a memory for words intact, but way to it blocked.

* See Dr. W. J. Rutherford, *BRITISH MEDICAL JOURNAL*, June 3rd, 1911, p. 1348, and Mr. Macleod Yearsley *ibid.*, June 10th, 1911, p. 1406.