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A GUIDE
TO THE USE OF THE
BUXTON MINERAL WATERS

BY WILLIAM HENRY ROBERTSON, M.D., F.R.C.P.,
CONSULTING PHYSICIAN TO THE BUXTON BATH CHARITY AND
DEVONSHIRE HOSPITAL.

TWENTY-FOURTH EDITION, REVISED & ENLARGED.

COMPRISING A
DESCRIPTION OF THE BATHS
OF THE MINERAL THERMAL WATER,
AND THE
USE AND EFFECTS OF THE DOUCHES AND MASSAGE
WITH THE WATER, &c.;
AND THE
RESULTS OF THE ANALYSES
OF THE
THERMAL, CHALYBEATE, AND GRITSTONE WATERS
OF BUXTON,

BY
THE RIGHT HONBLE. SIR LYON PLAYFAIR, K.C.B., F.R.S.,
Some time Professor of Chemistry in the University of Edinburgh;
DR. MUSPRATT, M. HEHNER, DR. THRESH, AND OTHERS;
WITH NOTICES OF
THE EXTENSION OF THE HOSPITAL,
THE GROUNDS AND BUILDINGS OF THE BUXTON
GARDENS COMPANY,
AND THE SANITARY ADVANTAGES OF BUXTON AND ITS
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A GUIDE

TO THE USE OF THE

BUXTON MINERAL WATERS,

&c.

PREFACE, &c.

This smaller Guide to the use of the Buxton Mineral Waters has now reached its twenty-fourth edition. There has been no edition of less than one thousand copies, and the more recent editions have consisted of two thousand copies; and more than 36,000 copies have been issued altogether. It cannot but be gratifying to have such additional proof of the extended usefulness of these great mineral waters.

Issuing from the earth at the uniformly constant tepid temperature of 82 degrees Farenheit, in unvarying and vast quantity, beyond any possible requirement for bathing purposes; of a chemical character that has undergone no change, as proved by successive examinations, extending over more than three hundred years; of slightly alkaline and emollient character; containing a considerable surcharge of pure nitrogen gas; bright and beautiful in appearance; easily raised from its natural temperature—which is from 30 to 40 degrees above that of ordinary cold water—to any higher temperature that may be desired for medicinal purposes; the prescribed

temperature being obtained with less alteration of chemical character than occurs in lowering the temperature of hot natural springs to any heat that can be used as baths; the mineral water of Buxton is at much advantage for medicinal use above other mineral waters of similar character and effects.

More recently, the long-continued usage by the Mineral Water Bath Establishment at Aix les Bains, dating it would seem from the time of the Crusades, and used at Aix apparently from that time to the present, has suggested a more methodical and energetic manipulation of the surface of the bathers by shampooing or massage; and this has been taken up by the more important mineral water establishments of Europe, and been added to the bathing appliances of Buxton. Douches have been in constant use in the mineral water baths of Buxton during the greater part of the present century, and been found to be of signal value in specially localised spinal, muscular, and joint conditions of rheumatic and neuralgic character; but a more special use of friction, manipulation and massage of muscles, tendons and ligaments was found to hold out curative expectations that douches alone could not obtain; and the full means of massage, &c., were asked for by the principal medical residents of Buxton, and immediately granted; and have secured an amount of success beyond all expectation. Many hundreds of cases, otherwise apparently intractable, have now been submitted to the massage treatment, in connection with the use of the Buxton Mineral Water, with conclusively curative results. There are separate rooms and massage bath apparatus for gentlemen and ladies; and good results have been obtained, not only beyond what, in these exceptional cases, have been derived from the use of the baths and douches heretofore exclusively employed, but beyond the benefit obtained at some other important mineral water resorts, confirming and extending the medicinal value of the Buxton thermal water, and justifying most fully this important addition to the mineral water bath appliances of Buxton.

The location of Buxton at an elevation of one thousand feet above the sea-level, and in the centre of an upland district having a diameter of from twenty to forty miles,

and consisting of the dry formations of mountain limestone and millstone grit, secures for it a dry and bracing atmosphere, which must conduce much to the restorative and medicinal value of the thermal water.

The sanitary character of Buxton is secured by a full water-supply for domestic purposes, of undeniable purity, obtained from the summit of the gritstone formation; and by a completed drainage, carried out from the plans and under the supervision of Sir Robert Rawlinson in the first instance, and by complete purification of drainage by the use of a local iron water and lime, under the skilled plans of Dr. Thresh, which has reduced still more a previously low death-rate, as recorded officially and tabulated by Mr. F. Turner, the Medical Officer of Health for Buxton; and thus the character of Buxton as a Health-resort, whether on account of its Mineral Water, or on account of its dry, pure, and bracing mountain air, or on account of its other sanitary advantages, justifies any claim that can be advanced on its behalf.

All these claims are set forth in this little work, that has been so long before the public. It would surely be well if similar claims as to sanitary conditions, could be advanced as to every place made use of as a health-resort, whether on the Continent or in the United Kingdom; and it is surely desirable, that such conditions should exist in all places, to which invalids may be sent, whether inland or on the sea-coast, and whether connected or not with the use of any specially indicated mineral water. The records of some health-resorts, more particularly on the Continent, have shown with sad frequency that these important conditions have not been secured, and that both drainage and water-supply are inadequate and impure. Surely such conditions should be fully and satisfactorily ascertained, before patients are sent, with weakened strength, and correspondingly increased susceptibility, to the risk of such dangerous liabilities.

The municipal character and importance of Buxton have been advanced by the erection of a Town Hall of considerable architectural merit, at the summit of St. Ann's Cliff, and of the terraced walks in front of the Crescent. This admirable building was opened to the public by the Marquess of Hartington, in June, 1889.*

In the same year, a large room, for general and dramatic entertainments, was erected on the north side of the Pavilion buildings, in the grounds of the Buxton Gardens Company, and has added much to the value and prestige of the Company. The Auditorium gives accommodation to about eight hundred people; and there is a large stage suitable for dramatic purposes, with all convenient dressing-rooms, &c. As an addition to the great Pavilion, with its Concert Hall, Central Hall, Corridors, Conservatories, and Reading Room, this additional room supplies a great public requirement.

BUXTON, 1891.

ADDITIONAL PREFATORY FACTS AND SUGGESTIONS.

The following re-prints from the Author's communications to the *Lancet*, &c., with additional observations, may also be desirably prefixed.

It cannot be too generally known, and appears to be little understood, that the Buxton baths and waters are made use of at all times of the year; and, as may be gathered from the statistics of the Hospital, as well as from the general medical experience, with the same curative results. The use of mineral waters during the summer months only, arose from the difficulty of access to them at other times of the year, when there were no railway facilities. The majority of the continental mineral waters are now used throughout the year. The use of sulphureous and the more strongly saline mineral waters may nevertheless be disadvantageous in cold weather; but the use of a nitrogenous water in the winter time, can only require a little more care as to clothing, and the avoidance of needless exposure to cold.

The opinion as to the importance of placing health resorts at a considerable elevation above the level of the sea, appears now to be universally entertained by medical men. Moreover, the degree of elevation required or thought desirable seems to be near to the one thousand feet of elevation, at which the lowest part of Buxton is situated. Very much greater elevations would seem to be chiefly useful from being within the influence of glaciers; and fifteen hundred feet of elevation have been assigned as representing the principal requirements of health restoration. The dry subsoil of the Buxton district may render a higher elevation than Buxton occupies less necessary; but the uplands which surround the shelving sides of the valley of Buxton, represent elevations of from twelve to sixteen hundred feet, and may give all the conditions that can be asked for.

A frequent and very important difficulty and hindrance, as to restorative or curative results from the use of mineral waters, arises from attendant or consequent debility. The probability or amount of such effect must be lessened by an upland, dry, and bracing location.

The relative good or less satisfactory effect of mineral waters, is often due to climatorial influence. The comparative cold of elevated localities, and even the occasional discomfort or inconvenience of exposure to wind or weather, may be more than counterbalanced by so much less risk or probability of relaxation. As to the effect of rainfall on health, there seems to be no doubt that its action is beneficial, where situation and subsoil secure against damp emanations, possibly contaminated with vegetative decay. These considerations are so far in the favour of the locality of Buxton.

There are many reasons why Buxton might be wisely selected for the recovery of health and strength, and as a place for rest and restoration after illness, during any obtainable intervals of time in a life of mental or bodily toil and wear and tear, or after a continuous strain of overwork. The healthiness and health-giving conditions of the locality may become hereafter more important in the general interests of the public than the medicinal tepid nitrogenous water, which is known to be so useful in the relief of rheumatism and gout, and their allied or concomitant morbid weakening or crippling conditions.

The physical characters of the climate of Buxton are exceptional in degree, and of great value in a sanitary point of view. The lowest part of the town of Buxton is at an elevation of one thousand feet above the level of the sea. Buxton is placed nearly in the centre of an elevated range of country, varying in height from nearly two thousand feet above the sea-level, and having a diameter in different directions of from twenty to forty miles. Nearly the whole of this great area consists of the dry geological formations of mountain limestone and millstone grit, which meet at the lower part of the town, being separated at this point close to the course of the Derbyshire river Wye. The extensive country occupied by these dry formations, is for the most part very thinly covered with soil, and chiefly consists of pasture land and occasional plantations, broken into hills and valleys, serving as the watershed of the less elevated districts; and giving origin to several rivers, principally the Derwent, the Wye, the Dove, the Manifold, the Goyt, and the Dane. The air of the district is therefore not only of corresponding rarity and purity, but is remarkably dry,

and singularly free from any terrestrial influences or impurities.

The dry, thin, mountain air has a bracing and stimulating effect, which is of eminent value in many, and probably in most invalided conditions. There is an increasing trust in the restorative character of such an air, when it can be borne without direct irritation, in contradiction to the older opinion that a blander and more relaxing air is medicinally preferable. Even pulmonary cases are often found to be beneficially influenced by a dry mountain air, although keener and colder; and to most conditions of weakness and relaxation, the drier and more thin air offers a greater chance of recovered strength, with reasonable care and protection as to clothing, &c.

There is, moreover, the important sanitary circumstance, that the water supply for all domestic purposes, independent of the naturally tepid mineral water, is derived from the summits of the adjacent hills, poured out from the surface of the gritstone by never-failing springs, arising above the level of any habitations, so far necessarily free from organic contamination, and stored in excess of any ordinary or probable requirements of the population.

Inquiries that are addressed to me from time to time by medical men lead me to think that the BUXTON TEPID WATERS are practically unknown to many, notwithstanding the great publicity which has been given to them by the extensively circulated reports of the Devonshire Hospital and Buxton Bath Charity, and notwithstanding that the guide-books to the use of the waters have an average sale of not fewer than from 2,000 to 3,000 copies yearly.

Buxton is so far to the north of the midland counties of England as to be placed about midway between Derby and Manchester, and almost centrally between the eastern and western coasts, at an elevation of one thousand feet or upwards above the level of the sea, on the great geological formations of mountain limestone and millstone-grit, which meet at Buxton; and from the edge of the mountain limestone formation the tepid water finds its way to the surface, from such depths as to have been cooled in its transit from the greater heat of the deeper source to the

comparatively moderate warmth of 82° F. At this temperature the outflow is so great as to supply the baths and well with an unvarying quantity of nearly 150 gallons per minute, entirely unaffected by heavy rain or long drought, and presenting chemical characters which do not seem to have varied in any degree from the time when the first analysis was made by Dr. Short, more than one hundred and fifty years ago, or that by Dr. Pearson more than one hundred years ago, or even from the time when it was examined by Dr. Jones, in the best way that the chemistry of the period allowed, more than three centuries ago, until the time when it was analysed with all modern facilities and exactness by Sir Lyon Playfair in 1852, by Dr. Sheridan Muspratt in 1870, by M. Otto Hehner in 1876, and by Dr. Thresh in 1881. The water is singularly bright and clear, of a very beautiful faintly-blue colour, as seen in bulk in the baths. As has been said, it is of the temperature of 82° F. It is slightly alkaline, remarkably soft and emollient to the skin, leaving the surface of the bather very smooth and pleasant to his feelings. There is no doubt that this affects the medical value of the water in a very important degree, increasing much the readiness with which it is absorbed through the skin of the bather; more particularly when, as is always directed in the case of invalids, the absorption is promoted by exercise and friction of the surface during immersion in the baths.

The water is surcharged with nitrogen gas on its issue from the earth. The fact that the gas held in the water is pure nitrogen was discovered by Dr. Pearson in 1780, confirmed by Sir Charles Scudamore and Mr. Garden in 1818, and shown to be present by Sir Lyon Playfair, Dr. Muspratt, and Dr. Thresh. The quantity of nitrogen in this water is probably greater than in any other mineral water, and seems to be approached most nearly by the water of Gastein and that of Wildbad, both of which are remarkable for having nearly the same action on gouty and rheumatic affections of the fibrous tissues as the waters of Buxton. In its natural state, whether used as baths or taken internally through the stomach, the water is too exciting in its effects to be used when there is acute or even active morbid action. The degree

of effect on the system can be readily adapted to the condition of the patient when the water is drunk, by holding the glass in the hand before drinking, during a longer or shorter time, so as to allow more or less of the gas to be dissipated; and when used as baths, by adding heated mineral water to the water at the natural temperature, to any required degree; and, if necessary, by immersing only a part of the body in the water of the bath. These are what are called three-quarter baths, or half-baths, or quarter-baths, the baths being used at any temperature from 86 to 100 degrees; or there may be no immersion, the water being sponged and rubbed into a larger or smaller extent of the surface of the body or limbs, or applied to any specially affected part by means of pads or compresses. In these ways, the water is adapted to almost any degree of excitability, or weakness, or morbid state; the effect being modified and lessened as it is heated above the natural temperature, and as it is applied to a greater or less extent of surface. In more chronic conditions, on the other hand, the local effect is increased by using it in the form of douches and massage, by which its absorption and action are secured at or near to any part which is specially affected.

The principal medical action is evidently on the fibrous tissues, promoting the absorption of morbid products, and relieving consequent disability; crippled joints becoming so far restored, and stiffened limbs relaxed. The result thus obtained, sufficiently great or even marvellous to prove the powerful action of the water, sometimes leads to an over-weening expectation as to its possible influence. It need not be told to medical men, that no such treatment can remove actual disorganisation, or re-produce a sound condition of joints or tissues, which have been structurally damaged by disease. The water has restored mobility to joints and limbs, after having been crippled during many years; but usually the effect is less certain or less complete, the longer the morbid condition may have existed; and usually the effect is more immediate, as well as more complete, the younger the patient, and the more recent the case. The effect on the constitutional condition is perhaps better evidenced in cases of gout than in cases of rheumatism, in that the attacks become commonly less frequent, and their character more acute, after one or

more courses of the Buxton waters; the seizures being so far restored to the character manifested in the earlier attacks, and partaking less of the more chronic and almost continuing irritation, which marks the cases of advanced and severe gout. But, although less marked, from the very nature of the disease, the same observation applies to cases of rheumatism and its morbid results. The liability to rheumatism becomes diminished in the same degree that the results of rheumatism are lessened; the effect on the local lesion is an index and earnest of lessened constitutional liability. Poor sufferers from rheumatism regain and retain sufficient mobility of limbs and flexion of joints, to enable them to continue their occupation as weavers, spinners, winders, frame-work knitters, colliers, agricultural labourers, &c., if the yearly visit, or the visit every two or three years, as may be, is paid to Buxton, its baths, water, and hospital, who otherwise lapse into more severe decrepitude, requiring an eventual visit of greater length, and attended perhaps with less sufficing results, although perhaps sufficient to show the medical value of the water. The emulgent action appears to be chiefly through the kidneys, but is obviously also through the skin. The effect can only be expressed by the old word "alterative," involving a degree of resulting debility, proportioned to the morbid condition and relative strength of the system.

The Buxton waters are so powerful in their action as to require careful use. If used in excess they weaken the system, and so far lessen the restorative power, and the probabilities of benefit. If the baths are used more frequently than on alternate days, or at the most on two successive days, omitting the third day, this debilitating and disadvantageous effect is very commonly induced. It is seldom that a longer immersion than ten minutes in the bath is necessary or desirable. The amount of medicinal effect from the baths is commonly influenced by the texture and absorbent power of the skin, and promoted by the degree of friction, or rather *pressure* or *kneading* by the hands of the bather, during the immersion. This *kneading* is necessarily more useful over the

insides of the legs and thighs, than where the skin is more thick and the absorbent power less active. It is commonly unwise to rub the parts affected while in the bath. This is one of the most usual errors committed by bathers, and often excites irritative action, and hampers the progress of the case. For the same reason the douches are often used disadvantageously. The object must be the absorption of the curative properties of the water into the general system, much more than their introduction to parts more than sufficiently disturbed by the morbid condition. This observation applies more particularly to gouty localisations. In the rigid, dense, and dormant thickenings resulting from rheumatism, manipulation in the bath and douches or massage with the waters are often important auxiliary means of relief. The time allowed for the so-called "Buxton course" is often too short to give a reasonable expectation of benefit. Recent cases and younger patients may be sufficiently benefitted by a three weeks' course of baths; but cases of longer standing and older patients need longer treatment. It is to expect miracles, rather than treatment, to look for relief of morbid conditions which may have resulted from hereditary bias, and been in existence, and gradually becoming worse and worse, during months or years, in a shorter time than six or eight weeks. In cases of extreme weakness or sensitiveness, or with cardiac or other visceral complications, the waters are beneficially used, without immersion, by general or local spongings and kneadings, or compresses soaked in the waters, or by shampooing or massage, and thus the range of cases to which the waters are applicable has become much extended.

INTRODUCTION.

RAILWAY COMMUNICATION; BUXTON HOSPITAL;
CENSUS RETURNS;
BUXTON GARDENS COMPANY; &c.

Two important wants from which Buxton had suffered were at length supplied in June, 1863. Situated on the old main line of road, between the west of Scotland, Manchester, and London, it was, before the time when railways were first established in this country, passed daily by mail and stage coaches, carriers' waggons, &c., and enjoyed the advantage of being on one of the greatest thoroughfares in the kingdom. Rival railway companies, and local prejudices, had succeeded in rendering Buxton, year by year, more and more difficult of access than most other places similarly situated. The town and its healing waters had continued to grow in importance, notwithstanding this injurious treatment; but its effect could not have been otherwise than disadvantageous. The grand mountain district of Buxton, and the High Peak of Derbyshire,—its picturesque scenery of hills, and dales, and rocks, and trout streams; its vast geological formations of mountain limestone and millstone grit; its pure, and dry, and bracing atmosphere; its never varying and great outflow of tepid waters, highly charged with nitrogen gas, proverbially famous for relieving cases of gout, rheumatism, &c., among the most obstinate and painful ailments;—are now connected with the London and North-Western and the Midland Railways. Two stations, belonging to these railway companies respectively, are only separated from one another by a roadway, and contain waiting rooms, offices, spacious glass-covered platforms, &c., and are situated very near to the Baths, the Crescent, the hotels, and other principal buildings; and Buxton is now placed, by the Midland Railway, within easy distance from London,

Bristol, Cheltenham, Norwich, Peterborough, Birmingham, Leeds, Sheffield, Liverpool, Manchester, Derby, and the important districts of which these towns form the centres; and by the London and North-Western Railway, in direct and rapid communication with Manchester and Liverpool, Lancashire and Scotland, Crewe, Chester, and Ireland, Shrewsbury, and South Wales, Birmingham and London, Huddersfield and Yorkshire; and by the North Staffordshire trains running into the London and North-Western station, with the teeming populations of the Potteries. The Midland line, from Buxton, traversing with a high level many of the most beautiful dales in Derbyshire, exhibiting valley scenery of the character that is peculiar to the mountain limestone formation, and precipitous crags of much boldness and grandeur, offers scene after scene of unique and wonderful beauty and interest; and the London and North-Western line skirts picturesquely the south side of the valley of Chapel-en-le-Frith to Whaley Bridge, and thence through Disley to Stockport and Manchester. The North Staffordshire system joins the London and North-Western by a junction at Middlewood.

Since the autumn of the year 1858, the Buxton Bath Charity (by means of which institution the fame and value of the medicinal waters have been in a considerable degree maintained and extended, restoring, as it has done, year by year, hundreds of disabled labourers and artisans to health and usefulness), has had provided for it a home commensurate to its importance and its needs—with the provision for the comfortable accommodation of one hundred and fifty patients, and the result of extending this to three hundred patients, every patient having a separate bed,—with large day-rooms, &c.,—the building being detached, and placed on an excellent elevation, close to the town, and very near to the Baths, commanding views of the Park, the town, and the open valley in which Buxton is placed, and having a large lofty covered central area, and having in front of the building an extensive sloping pleasure ground, with walks and shrubberies, the kind gift to the institution of the present Duke of Devonshire. By extending the means of using the baths and waters, under the very best conditions, to the more needy classes of

the people, such a home for this ancient charity cannot fail to have added to the importance, and increased the public estimation of Buxton and its waters. Since the year 1881, the whole of the great pile of buildings, originally intended for stables, and occupied as such, has been converted to the exclusive use of the Hospital, at an outlay of more than £38,000; £24,000 of which have been granted by the Governors of the Cotton Districts Convalescent Fund, in return for a prior claim on the additional beds obtainable for the patients. The institution has now 300 such beds, in addition to a vast recreation room of half an acre for the use of the patients, especially in wet or cold weather, canopied by the largest dome in the world.

The increase in the size and population of Buxton supplies a remarkable instance of prosperous advancement. The population of Buxton, Fairfield, Hartington-Upper-Quarter, &c., all now virtually contiguous to one another, and to be designated, for practical purposes, under the general name of Buxton, increased upwards of 53 per cent. in the ten years from 1851 to 1861. The number of houses had been increased in at least a corresponding proportion, while the size and character of the houses had been generally improved. And, when it is added, that notwithstanding the large resort of extremely invalided visitors—notwithstanding the Devonshire Hospital, with its invalided inmates, the annual death-rate of the population had been a fraction under 17 in 1,000, the sanitary character of the town and district is conclusively shown to have been unexceptionable. According to a summary, kindly supplied by the late Mr. Henry B. Bates, founded upon the Returns of the Registrar-General, the population of the Buxton district had increased in the ten years (1851-61), from 2,702 to 4,139; the annual death-rate of the eight years (1851-58) having averaged 57·375—equal to 16·77, or $16\frac{3}{4}$ per 1,000, on 3,420, which was the mean population of the inner census period (1851-61). But, whatever the sanitary character which may have been applicable to Buxton previously to the year 1860, this would have been raised to a higher point by the drainage works, which were executed during that year, under the able superintendence of Sir Robert Rawlinson, in connection with the provisions of the "Local Govern-

ment Act," within the jurisdiction of which the townships and districts of Buxton and Fairfield had the good fortune to be placed. And, accordingly, although in the year 1863 the deaths in the Buxton district amounted to 101, so extraordinary are the circumstances of the population, in regard to the immigration of residents and the sojourn of the temporary visitors, that 43 of the deaths had to be deducted as not representing the actual data derivable from the population: leaving 58 deaths only to represent the mortality from nearly 5,000 people—or the whole 101 deaths from a population varying from a minimum of 4,000 to a maximum of from 6,000 to 8,000, or more. The drainage and removal of sources of disorder from sewage and the like, with all the contingencies of typhoid fever and intestinal poisonings, might well be expected to have lowered the death-rate, and to have raised the healthy character, even of a district so favoured by Nature as Buxton is, with its limestone and gritstone subsoils, its mountain elevation, and its undulatory and easily drainable surface. And, accordingly, in the 52 weeks following February 27, 1868, when the deaths of strangers and recent residents were deducted, the deaths from the resident population were 67, which would be only $16\frac{3}{4}$ per cent. on the population return of the census 1861: making no allowance for the increase of residents during the eight years; an increase which, much beyond the average of population throughout the kingdom, may be found to be double or treble that amount.

The "census returns" for 1871 fully support the above statements and conclusions, which have been published in the successive editions of this work. Buxton Proper had a resident population in 1851 of 1,233; in 1861 the number had risen to 1,875; and in 1871 had further increased to 2,531. The population of Fairfield, practically a part of Buxton, had been only 574 in 1851, had increased to 1,074 in 1861, and to 2,003 in 1871, or had nearly quadrupled in the twenty years. The population of Hartington-Upper-Quarter, also practically a part of Buxton, had been 892 in 1851, was 1,190 in 1861, and 1,695 in 1871. The total population of Buxton and its outskirts, which had been 2,699 in 1851, was 4,139 in 1861, and 6,229 in 1871, or had more than doubled in the

twenty years. The population of the surrounding parishes or hamlets, as Chapel-en-le-Frith, Chinley, Bugsworth and Brownside, and Peak Forest, had either remained nearly stationary, or had decreased during the ten or twenty years. To the numbers which represent the resident population of the Buxton district must be added the correspondingly progressive increase in the number of visitors, residing in the district during a few days or a few weeks only, a number which may vary from less than one-sixth of the number of the resident population during the middle of the winter, to more than double the number of the resident population during the months of summer and autumn. The total deaths in the Buxton district during the three years from October, 1868, to October, 1871, were 379, or a yearly death-rate of 126. It was ascertained by the Registrar of the district that of these deaths at least 105 must be deducted as those of strangers or visitors, or recent residents, which reduces the death-rate of the resident population to 91. This would show a death-rate of less than 15 per 1,000. But if the actual death-rate of the district could be deducted from the total population of residents and visitors, a still lower percentage would be the result. A rapid increase of population, a rapid extension of buildings, a rapid improvement in the character of the houses that have been built, have been followed by the reduction of a small death-rate to one still more favourable to the sanitary character of the Buxton district.

A still more recently issued return of the Registrar-General, dated June 30, 1878, gives the annual death-rate of the Buxton district as 20 and 6 decimals per thousand from an estimated population of 8,373. The return of the Registrar of the district for the next two years gives 315 deaths, or 157 and 5 decimals yearly; of the 315 deaths, 96 are known to the Registrar as having been strangers or recent immigrants, leaving 219 as the deaths of the resident population, or 109 and 5 decimals yearly from the 8,373 inhabitants, or less than a yearly mortality of 14 per thousand. It is noteworthy that the mortality from the seven zymotic diseases is lower than in almost any other inland or seaside watering place, given as 48 decimals, or less than one-half death per thousand of the

quarter's return; and this notwithstanding the constant liability to an importation of zymotic disease from the influx of visitors. Every sanitary work has secured a lower and lower death-rate, notwithstanding the ever increasing population, showing that the reputation of Buxton as a health-resort is fully maintained. Every report that has been issued periodically supports these statements and expectations. The official reports of Mr. Frederick Turner, the Medical Officer of Health for Buxton, tabulate the estimated and census population during the last ten years, a summary of births and deaths, and a calculation of the percentage of mortality per 1000 for the same period, and show the death-rate of 1888 to have been 14 and 35 decimals, or less than $1\frac{1}{2}$ per cent. of the permanent population of the district. "The estimate of this death-rate is higher than it would have been but for the recent introduction of considerable bodies of labourers, temporarily engaged in the construction of railway and other works now going on, amongst whom accidental and other injuries occur, and are charged against the permanently resident population." In fact, the Urban district of Buxton may claim an average yearly death-rate below that of the most favoured districts of England, and far below that of the general death-rate of Great Britain and Ireland, and additionally very much below that of the various towns and districts of Europe, from which statistics are obtainable. Buxton is shown to have the highest position as a Health Resort from the sanitary point of view, and claims a death-rate below the utmost expectation as the result of the most judiciously carried out sanitary measures.

To quote the last annual report of the Medical Officer of Health for the Buxton district, presented to the Buxton Local Board on February 20th, 1891, "The first table, containing the census and estimated population for the last ten years, with a summary of births and deaths, and a calculation of the percentage of the mortality per 1000, shows the death-rate of 1890 to have been 10.30," or little more than one per cent., or "not much more than half the general death-rate obtaining in England for the same period." The continuous history during twenty years, endorses all that can be written, as to the sanitary character of Buxton.

The "Local Government Act" has created for the town and district of Buxton an executive system, by which nuisances have been abated, improvements regulated and carried out, and new streets, roads, and houses planned or supervised. The greater part of the Buxton district, and of the country which surrounds it, belongs to His Grace the Duke of Devonshire; and to the successive Dukes of Devonshire, Buxton is indebted for most of the larger improvements it has undergone; for the development of its resources; the planting of its hills and dales; the building and endowment of churches, schools, &c.; the rebuilding and extension of its Baths; the early supply of adequate hotel and lodging accommodation; and the laying out of parks, walks, gardens, and terraces, for purposes of ornament, recreation, and building extension. The resident agent of the Duke of Devonshire has been always of much importance to the interests of the place, in carrying out the intentions of the owner of the property. Buxton owes much to the late Mr. Heacock, who, during nearly fifty years, occupied this important position—who planted the district so extensively, giving shelter to its mountain position, and enriching the barer features of its upland scenery; to the late Mr. Smithers, who, during the five years (1851 to 1856) not only supervised the re-erection and extension of the Baths, but under whose care the Park was created, the Corbar Walks were made, and the important analyses of the waters, by Sir Lyon Playfair, were obtained; and Buxton owes to the late Mr. Wilmot, who was agent for the Buxton Estate from 1856 to 1864, that it is placed under the provisions of the "Local Government Act," that it is in so satisfactory a state as to its drainage, that it has a Cattle Market detached from the town, new walks, new streets, new roads, several miles of new footpaths, the secure establishment of the Devonshire Hospital on a broad basis of extensive usefulness, increased provision for the spiritual and educational wants of the people, much improved and extended provision as to cottage accommodation for the labouring poor, and that its internal resources, generally, and its railway accessibilities, have been so rapidly and so fully developed.

Since the death of Mr. Wilmot, in 1864, the ducal agency has been held by Mr. Drewry; and extensions

and improvements continue to be projected. Successive additions have been made to the Hospital, and it has become surrounded by its own pleasure-grounds,—the principal church has been re-seated, rendered more commodious, and thrown open to the public,—a new church has been built,—a large hotel has been aided towards its completion,—the operations under the Act for the “Local Government” in regard to drainage, &c., have been extended,—many new houses have been erected and many acres of land have been set out for building purposes,—and the increase and prosperity of Buxton have been materially advanced.

With the exception of part of a reserved central circular plot of twenty acres, much of which is now advantageously occupied by the Buxton Cricket Club, the whole of the area of the Buxton and Devonshire Parks, as marked out for building sites, has been sold, and the greater part has been built upon. A new road, connecting the Buxton Park with Upper Buxton, is now formed on the southwest of the town; and a number of building sites have been laid out. These sites are sheltered and have a sunny exposure, and offer views of the Public Gardens and ornamental grounds. This may become a most important extension.

The Buxton Local Board is a very valuable power in the interests of the town. The Board has undertaken the charge and responsibility of the supply of gas and of water, in addition to its various and other important duties as to streets, houses, drainage, and the removal or suppression of nuisances. The water-supply for domestic purposes has offered difficulties from the increased and increasing wants of the growing population; and the satisfactory drainage of the town had to embrace not only the main system of drains as executed under the supervision of Sir Robert Rawlinson, but the adequate communication of every private drain with the main drains, and the discharge of the whole beyond the range of the town, and subjected to chemical purification. It is ascertained that the drainage works have been carried out satisfactorily, and all the principal conditions been fulfilled. The water supply happily offers no difficulties, as to quality or quantity of gritstone water, for the purposes of a much larger population than will ever have

to be provided for. A large additional supply has been secured from springs of unfailing and great overflow; the mixture of surface water from the adjoining summits of the moorlands, an occasional source of discolouration in rainy weather, has been modified; and reservoirs have been provided large enough to meet probable contingencies.

During the year 1871, the present and future prosperity of Buxton were further promoted by the operations of the Buxton Gardens Company. This Company was primarily instituted in order to obtain money for the payment of the band of musicians, which had always been important to the interests of the place, and had been during a very long time defrayed by the Duke of Devonshire. As the number of smaller freeholders of Buxton increased, and the proportion of property belonging to the Duke of Devonshire became relatively smaller and smaller, it became less and less justifiable that the whole of this considerable outlay should be made by the principal owner; and during more recent years, a subscription of £100 on the part of the Duke of Devonshire had been supplemented by donations and subscriptions from residents and visitors. The sum required was obtained, but with an increasing difficulty. To obviate this, it was kindly proposed, on the part of the Duke of Devonshire, to convey to a Public Company twelve acres of land, from about forty acres left free to the use of the public as pleasure-grounds and plantation walks; the conveyance being made without any charge, on the conditions that the twelve acres should be enclosed, that the enclosure should be embellished by landscape gardening, that a suitable building should be provided in which the band might perform in unpropitious weather, and that the Company should pay the members of the band from the receipts for admission to the grounds. These conditions were fulfilled, under the able advice and supervision of the late Mr. Edward Milner, in the most satisfactory manner. A large Pavilion was erected in glass, iron, and wood, with central hall, corridors, and terminal conservatories, 120 yards in length, and of proportionate width and height, with a terrace promenade in front of it having the same length and width, the whole facing the south, with grassy slopes and walks

down to the river Wye; the river being crossed by a handsome bridge, ornamented with flower vases and gas lamps; the bridge leading to a central band-stand, from which another bridge and broad walks lead to ornamental waters, artistic rock works, extensive tennis grounds, gardens, lawns, &c. The building when needful is warmed by hot water pipes, and brilliantly lighted with gas. The walks throughout these grounds have been carefully constructed and drained in the best manner, and a succession of floral beauty at different seasons of the year has been secured. All these works were executed within less than a year; and the Company from the first obtained a financial success, notwithstanding the outlay of a considerable capital, the cost of the band, the cost of the labour, and at a charge of fourpence only for admission during the day, and sixpence to the concert in the evening; these charges being less in proportion when a ticket is taken for the week, month, or year; the longer the term, the lower the proportion. The financial success under such circumstances supplies conclusive proof of the prosperity of Buxton as a place of public resort; and these buildings and gardens are a most valuable addition to the advantages of the town. These grounds were added to in 1878; and a concert hall, skating rink, and extended terrace were constructed. The concert hall is large enough to seat two thousand persons on the floor, and forms part of the great area of the Pavilion; the extended terrace, from its length and breadth, dry formation, southern exposure, shelter, and views of the grounds and gardens, prove a very valuable and important addition; and a skating rink, and quoit ground, with surrounding and planted embankments, offer protection and shelter, and are farther sheltered by being partially roofed, with open sides. Still more recently (1884) these grounds and gardens were additionally extended. A sheet of water of important size was included within their area, and widened to a considerable extent, enabling boats to be added to the public attractions. Gravelled courts for the popular game of tennis, and lawns for the same in dry weather, are valuable and popular additions. An extensive rockery and fernery, created in the course of the needful excavations, adds to

the general interest. The sides of the rockery are crowded with limestone fossils, and the clefts and edges are planted with ferns and flowering plants in endless variety, intended eventually to embrace most of the botanical specimens of this most interesting district. The extensions and additions have been carried out under the direction and from the plans of Mr. Hogg, the Curator of the Company. A large entertainment-room, suitable for general and dramatic purposes, with gallery, stage, &c., and capable of seating eight hundred persons, was added to the other public advantages in the year 1889. A second band stand, on the Terrace, has been added in the year 1890.

THERE are some points in reference to the use and effects of the Buxton waters which seem to require an especial degree of notice or explanation; and perhaps these may be considered to most advantage, or be more likely to arrest attention, if separately mentioned, preliminary to the work of which the greater part has been so long before the public, than if embodied in its substance.

Greater caution ought to be enjoined and practised in the use of these very powerful medicinal agents. Notwithstanding the directions and cautions which have now been so often repeated, even medical men residing at a distance from Buxton are not sufficiently impressed with the need of a very careful and discriminating use of them, or do not appear to state this to their patients with sufficient explicitness. Some invalids cannot bathe in these waters with any chance of benefit, or even with safety, who drink them with much benefit. Some may use the warmer baths of these mineral waters with advantage, who cannot bathe without risk, or with a reasonable probability of benefit, in the waters at the natural temperature of eighty-two degrees Fahrenheit. Some are unduly stimulated by the internal use of the waters, and are unduly relaxed by the use of the warmer baths, who use the baths at the natural temperature with perfectly satisfactory results. Some cannot either drink the waters or use the baths without disadvantage,

or even without injury, who derive benefit from sojourning for a time in this mountain district, breathing the thin and bracing air of one thousand feet above the level of the sea, upon the contiguous and extensive formations of millstone grit and mountain limestone, with the dry soil and many secondary advantages referable thereto. The character of these mineral waters, their peculiar and great effect on the system when used either externally or internally, the modification of their effects, according to the quantity that is drunk, the temperature at which the baths are used, the frequency with which the baths are used, and the period of the immersion, should be carefully studied, in order to the judicious and prudent use of so valuable a medicinal agent. It is only by such discriminating attention that these waters can be made to act beneficially upon different ailments, in different stages of these ailments, and in the infinitely modified states of system induced by the hereditary or acquired circumstances and conditions of life. The use of these waters disadvantageously is a direct reflected injury to the medical man who may have suggested their employment, and to the reputation of the waters, as well as a manifest (however unintentional) wrong to the patient. The essentially stimulating, and the no less essentially alterative character of the waters, must be known, and ever borne in mind, if they are to be prescribed otherwise than empirically; and the necessity of using them with discretion and care must be enforced accordingly, if they are to be made as useful as may be possible. This pre-supposes, of course, that the case under consideration is suited for the use of the waters in some way or other.

The second of the subjects which seem to demand more prominent attention is the unquestionable and great efficacy of the hotter baths of these mineral waters. The waters at the natural temperature of eighty-two degrees may be too cold or too stimulating for unmodified use. The addition of a very small proportion of the same waters artificially heated, is sufficient to raise the much greater quantity of the waters in the bath to any required higher degree of temperature—even to that of ninety-five degrees; and at this heat there is no doubt that the waters retain a sufficient amount of their

medicinal character to prove curative in such cases as are adapted to their ordinary effects, and which may not be suited to the use of the baths at the lower degree of heat. I have seen cases of rheumatism, and gout, and neuralgia, and such impaired use of the different joints as result from these ailments, or from fractures, dislocations, sprains, or other local lesions, as effectually relieved by the use of these hotter baths as by that of the natural baths—the difference being that the number of baths necessary to be taken is generally greater in the case of the warmer baths, and likewise that the time of immersion in the water must be longer in most instances. When the small quantity of the same water artificially heated, which has to be added to the water of the naturally tepid degree of heat, in order to raise the water of the bath to any required degree of temperature, comes to be considered, the wonder is, not that the medicinal efficacy of the water is so sufficiently retained, but that the degree of this efficacy should be even so far lessened as it is considered to be.

The third of these subjects for especial notice is one which must be noticed, although this is not done without reluctance. The important analysis of the waters by Sir Lyon Playfair had the effect of increasing the degree of confidence in their medicinal efficacy on the part of medical men generally, and led to the inference that their medicinal value may be largely, if not exclusively, referred to the gaseous impregnation. It has been generally and fairly inferred, that, even when used as baths, the water surcharged with free nitrogen gas, if absorbed largely through the pores of the skin, which must be the case if either exercise or friction is freely made use of during the time of bathing, must carry with it the gaseous constituent, and that this may well be expected to exert an important degree of medicinal influence upon certain disordered states of the system, and more especially upon those which affect the subcutaneous and the muscular tissues. All this is matter for fair and reasonable inference. It is impossible to conceive that free nitrogen can be presented to the whole surface of the body, the skin being at the same time softened, and effectually deterged, and thus rendered remarkably absorbent, by the watery medium in which

the gas is presented, and by the genial temperature of eighty-two degrees or upwards, without the absorption of this gas into the body, and a proportional amount of effect. Any additional opinion as to the way in which nitrogen could thus influence the system, whether by acting singly, or as a foreign body, and consequently as a stimulus and eventual alterative, or by entering into combination with one or more of the elements of the blood itself, or of the living or the effete tissues or secretions, and thus forming new compounds having medicinal effects, can only be matter for theory and speculation, and could hardly lead to any conclusions of practical value. It has, however, been advanced, that the nitrogen when absorbed, is immediately rendered capable of decomposing a portion of water, combining with the hydrogen in the due proportion necessary to form ammonia, and that this ammonia is the essentially curative principle of the Buxton tepid waters. This is assumed without any foundation whatever; and it may be necessary to add that, even if it were otherwise, the action of ammonia would be quite unequal to explain that of the Buxton waters. These waters are more stimulating and more alterative in their effects than could be thus accounted for. Moreover, this ammoniacal hypothesis is further based upon a statement, that the diseases in which the action of the Buxton waters is known to be remedial are marked by a deficiency of ammonia in the secretions. Animal chemistry demonstrates the incorrectness of this. Even the urine of healthy persons does not contain so much ammonia as serves to neutralise the acids which it contains; and in almost all the diseases of excitement or inflammation the urine is likewise free from the ammoniacal character. The ammonia which characterises urine, is for the most part formed from the putrescence of the urea and other animal matters contained in it, after it has been discharged from the system. Medical men need not be told that ammonia is equally inadequate for the relief of gout or the cure of rheumatism, however it may be made use of; complaints in which the efficacy of the Buxton tepid waters is signally evidenced. Any attempt to theorise as to the way in which a medicinal agent influences the system, if carried beyond the boundaries of facts, must

be disadvantageous; and I have noticed this subject accordingly. It is surely enough to satisfy the mind that these waters must have an important amount of medicinal value, to find that they contain an important impregnation of free nitrogen gas, in addition to the peculiar saline constituents which characterise the class of mineral waters generally; confirmed and borne out, as this is, by the immemorially ancient, wide and increasing reputation earned by these waters, in relieving some of the most painful, disabling, and obstinate diseases to which mankind is liable.

SUCCESSIVE ANALYSES, HISTORY,

AND

MEDICAL USE OF THE BUXTON WATERS.

BUXTON, so long celebrated for its tepid waters, is situated at the western side of the north part of the County of Derby, and on the margin of an extensive mountain limestone formation.

There can be little doubt that the tepid springs of Buxton were known to the Romans; and it is probable that a warm water, of sufficiently elevated temperature to be remarkable by its steam and heat, and thus tempting the people to bathe in it, would be used from the earliest ages as a luxurious bath, and thence have any medicinal properties it might possess, gradually, and probably not very slowly, brought into notice. However this may have been, history tells us very little of Buxton until the age of Queen Elizabeth, farther than the discovery of very old baths, of Roman, or even earlier construction, leads us to imply. But history does tell us, that, at that

sufficiently remote time, Buxton was much celebrated as a bathing place—that it was visited by Mary Queen of Scots on several occasions, and frequented by some of the highest and mightiest individuals of Queen Elizabeth's Court for the cure of their ailments.

The formation of mountain limestone, on the margin of which Buxton is situated, is of very considerable extent; and it contributes much, by its elevation and physical characters, to the salubrity and general features of the climate of the place. The lowest part of the town is 1,000 feet above the level of the sea; and this considerable elevation together with the well-known and characteristically absorbent nature of the mountain limestone, renders the air necessarily light and dry, remarkably free from fogs and exhalations, and bracing and healthful in a proportionate degree.

For the information of the distant inquirer, it may be well to mention here, that the principal building of Buxton, called, from its form, The Crescent, is devoted to two large hotels, called St. Ann's Hotel and the Crescent Hotel, and the St. Ann's lodging house; and that, besides these, there is one of the oldest buildings, the Hall, which forms a large hotel; and farther that the Burlington Hotel, the Grove, the George, the Royal, the Lee Wood, the Shakespeare, the Midland, the Eagle, the King's Head, the Cheshire Cheese, the Queen's Head, and several others, are well-supported and well-conducted establishments; that, with few exceptions, some part of every house is devoted to the reception of lodgers; and that probably from four to six thousand visitors are commonly accommodated in the town at the same time, when the place is said to be full. It deserves to be added that many additions have been recently made to the resources and accommodations of Buxton; and that these are now probably almost equal to public wants or expectations. The Palace Hotel, a very handsome building, near to the Railway Stations, situated in its own grounds, facing the south, on a commanding elevation, well furnished, warmed, and ventilated, is one of the more recent and valuable additions to Buxton. Still more recently many large and successful Boarding Houses have been established, and added more and more to adapt the town to public requirements. There is also a kindly

Institution for the reception of Invalided Ladies, on very moderate terms, called "The House of Rest," or Hartington House.*

The temperature of the water of the warm springs of Buxton is eighty-two degrees, Fahrenheit. The tepid waters make their final way to the surface through several openings or fissures in the mountain limestone. Some of the water is lost, finding a passage into the River Wye, which runs within a short distance. The quantity of the waters thus wasted is probably still very considerable; but a large amount has been regained. The amount of flow of these waters, which is now used for the Natural Baths, is ascertained to be $129\frac{1}{2}$ gallons per minute. They had been estimated by Dr. Pearson, who wrote most ably on the Buxton waters in 1784, to be discharged at the rate of 140 ale gallons per minute, which would be $116\frac{1}{2}$ imperial gallons. Much of this flow, however, must have been lost, as, according to a report by Mr. Eddy and Mr. Darlington, the engineers, in November, 1851, the amount of flow made use of at that time was $84\frac{3}{4}$ gallons per minute. In the process of levelling and

* It may be briefly stated here that Buxton is situated in a remarkable district. The rich and romantic beauties of Ashwood Dale, Cow Dale, Chee Dale, Millers' Dale, Monsal Dale, and Middleton Dale; of Dove Dale, and the Dale of Goyt; the cavern wonders and wild scenery of Castleton; the pretty town of Bakewell; the rocky grandeur and wonderful beauties of Matlock; Chatsworth, the princely seat of the Duke of Devonshire; Haddon Hall, the glorious old residence of the Vernons; Hartington and Beresford, famous for the sports and memory of Izaak Walton; Lyme Hall, the seat of the distinguished family of Legh, during it would seem, at least fifteen generations; are all within easy reach of Buxton. To this list of things worth seeing in the Buxton neighbourhood should be added: Tideswell Church, with its Memorial Tombs and Brasses; Chelmorton Church, which has been recently restored, and is said to have points of interest to the Ecclesiologist; Eyam with its romantic and most sad plague history and gravestones; Arbor-low, some nine miles on the road to Ashbourne—a large and perfect Druidical circle, which has been called "The great Druidical Temple of North Derbyshire;" a Rhedagua, or chariot course of the ancient Britons, at the distance of half-a-mile north-east from Whaley Bridge, near to Horwich House, said to be in a perfect state of preservation; and last, not least, Poole's Cavern, within half a mile of Buxton—an extensive natural limestone cavern, of much natural beauty, and now, strange and satisfactory to say, lighted, and shown throughout its depths, and heights, and roofings, and irregularities, with its many surfaces and sparry incrustations, by two hundred and fifty gas-lights. Buxton is a hundred and fifty-nine miles from London, twenty-four miles from Manchester, twenty-six miles from Sheffield, thirty-eight miles from Derby, twelve miles from Macclesfield, and twelve miles from Leek.

excavation for the Baths, made in the year, 1852, the amount of the waters which had been previously wasted was recovered; and the flow through the baths is now greater than it was previous to the erection of The Crescent, in 1784. There is, besides this large flow of waters, which is used for the supply of the Natural Baths, and the amount of flow which is still not recovered, the flow of the tepid waters which supplies the Drinking Well, and the much greater flow of the same waters for a spring called Bingham's Well, which is devoted to the supply of the Hot Baths.

Six important analyses of the Buxton tepid waters have been made at different times. The first of these was made by Dr. Pearson, in 1784. According to this analysis, the imperial gallon of the tepid waters contains $19\frac{1}{2}$ grains of solid matter :—

	Grains.
Carbonate of Lime.....	14·000
Sulphate of Lime	3·333
Chloride of Sodium	2·333
	<hr/>
	19·666

The second of these analyses was made by Sir Charles Scudamore and Mr. Garden, in 1820. According to this, the imperial gallon was found to contain 20 grains of solid matter :—

	Grains.
Chloride of Magnesium	0·773
Chloride of Sodium	3·200
Sulphate of Lime	0·800
Carbonate of Lime	13·866
Extractive Matter	0·666
Loss	0·693
	<hr/>
	19·998

It will be observed, that there is only a difference of half a grain between the amount of the total solid constituents resulting from these two analyses, and that chloride of magnesium is the only additional substance obtained by the more recent of these two analyses.

The third analysis was made by Sir Lyon Playfair, dated July 24th, 1852. The following table gives the amount and nature of the solid ingredients obtained from an imperial gallon of waters. The total solid constituents obtained amounted to $20\frac{1}{2}$ grains per imperial gallon :—

	Grains.
Silica	0·666
Oxide of Iron and Alumina	1·240
Carbonate of Lime	7·773
Sulphate of Lime	2·323
Carbonate of Magnesia	4·543
Chloride of Magnesium	0·114
Chloride of Sodium	2·470
Chloride of Potassium.....	2·500
Fluorine (as Fluoride of Calcium).....	trace
Phosphoric Acid (as Phosphate of Lime)	trace
	20·579

According to this very careful analysis, the waters contain only ·913, or one grain per imperial gallon more of solid ingredients than was obtained from them by Dr. Pearson, and ·581, or half a grain more than was obtained from them by Sir Charles Scudamore and Mr. Garden. It will be noticed, however, that a very appreciable proportion of carbonate of magnesia, silica, and oxide of iron and alumina is obtainable from the water, and that traces of fluorine and of phosphoric acid are found in it; the former being present in sufficient quantity to have enabled Sir Lyon Playfair to etch with it upon glass the words—"Buxton Water."

In regard to the gaseous constituents of these waters, the result of Sir Lyon Playfair's analysis is more important. The circumstance that these waters contain a very considerable proportion of gaseous matters must have attracted attention at an early period.

Large bubbles of gas rise through the waters in frequent but intermittent bursts; and when a glass bottle is filled with the waters, and held between the eye and a strong light, it is seen to be charged with small bubbles of the gas, presenting very much the appearance of soda water. Previous to the analysis of Dr. Pearson, this gaseous impregnation was supposed to be composed of a mixture of atmospheric air and carbonic acid. Dr. Pearson is entitled to the great credit of having ascertained that this gas is free from any admixture of atmospheric air, and consists of a very small proportion of carbonic acid, by much the larger proportion of it being free nitrogen gas. This very curious and interesting discovery was fully confirmed by Sir Charles Scudamore's analysis. The amount of gaseous matters obtained by Sir Charles Scudamore from the Imperial

gallon of the waters was 8.18 cubic inches, or $8\frac{1}{4}$ cubic inches. The results of the more recent analysis are so much more considerable that it seems to be expedient to quote the words used by Sir Lyon Playfair in his report:—

“ On examining the water there are found present carbonic acid and nitrogen, in addition to the solid ingredients. It was important to estimate the amount of the former in an exact manner. Some of the water was received from the spring in a glass stoppered bottle, and the stopper was immediately inserted and secured. One gallon of the water was found to contain altogether 13.164 grains of carbonic acid; but, of this quantity 5.762 grains were due to the carbonates of lime and magnesia, and, therefore, only 7.402 grains could, in any sense, be considered as free. Again, the carbonates of lime and magnesia are present as bicarbonates, or as carbonates dissolved in carbonic acid, and 5.762 grains of carbonic acid would require to be added for this purpose. Hence of the 7.402 grains, or 15.66 cubic inches of gaseous carbonic acid in the water, only 1.64 grains, or 3.47 cubic inches, can be considered as wholly free and uncombined.

“ The nitrogen in the water could only be present in solution, and not in combination; and, as there is no very accurate method of ascertaining the precise quantity of this gas in the water at a given temperature, it was considered chiefly important to ascertain accurately the composition of the escaping gas, as this would indicate that of the gas held in solution. The following are the analyses of two portions of the gas collected as formerly described, the analyses being given according to volume:

	I.	II.	Mean.
Carbonic Acid	1.169	1.164	1.167
Nitrogen	98.831	98.836	98.833
Oxygen	trace	trace	trace
	<u>100.000</u>	<u>100.000</u>	<u>100.000</u>

“ The gas, therefore, consists entirely of carbonic acid and nitrogen; for the oxygen, which did not amount to one-tenth per cent., may be viewed as quite accidental, arising, probably, from the corks used to close the bottles.

“Judging from the analysis and proportion of the gases, it is assumed that, *at the moment of issue*, the water is charged with 206 cubic inches of nitrogen, and 15.66 cubic inches of carbonic acid per gallon. This assumption is founded upon the proportional relation of the two gasses. The proportion of carbonic acid in the water being determined, and the proportion of carbonic acid to that of nitrogen contained in the water being 1.2 to 98.8, the amount of nitrogen contained in the water at the moment of issue may fairly be assumed to be 206 cubic inches per gallon.”

In the year 1860, Dr. Muspratt, of Liverpool, published the following analysis of the Buxton tepid water:—

	Grains in the Imperial Gallon.
Carbonate of Lime	8.541
Carbonate of Magnesia... ..	3.741
Carbonate of Protoxyde of Iron	0.082
Sulphate of Lime	0.330
Chloride of Calcium	1.227
Chloride of Magnesium	0.463
Chloride of Sodium	2.405
Chloride of Potassium.....	0.260
Silica	1.044
Nitric Acid	trace
Organic Matter	0.341
Fluoride of Calcium.....	trace
Phosphate of Lime	trace
Total per gallon	18.434
	Cubic inches.
Free Carbonic Acid	3.5
Nitrogen.....	504.0

This analysis so far differs from that published by Sir Lyon Playfair, in the year 1852, as to give a larger proportion of silica, a much smaller proportion of sulphate of lime and of chloride of potassium, and two grains less of total saline constituents in the gallon of water. Inasmuch, however, as Sir Lyon Playfair's analysis was obtained from the residue of 100 gallons of the water, it may be probably held to be the more authoritative analysis, so far as regards the saline constituents. What is much more interesting is, that Dr. Muspratt obtained from the water an appreciable proportion of organic matter. This may have an important degree of influence on the absorption of the water through the pores of the skin during the immersion in the baths, and

may contribute to or produce the remarkably emollient effect on the skin produced by the Buxton Baths. The large proportion of nitrogen first claimed for this water by Sir Lyon Playfair's analysis was confirmed by the analysis of Dr. Muspratt, and no less than 504 cubic inches per gallon are said to have been obtained from it.

It may be advanced that the modern researches, discoveries, and deductions of chemistry have caused more and more importance to be attached to the great elementary principle, with which the Buxton tepid waters are surcharged. The very large proportion of nitrogen contained in the essential crystallisable principles of tea, coffee, and cocoa—in taurine, the great azotised constituent of the bile—in the various fibres and tissues, and in the secretions and excretions of the body—the consumption of nitrogen shown by Baron Liebig to be involved in every movement and process of the animal system—the relative bearings of the proportional amount of nitrogen in the composition of the various articles of food, upon the degree of their nutritive qualities—are so many indications of the tendencies and inferences deducible from the great and practical advances of modern chemistry, and so many reasons why the nitrogen discovered to be contained in the Buxton tepid waters, and in an available form for internal or external use, may have a significance, and justify an amount of expectation, that may hardly admit of exaggeration.

From the year 1860 to 1876, no new analysis of this mineral water was published. In 1876 the well-known chemist, M. Otto Hehner, when on a visit to Buxton, became so much interested in the character and medical value of this water, as without solicitation or recompense, to undertake a new analysis of its saline ingredients, especially moved thereto by the wish to ascertain, by the more recently discovered means of Spectrum Analysis, whether any hitherto undetected constituents of medical interest might be obtained from it. The analysis, however, resulted in confirming the accuracy of the previous analyses, with the discovery of a small but notable quantity of lithia, and a very small quantity of iodine, but in both cases too small to allow of a quantitative determination. M. Hehner did not

examine the water as to its gaseous constituents "aware that the nitrogen is the chief and most remarkable constituent of the water; but I considered its presence is so far beyond all doubt, that, even with the better means of collection than were at my command when I obtained the samples for analysis, it appears questionable to me whether I could have added anything to Dr. Playfair's and Dr. Muspratt's results." It cannot but be a satisfaction that the saline ingredients were so recently examined, more than confirming the accuracy of previous investigations, and leaving the nitrogen contained in the water the ostensible cause of its medicinal value.

M. OTTO HEHNER'S ANALYSIS OF SALINE CONSTITUENTS
ONLY, 1876.

	Grains per Imperial Gallon.
Chloride of Sodium	4 51717
Sulphate of Soda	0·20233
Sulphate of Potash	0·66896
Sulphate of Ammonium.....	0·01564
Sulphate of Lime	0·67364
Nitrate of Lime	0·25660
Carbonate of Lime	9·18584
Carbonate of Magnesia ...	4·72693
Carbonate of Iron.....	0·03709
Carbonate of Manganese	0·00847
Silica	0·83769
Total	21·13006
Phosphoric Acid.....	trace
Iodine.....	trace
Lithia	trace

The most recent analysis of the thermal water of Buxton is by Dr. Thresh. This very important examination required three separate analyses. As in the examination of the water by Sir Lyon Playfair, the words of the analyst are quoted, and the several analyses are detailed.

DR. THRESH'S ANALYSES OF THE RESIDUAL DEPOSIT
FROM THE BUXTON WATER, OF THE GAS OF THE
WATER, AND OF ITS SALINE CONSTITUENTS, 1880,
'81, '82.

"The last analysis made of the Buxton thermal water occupied most of the writer's leisure during the winters

of 1880-81 and 1881-82. Residing upon the spot, and with a laboratory within a very short distance, unusual facilities were enjoyed for making a prolonged and searching chemical investigation. The complete examination necessitated three series of analyses; the first, of the mud deposited near the mouth of the spring; the second, of the gas issuing from the spring, and of the gas dissolved in the water; and the third, of the saline constituents.

“Every thermal water deposits more or less rapidly upon cooling, or from loss of carbonic acid gas, or exposure to the air, a mud or sinter, differing in appearance and in composition according to the character of the strata through which the waters pass in their subterranean journeyings. Very frequently the examination of such deposits reveals the presence of elements which, on account of their excessively slight solubility, are present in the water in such minute quantities that their presence may be overlooked in an analysis of the water itself.

“When the springs and reservoirs into which the water flows were examined, the slabs, walls, &c., were found to be coated with a very dark brown mud which stained the skin when rubbed between the finger and thumb. It appeared of a peculiar character, and it was felt that its analysis could not but yield interesting results. Such proved to be the case. It was found to consist chiefly of the higher oxides of manganese in a hydrated condition, and capable of combining with oxygen when exposed to the air, or to water containing oxygen in solution. In composition it corresponds closely with that of many samples of psilomelane and wad, ores of manganese. The importance of the inference to be drawn from this discovery will be discussed later on. Molybdenum has never before been discovered either in a mineral water or in a deposit from such a spring, but probably is derived from a molybdate of lead which may frequently be found in cavities of limestone rocks. The tabulated result of the analysis is appended:

Oxide of manganese.....	80.32
Sulphate of barium, sand, &c	1.08
Lead oxide .....	.15
Copper ,, .....	.07
Molybdic acid .....	.02
Cobalt oxide.....	.30
Iron and aluminium oxides	1.36
Zinc oxide.....	.46
Barium oxide .....	.79
Calcium ,,	5.31
Strontium ,,	a trace
Magnesium ,,	3.18
Carbon dioxide	3.23
Phosphoric acid .....	.01
Water	3.93
	<hr/>
	100.21

“The results obtained by the analysis of the gas evolved at the spring were in close accordance with those of Dr. Playfair, but it was noted that the composition of this gas varied slightly, according to the length of time during which it was allowed to remain in contact with the water under the reduced pressure to which it is subject when it has risen to the earth’s surface. Thus the mean of two analyses of the gas collected at the mouth of the spring, and at once removed from contact with water, gave:—

Nitrogen	99.12
Carbonic acid.....	.88

whilst some of the gas which had been allowed to stand over a little water gave:—

Nitrogen	98.63
Carbonic acid	1.37

“This difference would be inexplicable were Dr. Playfair’s assumption correct. Undoubtedly at some little depth the free gas consists of pure nitrogen, whilst at a still greater depth even that will be in solution.

“In determining the amount and composition of the gas held in solution by the water at the moment of issue from the springs, the greatest care was taken to obtain reliable and accurate results, and as an appendix to the original paper an illustrated description will be found of

the apparatus used in collecting and measuring the gases. The mean of a number of experiments gave the following results :—

	Cubic Inches per gallon of water.
Nitrogen	6·1
Carbonic acid gas	4·1
	<hr/>
Total	10·2

From this the calculated per centage composition is—

Nitrogen	59·78
Carbonic acid gas	40·22
	<hr/>
Total	100·

“ To dissolve 10·2 cubic inches of such a gaseous mixture at a temperature of 81·5 F. (that of the thermal water) would require a pressure of 1·64 atmospheres, consequently on exposing the freshly drawn water bubbles of free gas commence to make their appearance, and after a time the excess passes off, but this takes place if the water is not agitated, much more slowly than might be anticipated, considering the insoluble character of the gas. In fact when the water is agitated, as in bathing, the surplus gas is liberated almost instantaneously, and in bubbles so minute that the water becomes opalescent. Doubtless much of the gas is liberated within the very pores of the skin during bathing, and acts in what may be considered its semi-nascent state, producing effects altogether unattainable by use of the same agent in any other condition.

“ The analysis of the mineral constituents was conducted after the manner of Baron Bunsen, in his examination of the mineral springs of Baden-Baden. The process, though exceedingly tedious, leaves nothing to be desired as regards the accuracy of the results, and has the advantage over older methods in allowing these results to be so completely checked that there is little danger of overlooking any of the constituents. As was previously stated the whole of the elements present in the deposit were not found in the residue obtained by evaporation of large quantities of the water, but this was

doubtless owing to their almost entire insolubility, and to our ignorance of reactions sufficiently delicate to detect such minute quantities. Calculated into grains per gallon the water was estimated to contain—

Bicarbonate of calcium	14.01
" magnesium	6.02
" iron .....	.03
" manganese .....	.03
Sulphate of barium .....	.05
" calcium .....	.26
" potassium .....	.62
" sodium .....	.84
Nitrate of sodium .....	.03
Chloride of calcium .....	.02
Chloride of sodium	3.10
" ammocium	trace
" magnesium .....	.95
Silicic acid .....	.95
Organic matter .....	.02
Carbon dioxide .....	.20
Nitrogen.....	.19
	27.32

Lithium, strontium, lead, and phosphoric acid, traces.

From this analysis, or rather from the manner in which the results are expressed, it would appear as if the quantity of saline matter per gallon was much in excess of that found by any other observer; but this difference is only apparent, and arises from the fact that the compounds represented by them as carbonates are found here as bicarbonates. The carbonates of calcium, magnesium, iron, and manganese are practically insoluble in water, but in the presence of carbonic acid the bicarbonates are formed and these dissolve. Upon evaporating a water containing such salts, they are decomposed, the carbonic acid being given off and an insoluble carbonate remaining. This decomposition is readily seen when a little of the Buxton thermal water is boiled in a glass flask. Hence, whilst the last analysis represents, as nearly as can be ascertained, the composition of the saline matter as it exists in the water, the former ones merely represent the result of the analysis of the water residue.

“The waters of many mineral springs vary in composition from time to time, certain constituents gradually increasing or diminishing; and to ascertain

whether any change is taking place in the Buxton thermal water, it is necessary to compare the results of such analyses as may be applicable for that purpose. Unfortunately, on account of their imperfect character, the results of the examinations made during the last century are not available. The results since obtained are tabulated below to facilitate comparison. In each case the carbonates mentioned in the older analyses are calculated into their equivalents of bicarbonates, as it is in this state that they exist in the water.

	Scudamore and Garden.	Playfair.	Muspratt.	Hehner.	Thresh.
Calcium bicarbonate.....	19·967	11·193	12·299	13·228	14·010
Magnesium „	—	6·919	5·698	7·199	6·011
Iron „	—	·240*	·113	·051	·031
Manganese „	—	—	—	·011	·028
Barium sulphate	—	—	—	—	·048
Calcium „	·800	2·323	·330	·674	·260
Plumbic „	—	—	—	—	·004
Potassium „	—	—	—	·663	·621
Sodium „	—	—	—	·202	·843
Ammonium „	—	—	—	·016	—
Sodium nitrate	—	—	trace	—	·026
Calcium „	—	—	—	·257	—
Calcium fluoride	—	trace	trace	—	·020
Sodium chloride	3·200	2·420	2·405	4·517	3·088
Potassium „	—	2·500	·260	—	—
Ammonium „	—	—	—	—	·002
Calcium „	—	—	1·227	—	—
Magnesium „	·773	·114	·463	—	·953
Silica.....	—	·663	1·014	·838	·949
Organic matter (and loss) ...	1·359	—	·341	trace	·201
Strontium	—	—	—	—	trace
Lithium	—	—	—	trace	trace
Phosphates	—	—	trace	—	trace
Iodides.....	—	—	—	trace	—
Total grains per gallon	26·099	26·375	24·180	27·662	27·096

“ It will be noticed that Muspratt’s results differ considerably from the others, and we must conclude either that he did not obtain his water from the same source as the other analysts, or that the saline constituents had varied considerably during the years 1852 and 1860. There is, of course, just the possibility of an error

* Oxide of iron and alumina.

having crept into this analysis, or into the calculation of the results; but, as we have no details of the examination, we cannot judge whether such is the case or not. It will be remembered, however, that the thermal waters supplying the baths, wells, &c., are not derived from a single spring, but from a number of springs arising in close proximity. These are now built over, hence it is difficult to obtain access to them, or to ascertain their number; but in 1645, before the present buildings were erected, there were said to be nine springs within a radius of eight yards; eight of which were warm and the ninth cold. The two principal springs arise immediately beneath the slabs at the bottom of the gentlemen's natural bath, and have precisely the same temperature; but a more uninterrupted stream of gas bubbles comes to the surface at one spring than at another. There is therefore a possibility that a slight difference might be detected in the constituents of one or more of these springs; and, if such were the case, the variations in the analysis would be readily accounted for, were the waters not collected at the same source. Unfortunately, previous analysts do not mention where or how their samples were obtained; but so far as can be ascertained the water examined by Playfair was taken from one of the principal springs, whilst that employed in the two last analyses was derived from the bath over the springs. In this case Playfair's result represents the composition of the waters of one only of the springs, and the other that of the mixed waters of all the springs.

“Scudamore and Garden found only four salts, whereas Playfair enumerates ten, Muspratt twelve, Hehner thirteen, and the writer eighteen. It does not follow that a proportionately large number of elements was detected in each case; but merely that the relative quantities of acids and bases lead to the inference that they are combined in so many different ways. Thus suppose three acids and three bases to be present, these may be united to form not less than three salts nor more than nine; and whether these or any intermediate number are supposed to exist in it, it depends chiefly upon the proportion of the various radicles; but not unfrequently the result is influenced by the theoretical

views of the analyst. A careful consideration of the results will, however, lead anyone capable of judging, to the conclusion that Muspratt had analysed a water from a different source to that from which the others were obtained, and that from the defective method of analysis Scudamore and Garden's result cannot be used for comparison. Taking, therefore, only the analyses of Playfair, Hohner, and the writer, the saline constituents appear to vary slightly from time to time both in character and in quantity. The sulphates of potassium salts have diminished; whilst the carbonates, sodium salts, and silica have increased. The proportions of the calcium and magnesium salts, and the total amount of solid matter, however, vary to so small an extent as not to affect in any way the distinctive character of the water. With regard to the gaseous constituents, no change whatever has taken place, the slight difference in the analyses being doubtless due to the methods of collection. The gas evolved at the spring is nearly pure nitrogen, and the amount of this gas dissolved in the water in 1852, as calculated from Playfair's results, is the same as has recently been found by actual experiment.

“On account of this special organic purity of the water, the comparatively small quantity of the saline constituents, and the large volume of nitrogen contained in it, the Buxton spring is usually classed with those of Gastein and Wildbad. It differs from these, however, in containing in solution a much larger proportion of nitrogen, whilst the gases evolved from the waters of its congeners contain very considerable proportions of oxygen (Gastein), or of oxygen and carbonic acid (Wildbad).”

“The springs at Gastein, in Austria, are 3,051 feet above the sea level, and the waters have a temperature varying from 95 degs. to 118 degs. Fahr. It is evident, therefore, on account of this higher temperature, that upon coming to the surface, these waters must lose their gaseous elements much more rapidly than the Buxton waters, for the solubility of all gases diminishes with increase of temperature. The evolved gas consists of

Nitrogen	69·1 per cent.
Oxygen	30·9 ”
Carbonic acid.....	— ”

and each gallon of water contains :—

Bicarbonate of calcium.....	5.1 grains.
" magnesium.....	.3 "
" iron.....	.7 "
" sodium.....	.6 "
" manganese.....	.3 "
Sulphate of sodium.....	15.1 "
" potassium.....	.1 "
Chloride of sodium.....	3.6 "
Phosphate of aluminium.....	.4 "
Silica.....	2.4 "
Fluorine, Strontium, and Organic matter.....	traces
Total	28.6

“On account of the difference in the solubility of oxygen and nitrogen, and of the proportion in which they exist in the atmosphere, water, when agitated with air, takes up for every 65 volumes of nitrogen 35 volumes of oxygen, and therefore is richer in oxygen relatively to nitrogen than the atmosphere. Now the Gastein waters evolve a gas differing from common air only in being somewhat richer in oxygen, and therefore the gas held in solution must contain a still larger proportion of the latter element. By calculation based upon the analytical data just given, the dissolved gas will consist of

Nitrogen	52.5 per cent.
Oxygen	47.5 "

And assuming the water as it issues from the earth to remain as highly surcharged with gas as does that of the Buxton Thermal Spring, it would only contain per gallon—

Nitrogen	4.0 cubic inches.
Oxygen	3.6 "

or less than two-thirds the amount contained in the Buxton Water. Supposing this water to have derived its nitrogen from the atmosphere, it must have passed into its subterranean course through very different strata to those traversed by the waters of the Buxton Thermal Spring, since instead of losing oxygen it has actually become more highly charged with this gas.

“The Wildbad (Württemberg) Springs, about fifty in number, arise at an elevation of 1300 feet, have a

temperature of 96 degs. Fahr., and are found very beneficial in cases of chronic rheumatism and gout. They contain more nitrogen than the Gastein Springs, and are in other respects more allied to those of Buxton. Each has been found to contain—

Sodium chloride	8.2 (?) grains.
" bicarbonate	8.5 "
" sulphate	4.0 "
Potassium sulphate.....	2.0 "
Calcium bicarbonate	4.9 "
Magi esium	10.6 "
Manganese and iron.....	4.0 "
Silica	3.9 "
	<hr/>
Total	46.1

The gas evolved consists of—

Nitrogen	79.25 per cent.
Oxygen.....	8.25 "
Carbonic acid	12.5 "

“ From which it is evident that, like the Buxton water, it has lost oxygen and taken up carbonic acid; but, unlike it, it has not parted with the whole of the former element. The composition of the gas held in solution will be—

Nitrogen	9.4 per cent.
Oxygen	2.0 "
Carbonic acid.....	88.6 "

“ *And assuming these warmer waters capable of remaining as surcharged with gas as do the Buxton waters, they would only contain in each gallon 4.7 cubic inches of nitrogen, or a little over two-thirds of the amount found in the Buxton springs. Moreover, this would be highly diluted with carbonic acid, as one gallon of water would contain—*

Nitrogen	4.7 cubic inches.
Oxygen	1.0 "
Carbonic acid gas	44.3 "

“ *In its richness in nitrogen, then, the Buxton water stands pre-eminent.*”

Much merit is due to Dr. Thresh for this very comprehensive series of analyses. The examination of the

deposit from the water gives results of much interest, whether it be held to solve the problem of the origin of the nitrogen in the water or not. By every chemist who has examined the gases with which the Buxton thermal water is charged, it is placed at the head of all mineral waters that are so constituted, and is shewn to be surcharged with nitrogen, whatever medicinal value may attach to such constitution. Even the well-known mineral waters of Gastein and Wildbad, remarkable as these waters are known to be for their medicinal character, contain less of nitrogen gas than is evolved by the Buxton mineral water, as demonstrated by Dr. Thresh's calculations.

The waters are singularly clear and brilliant, and faintly tinged with a blue colour. They are vapid and somewhat calcareous to the taste. They are what is called *soft* to the touch, and are admirably adapted for infusing tea, boiling vegetables, and the uses of the laundress. They have a remarkable deterative and emollient effect on the skin. This is partly due to their calcareous and alkaline character, but may be partly referable to glairine which is said to be present in many mineral waters, of similar composition, and to communicate to them this emollient effect upon the skin. Whatever the cause, or causes, this effect is well known and very agreeable. Their temperature, remarkable buoyancy, softness, and clearness, and freedom from smell, or marked taste, render their use as a bath very pleasant; giving, at the instant of immersion, the slightest possible shock, instantly followed by a perfect and general glow, which usually continues during the whole time the person is in the bath, and indeed generally lasts for several hours afterwards.

There are large baths of the water at the Natural temperature. These baths are of considerable size—large enough for all purposes of exercise, swimming, &c. There is, besides these, the Natural bath, which is made use of by the patients, of the Buxton Bath Charity. These are public baths; furnished, of course, with separate accommodation for dressing. They are lined with the patent white or porcelain covered brick, and floored with white marble. The waters enter through perforations in the marble floorings of the baths, and

flow out at the top, so that there is a constant current of fresh waters. Besides these large baths there are smaller private baths. All these baths are called in Buxton *the Natural Baths*. The water in these baths is between four and five feet in depth; enabling them to be used in the erect position, and permitting as much exercise to be used by the bather as the circumstances of the case may admit, in order to secure the largest possible amount of absorption of the water through the skin. A considerable amount of exercise and friction or kneading during the time of immersion appears to be needful, in order to secure the full amount of medical action from the use of the bath. The greater the amount of kneading of the surface of the body, or of exercise of the trunk and limbs, while in the bath, the greater is the probable amount of absorption of the water.

These baths are contained within a commodious building at the western end of the Crescent, approached under cover from the Crescent, the Hall, and the Square, and entered by separate corridors.* This building is covered with a roof of glass; and double-action force pumps, with suitable nozzles, are provided for the special application of the water to particularly affected parts of the body or limbs in the form of douches. The impulsion of a continuous stream of the water, with a greater or less degree of force, and in larger or smaller volume, against any part of the surface, is often found to be of the greatest value in rheumatic, gouty, spinal, uterine, and other cases.

The baths above described are to be distinguished from the Hot Baths, in which any quantity of the same water, carefully heated, is added to the naturally tepid water, in order to secure baths of any temperature that the circumstances of different cases may indicate. These are called in the place *the Hot Baths*, and are situated at the opposite end of the Crescent to those called *the Natural Baths*. The Hot Baths are contained in an extensive structure, composed principally of glass and iron, approached by a covered way from the Colonnade of the Crescent, and entered by separate corridors. These are private baths; and douches of the heated mineral

* The able architect of the Baths and of several of the more important new buildings of Buxton, is Mr. Henry Currey, of London.

water, and appliances for the advantageous and comfortable use of the baths, &c., are provided. The Hot Baths have a somewhat less amount of medicinal efficacy than the Natural Baths, which is estimated, from extended experience, to be usually in the proportion of two-thirds—that is, three Hot Baths are estimated to be equal to two Natural Baths. This infers, however, that the Hot Baths be used at the medium temperature of 93 degrees. If hotter than this the effect would be by so much weakened, and a larger proportion of baths would be necessary; and, if cooler than this, the amount of effect would approach more nearly in degree to that of the Natural Baths. When it is remembered that all the water used for these Hot Baths is the tepid mineral water, it will be perceived that a very small addition of heated water is needed to raise the temperature to any degree that may be indicated; and it will not seem to be surprising that the medicinal efficacy should be so little impaired. A larger and larger proportional number of these baths are taken every year.

The bathing accommodation has from time to time become unequal to the increasing demand. In little more than twenty years the bath extension, which then seemed to be sufficient, had become inadequate. Ten additional Hot Baths and six additional Natural Baths were provided. During how long or short a time these baths may be found to be sufficient, it may be impossible to foretell. Happily, the supply of the mineral waters is sufficiently ample to meet any required degree of future extension.

It has been mentioned that Buxton is situated on the margin of the mountain limestone formation; to an adjoining narrow bed of shale it is indebted for a chalybeate water; and, immediately beyond the bed of shale, on one side of the place, and at no considerable distance on nearly two sides of the town, begins an extensive gritstone formation, forming the ridges of hills which more or less protect it from the northern and westerly winds. The summit of one of these ridges—that to the west—is, at the distance of three miles from the town, somewhere about seven hundred feet higher than the elevation of Buxton; and when the winds are easterly or southerly, the clouds, attracted by these hills,

are often and evidently carried away from Buxton, to be emptied on the farther districts; and to this may be referred the fact, that, although Buxton, like all hilly districts, is sufficiently subject to wet weather, it is by no means so much so as many districts having the same elevation, nor probably even so much so as some of the champaign country around it. It is to this gritstone formation that Buxton is indebted for the water with which it is supplied for domestic and ordinary purposes. This water is remarkably free from deleterious impregnation.* This deserves to be especially mentioned in every account of the Buxton waters, inasmuch as it obviates what is found to be a great inconvenience by strangers resorting to limestone districts in general—viz., the necessity of drinking the calcareous water, which is often found to disagree with those who are not accustomed to its use.

The chalybeate water was analysed by Sir Lyon Playfair. The imperial gallon was found to contain 1.044 grains of proto-carbonate of iron. It is a simple chalybeate water. It should be taken after food, rather than before food. The chalybeate and tepid waters are often mixed together, and so taken with much benefit. It is also used and valued as an application to the eyes.

The tepid waters of Buxton, whether drunk or used as a bath, or made use of in both ways, are found to be especially useful in cases of rheumatism, gout, neuralgia, spinal irritation, and certain forms of derangement of the digestive, urinary, and uterine functions.

The effect of the water on the system, whether in health or disease, is essentially stimulating. The stimulating

" Buxton, 30th August, 1858.

* " Dear Dr. ROBERTSON,

" I have examined the water with which Buxton is now supplied (for domestic and ordinary purposes), and find it to be pure and soft, such as is indeed to be expected from a water flowing from the millstone grit. Its hardness is two degrees—that is to say, it is of the same hardness as would be given to one gallon of distilled water by dissolving in it two grains of chalk (carbonate of lime).

" The water from the brook, which is intended to be used for the further supply of Buxton, is 4.35 (4 $\frac{1}{2}$) degrees of hardness. This is also a soft water, though twice as hard as the previous sample.

" Perhaps you may judge better of the relative qualities of these waters by contrasting them with the water of the river Thames, which is about thirteen degrees of hardness.

" I am, very sincerely yours,

" LYON PLAYFAIR."

effect is usually produced more immediately, and in a more marked degree, when the waters are drunk, than when they are only used as a bath; but the effect is generally of much shorter duration. When the waters are drunk by a person in perfect health, they frequently produce a slight sense of giddiness, followed by a sufficiently perceptible degree of increased warmth, and the usual marks of increased action that attend the use of any other stimulant. If, however, the waters have not disagreed with the system, these indications will be found to pass away very speedily. If not thus rapidly got rid of, or if the internal use of the waters be continued under improper circumstances, the excitement increases, and irritation is set up,—marked by thirst, loss of appetite, headache, quickened circulation, and other symptoms of feverishness and derangement. The effect of the bath on a healthy system is, that the momentary shock at the instant of immersion is followed promptly by reaction, with a decided general glow, and increased vigour of mind and body, increase of appetite, and of general secretion and excretion. This is apt to be followed in the course of a few days—the use of the bath being continued every day, or even if used somewhat less frequently—by some degree of sluggishness of the organs, and, these indications being unheeded, by feverishness and general derangement. It need hardly be said that no such effects would succeed the drinking of repeated tumblers of common warm water at the temperature of 82 degrees, nor would such be induced by bathing repeatedly in water of this temperature; and this would be sufficient to show that the tepid waters of Buxton have specific and remarkable effects upon the human system, and be *à priori* evidence that they may be influential in certain cases of disease.

The fact that these waters are so essentially and largely stimulating, renders especial care necessary that they be not made use of under improper circumstances, and that every means be taken to render the cases to which they are adapted as fit as possible for their beneficial operation.

In regard to the first of these particulars, cases of recent organic change or structural alteration in any of the great internal organs, whether of the brain, heart,

lungs, liver, or kidneys, would indicate that these waters should not be made use of. And it should be added, that in cases where disease is of congestive or inflammatory type, they should either not be used at all, or used most cautiously, until the congestion or inflammation had been subdued by appropriate means.

In regard to the second of these particulars, *i.e.*, to adapt the system as far as may be to the use of these waters,—to fit it, as far as possible, to derive the fullest benefit from their use, it is of primary importance to secure a free and active condition of the great excreting organs. For this purpose, two or more doses of efficient aperient medicine are often usefully taken, before the course of these waters is commenced; and moreover, during the course, it is found by most people that an occasional aperient is quite necessary. The compound rhubarb pill, or the compound extract of colocynth, in pills of five grains each, of which one or two may be taken at bed time, when required, often subserves this important purpose sufficiently well.

The primary effect of these waters, however used, is essentially stimulating. Their secondary effect is equally and essentially debilitating. After they have been used for a longer or shorter time, according to the nature of the case and the strength of the individual, they begin to impair the powers of the system; and this is to be regarded as the best proof that the course has been persevered in for a sufficient length of time to enable the waters to influence, as far as possible, the complaint under treatment. This debilitating effect, in most cases, ceases within a very short time of their being discontinued.

It is always well that the fatigue and hurry of a journey should be recovered from before beginning to make use of these waters; and this interval, of one or more days, is generally well spent in taking one or more doses of some suitable aperient medicine. There is another reason why this little delay should be afforded, and why some cooling medicine should be taken in most cases. It is, that any change of air is apt to occasion some degree of derangement and irregularity of system, and that this is of course more likely to be the case, or to be so to a greater degree, when the change is to a

thinner and lighter air, which must, of necessity, in itself, be more or less stimulating and exciting. Although the effect of bathing in these tepid waters is not so suddenly stimulating as when they are drunk, the fullest effects are only to be attained by bathing in them; and the effect of the waters on the system is not only more decided when they are used as a bath than when used internally, but it is much more lasting.

The best times for using the bath are before breakfast, and about three or four hours after any meal. Inasmuch as the bath is more efficient when used before breakfast, it is usual in all cases to commence its use about three hours after a meal; and when two or more baths have been taken, and they have been found to produce no unduly stimulating or deranging effects on the system, to begin to use them before breakfast. It should be said, and borne in mind, that many persons are either constitutionally or from long protracted ailment, of such feeble habit, or are of so excitable a system, as to render it inexpedient that they should ever bathe before breakfast.

The time during which a person should remain in the bath necessarily depends on the nature of the case, the powers of the constitution, and the excitability of the system. It is, however, almost always advisable, that little more than a momentary immersion should be allowed at the first; and the time during which the individual remains in the water may be increased one or two minutes every time, until it reaches that sufficient time which is required by the case in its several relations. It may be stated, however, that there are few cases in which the time for remaining in the bath may not be ultimately extended to four or five minutes, and as few cases in which an immersion of more than ten or twelve minutes will be found to be either necessary or expedient. In many cases it can signify very little whether the patient jumps into the bath, or descends into it more slowly down the bath steps. But those persons who are debilitated by disease, or are naturally feeble, the highly sensitive, or those in whom there may be any doubt as to the power, the elasticity, or the *hardiness* of the system, should descend into the bath gently by the steps. In these cases, and perhaps in cases generally, it may be wise to wet the head with a few handfuls of water before

immersing the trunk of the body; or where the hair is too long to allow the head to be wetted without some discomfort and risk of taking cold, it is expedient that an oiled silk bathing cap be worn, and that some of the water be poured over the head thus covered. Whether the head be wetted or cooled in this way or not, it is right, with very few exceptions, that the head, whether with or without bathing cap, be immersed at least once in the water, and as soon as may be after the person has got into the bath.

When the circumstances of the case permit it, walking exercise should always be taken before the bath is used. The degree of this can hardly be specified. It must vary necessarily with the powers of the system and the nature of the case; but it may be said generally, that it should be sufficient to warm the individual thoroughly, without unduly heating the body, inducing sensible perspiration, or involving any feeling of fatigue.

Exercise should not be taken immediately after the use of the bath—at least this is the general rule, the exception being some cases in which the bath agrees in all other respects, but is followed by an insufficient degree of reaction, and a sense of chilliness and depression. In such cases, exercise may be needfully taken after bathing; but the degree of the exercise should be no more than is sufficient to secure the desirable amount of reaction. If exercise be not required immediately after the use of the bath, to secure a due reaction, or if it be taken to a greater degree than is needful to answer this intention, it adds to the risk of undue primary stimulation from the specific effects of the baths. Usually the bather should remain as much at rest in mind and body for an hour after using the baths, as may be possible. During this time, or in case of much debility, for a longer period, the individual should confine himself to the lodging, and to the chair or the sofa. It is of much importance that, during this time, the individual should not allow himself to go to sleep. The propensity to fall asleep after bathing is often very strong; and to sleep at that time almost always deranges the nervous system, and occasions vascular excitement and irregularity; sometimes leading to headache, feverishness, indigestion, and derangement of the bowels. This is a

case of by no means rare occurrence, and of sufficiently easy prevention, by having recourse to an amusing book or easy conversation. It is as well, too, that a period of at least half-an-hour, and in most cases it is much better that an hour should elapse, between leaving the bath and taking any food.

Friction of the surface generally, and probably less of any affected part, should be used assiduously while the person is in the bath; and a thorough rubbing after coming out of the water is extremely useful in securing and maintaining full reaction.

Sufficient notice has, perhaps, been taken of the period of the day when the bath should be used. It may however be added, that the later in the day, the more excitable the system always becomes, and the more apt the bath is to stimulate unduly. It is only the less excitable who should venture to bathe late in the day; and in their case the beneficial effects might be more likely to be obtained by bathing earlier in the day.

It is neither customary nor right to use the bath every day. There can be little doubt that the effects are, to a certain degree cumulative—that, by bathing on several days successively, there is great risk incurred of a sudden manifestation of the stimulating effects of the waters on the system; and in this way it often happens that very serious injury results, and that cases are much aggravated. The risk is avoided, as far as may be, by using the bath two successive days, omitting its use on the third day; the frequency of its use being determined by the nature of the case and the powers of the system.

In many cases, especially in cases of rheumatism, of neuralgia, of relaxation of the spinal column, and of internal derangement, and although much more rarely, in some gout cases, the douche forms a very valuable auxiliary to the bath. It is seldom, however, wise to make trial of the douche until one or more baths have been taken; and the degree to which the system may prove to be susceptible to the influence of the bath, has in this way to some degree been tested. The bather should keep himself as much immersed in the water during the operation of douching, as convenience, and the necessary elevation of the part, render practicable; and it is found that the best time for douching is, when

the person has only been in the bath long enough to have experienced a degree of glow or reaction; permitting sufficient time for the use of the bath afterwards, so as to enable him to exercise, and reproduce the glow, after the somewhat chilling application of the douche. It is well to regulate the degree to which the douche is used, by counting the number of double strokes of the pump; and in general the patient should begin by having the moderate number of ten or twelve of these double strokes on any affected part to which the douche is ordered; and this number should be increased afterwards according to circumstances, by degrees, to forty or fifty, or, in rare cases to a hundred, or it may be two hundred strokes.

The number of baths which should constitute the course varies necessarily very much in different cases. Of the three varieties of rheumatism, that which affects the periosteum requires a greater number of baths, other things being equal, than that which is seated in the ligaments of the joints; and this, than that which is confined to the muscles. The number of baths required in neuralgic cases likewise varies very much, according to the part that is affected: the deeper seated the tissue affected, the greater the number of baths usually found to be necessary. Sciatica illustrates this; it usually requires a full course of baths for its satisfactory relief. Generally speaking, gout cases neither require, nor will bear, so great a number of baths as rheumatic cases are found to stand in need of; and usually, the bath should not be used so frequently in cases of gout, as it may very properly be used in cases of rheumatism. Usually, the less recent the case, and the older the person, the greater the number of baths the course should consist of. It may be said—with the wish to give some idea of the probable number of baths to be required—that a course can seldom be followed by satisfactory or permanent effects, which consists of fewer than fifteen baths, and that more than thirty baths at the natural temperature, or the so much larger proportion of warm baths, can seldom be taken advisedly, without an interruption of some weeks. The average number of baths taken probably is fifteen or sixteen.

By so much as heated water is added to the natural water in the hot baths, are these less stimulating than

the natural baths, and produce a less degree of specific effect. This circumstance makes them convenient and useful to a very considerable extent. There are many cases in which the natural bath is unduly stimulating, whether from the excitability of the constitution of the individual, or the nature of the case, or the condition at the time of the system, or of the part affected. And farther, there are many cases in which the natural bath, if used in the first instance, is found to be unduly stimulating, yet in which the warm bath is found to be borne sufficiently well; and, where the system has been gradually prepared by any requisite number of the warmed and less stimulating baths, in which the natural baths are afterwards used without inconvenience and advantageously. Hence these warmer baths enable many persons to use the waters, who would otherwise be unable to take advantage of them; and, in many cases, they offer a suitable and excellent preparation for the use of the natural baths. It should be borne in mind, that the warmer these baths are taken, the less stimulating they are, and the less of the specific medicinal effects do they retain. It should not, however, be concluded from these observations, that it would be in all cases expedient that the use of the natural bath should be preceded by that of the warm baths. On the contrary, there are many cases in which the system is so far relaxed, that these baths are of doubtful utility, or it may be are positively injurious, and in which the natural baths alone are beneficial. Again, it must be borne in view, that although these warmed baths are by no means so stimulating in their effects as the natural baths, they are largely composed of the natural water, mixed with the same water heated, and but little altered, and only so far diluted in its qualities; and that these baths are therefore by no means to be regarded as a medicinal agent of little power, but are in fact, as many cases fully prove, sufficient of themselves for the cure of many cases of disease, in which, from circumstances, it is never deemed expedient to make use of the natural bath at all.

It is customary, in cases where a preparation for the use of the natural bath by means of the warmer bath is indicated, that the first bath is taken at the temperature of 95 degrees; and that it is used at a lower temperature—

say 93 degrees—the next time ; then at 91 degrees ; and then at 89 degrees. Below 86 degrees it is difficult to reduce its temperature, inasmuch as the water is, in the first instance, at the temperature of 82 degrees, and as so little warmed water is sufficient to raise the temperature 4 degrees, the pipes and apparatus being all heated, and in such proximity to these baths.

The time during which persons remain in these warmer baths is from three to fifteen or twenty minutes. The proper time for bathing is, as in the case of the Natural Baths, either before breakfast, or from two to four or five hours after breakfast. Exercise before using these baths is not so necessary as in the case of the Natural Baths, but it is desirable if circumstances enable it to be taken. The going immediately after bathing to the lodging, and remaining within doors, and at rest, at least an hour afterwards, is as necessary as after using the natural bath ; and, during this period, any propensity to sleep should be as positively discouraged. It is, perhaps, not so necessary that the head should be immersed in these baths as in the natural bath ; but having the head or the bathing cap wetted or cooled, by pouring over it half a pint or more of cooler water, is often desirable or necessary. There are attached to these baths douches, by which a current of water is directed to any part, the current being, of course, composed of heated water. This is, therefore, a somewhat milder form of douche than the douching at the natural baths, and answers a very useful purpose in many cases, to which the douche of the waters at the natural temperature would not be adapted.

The effect of the warmer baths is modified according to circumstances, by the depth to which the bather is immersed in the water. The bath may be only one-quarter filled, or half-filled, or three-quarters filled, or wholly filled, so as to suit the peculiar conditions of individual cases ; and the baths are thus adapted to many cases in which they could not otherwise be used wisely or well. And, again, in more severe cases, whether in regard to general debility or special morbid states, there may be no immersion in the water ; but the water at any required temperature, may be sponged and rubbed into a larger or smaller extent of the surface of the body or limbs, or may be applied to any specially affected part by means of

pads or compresses. In these ways the external use of these waters may be adapted to almost any degree of excitability, or weakness, or morbid condition; the effect being modified or lessened in proportion as the waters are heated above the natural temperature, or applied to a smaller extent of the surface of the body.

A valuable additional means of using the Buxton Mineral Water externally has been obtained, during recent years, under the general name of Massage and Douche Baths. These do not involve immersion in the water. They consist either of descending, ascending, or horizontal douches, by which any part of the body may have the water pumped upon it in a continuous stream, at any temperature that may be desirable, and with a greater or less impulse; or the patient may recline on a more or less shallow surface of water, and be manipulated, or pressed, or rubbed, or shampooed, by a skilled attendant, on any part of the surface of the body or limbs, and with any degree of kneading or pressure, or extension or bending of the joints that may be required or indicated. This has been found to meet a great desideratum in many cases, as when the heart's action may be disturbed or weakened, or when localised consequences of rheumatism, or of accidental injury, may need persistent and energetic massage of nerves, muscles, tendons, or ligaments. Baths and douches, with these special adaptations, have been for some time provided in the Buxton Mineral Water Baths, and been used with frequent and great relief to infirm and crippled tissues of the trunk of the body or the limbs.

There are shower baths attached to the baths; but they are comparatively little used, for the obvious reason that the water runs too rapidly off the surface of the body, to enable it to exert its specific effects to an extent that may be reckoned upon with any degree of certainty. And yet even the shower baths are sometimes found to be efficacious, when the circumstances of individual cases do not render the use of the other baths justifiable.

It is not by any means expedient to confine bathers to the room, after the hour or two has expired which should intervene between the bath and taking exercise. On the contrary, exercise can at no time of the day be taken more advantageously than one or two hours after the bath;

and this is commonly the time devoted to drinking the waters, and taking the needful exercise after doing so.

The fact that the drinking of the tepid water produces a more immediate stimulating effect than is occasioned by the use of the natural bath, renders its internal use unfitted for many cases in which the baths are indicated. There are, for instance, comparatively few cases of gout in which it is desirable that these waters should be used internally; and on the other hand, there are many cases, as of irritability, relaxation, and it may be congestion, of the mucous membranes—whether of the bronchiæ, or stomach, or bowels or bladder, &c.—to which the internal use of these waters is found to be eminently serviceable, and in which the use of the bath may be altogether contra-indicated, or be found, after trial, to be unsuited or injurious.

These waters usually stimulate the appetite and digestion, and act specially on the kidneys and bladder; increasing the quantity of the urine; and, in cases of red or pink sediment, or of the urine passed being charged with mucus, influencing it speedily and decidedly in these particulars—supposing, of course, that they are merely dependent on functional causes. Occasionally, as it should appear, when they meet with much free acid in the stomach and bowels, the waters act at first as a somewhat powerful purgative; and this is sometimes the case to such a degree as to render it necessary that the internal use of the waters should be interrupted for some days; and in some few cases it is found that on account of this effect, the waters cannot on any account be drunk, although apparently otherwise indicated. In general, however, this effect passes away entirely after the first two or three days, and does not return during the course; and, on the contrary, is succeeded by a costive condition of the bowels, rendering the frequent use of aperients necessary during the remainder of the course. In the large majority of cases in which the waters are drunk they never exert this laxative power; and, indeed, it much more usually happens, that though acting decidedly as a diuretic, and otherwise evidently agreeing with the system, their use is attended with such an increase of costiveness as to render aperient medicines more than usually necessary.

The proper times for drinking the waters are half-an-hour before breakfast, and one hour before any other meal. They are supplied to the drinkers in glasses of three different sizes, the smallest holding a quarter of a pint, the second one-third of a pint, and the largest a half-pint. It is usual to begin the course by taking one of the smallest glasses of the water one hour before luncheon, or before dinner; to increase the quantity by taking one such glassful before breakfast, and a second glassful before the second or third meal; and if found to agree, to increase the dose, by taking the second-sized glassful, and in the course of a couple of days more by taking the half-pint glassful. It is not often desirable that more than a pint of these waters should be drunk every day. Yet there are, of course, cases in which double or even three times this quantity is eventually found to be needful.

It is not a necessary inference that, because the drinking of these waters may at first occasion a little giddiness or sickness, or derangement of stomach, they are therefore not suitable to the case. Such effects often cease after they have been taken two or three times. Yet these cases ought to be regarded watchfully, and perhaps with some suspicion; and any possibility of cooling medicine being required ought to be properly considered. To lessen the chance of such unpleasant effects, it is always well that the first glass or two should be taken slowly, and even perhaps that the glass be held in the hand during some seconds before it is drunk; and the smallest glass only should be taken until such effects cease to be experienced. Exercise, when the individual is not too much crippled to admit of it, should always be taken after drinking the waters. The degree of it must, of course, depend on the powers of the individual, and other circumstances. This is one reason, and by no means the only one, why the waters should never be drunk immediately after using the bath, inasmuch as it is not well that the system should be excited by exercise, nor needlessly exposed to the open air, immediately after using the bath; whereas it is expedient that exercise should be taken after drinking the waters, in order that they should be absorbed from the stomach, and dispersed through the system as soon as possible—which purposes

exercise unquestionably subserves. But the other reason why these waters should not be used immediately after using the bath—and it is even a more important reason—is, that whether bathed in or drunk, these waters have essentially the same stimulating effect on the system; and so far as the primary effect is concerned, it is so apt to be more than is desired, and is so little serviceable in the end—and this is so much less likely to be excessive when the baths are taken and the waters drunk at different times—that it is always wise to have an interval of an hour or more between the two ways of using these waters.

When it is desirable that the waters should be drunk oftener than twice in the day, either because the stomach is not able to digest them readily when taken in the larger quantities, or because more than a pint a day is required to meet the wants of the case, a third glass may be taken half-an-hour or an hour after the second glass; and, if need be, a fourth glass about two hours after luncheon, or about the same time after a light dinner.

Persons in health should not either bathe repeatedly in these waters, or drink them. Supposing the stomach and bowels to be in good order, or that care is taken by some fitting medicine to put them into good order in the first instance, and that there is no lurking ailment that would be a just and sufficient prohibition, there can be no reason why an occasional bath should not be taken—say one or even two baths a week—for the purpose of cleanliness and comfort; but it may be confidently affirmed that in no case is it right or even prudent that healthy persons should use these baths oftener; and it may be added, that it might be unwise under these circumstances to remain in the water longer than three or four minutes. To prove how careful people ought to be about using the baths: Several years ago I was summoned home suddenly, and found a young lady, of some thirty years of age, extended on the sofa, senseless, and evidently labouring under pressure of the brain. The history I received from her distressed relatives, who were with her, was, that they were on a pleasure tour, passing through Buxton, and staying only a few days exploring the scenery of the mountain district; that the young lady had been apparently in perfect health, had bathed for the

first time that morning in a natural bath, for amusement and curiosity, had immediately become comatose, and continued so ever since. There were the usual symptoms of such cases; and there was evidence that there had been a masked disease of the heart, of probably long standing. The case terminated fatally, in defiance of all means, in the course of a few days. Her case is of much interest, inasmuch as the sufferer was young, and had appeared to herself, and to all about her, to be in perfect health up to the time of bathing;* but cases in which invalids use the baths under improper circumstances are of very common occurrence; and cases in which healthy people use them to their disadvantage are by no means seldom met with; and they point out, often and strongly, the importance of careful diagnosis and direction on the part of the medical attendant, and of caution on the part of the visitors to Buxton. It will be understood, that, under doubtful circumstances, the warm baths can be used with much less risk than the natural baths; and that it is only in rare cases, and never when proper care is taken, that a single bath, or anything but a course of such baths, can be hurtful to the really healthy. As to the drinking of the waters, it may be said emphatically, that this should be avoided except by those invalids whose cases require them.

The considerable elevation of Buxton and the surrounding district above the level of the sea, not only renders the atmosphere by so much specifically lighter and drier, and by so much more stimulating and bracing to the system, but added to the absorbent nature of the mountain limestone, renders the town and district remarkably free from stagnant waters, and other sources of miasmatic impurity. Hence cases of epidemic, endemic, and contagious diseases, are comparatively little known in Buxton. Even the ordinary exanthemata (measles, scarlatina, and the like), are comparatively rare, and usually of a remarkably mild character; and typhus, and even common continued fever, rarely obtains, unless

* It may be inferred that bathing in any water whatever would at the time have been equally fatal to this poor young lady, and that the death is not ascribable to any peculiar effects of the natural bath. The specific effects would not have been manifested until some hours after the bath, and perhaps not until several baths had been taken.

brought into the district by persons who have been sojourning in less favoured places; and has in no single instance that I have met with, extended to a second case, or proved either contagious or infectious. As to typhoid fever, and its probabilities, the only trustworthy assurance against it must be derived from the efficient drainage and sewerage of the town and district, by Sir Robert Rawlinson, under the "Local Government Act," by which, it is to be hoped, the local source of such endemic poisoning may have been for the most part done away. In the visitations of epidemic cholera which have afflicted these kingdoms, not a single case has been met with in Buxton. Cases of influenza are usually of a mild character, and occur in comparatively scanty numbers; and cases of diphtheria have been rare, and of a much modified type. When it is considered that, according to the able and trustworthy reports of the Registrar-General nearly one-fifth of the total mortality of England is referred to the record of "epidemic, endemic, and contagious diseases," a locality must be admitted to be singularly happy in which people are so remarkably exempted from this extensively important class of diseases. If the mortality of this class of diseases is estimated at one in twenty of those attacked, the smaller amount of sickness, protracted indisposition, and resulting debility, that the inhabitants of this district suffer, in addition to the proportionally smaller rate of mortality, deserve some mention in a medical account of Buxton and its waters.

It is necessary to mention, that there are many cases in which the thin pure dry air of the mountain district must necessarily prove beneficial, to which the mineral waters of Buxton are in no way suitable. There are many who visit Buxton under these circumstances, who would be much benefitted in this way, who not only deprive themselves of such benefit, but do themselves harm, by tampering with these stimulating and powerful agents.

General debility, the consequence of febrile attacks, whether rheumatic or not; local weakness of the spinal column, the joints, or the mucous membranes and passages; muscular, synovial, and periosteal rheumatism, if not in an acute stage; gout, especially perhaps chronic gout, or the sequelæ of more active or acute gout, are all cases for the use of the Buxton Baths. Dyspepsia in

many of its forms, and especially when dependent on, or largely mixed up with, general feebleness and relaxation—neuralgia, and more especially when partaking most of rheumatic character—some cases of paralysis, especially such as may be ascribed to cold, or to spinal affections, or such as are of long standing—are all cases for a trial of the baths, or the waters internally, or both. Cases of general debility, consequent on the decline of life, or on having lived hard, and expended unwisely the nervous energies, either by intemperance, or debauchery, or sedentary occupation, and overworking of the mind, are those in which these waters often do much good, and in which they deserve to be tried. In cases of irregularity or relaxation of the female constitution, their effect is very often marked and rapid, and deserves to be better known than it has even of late years become. To this sufficiently long list must be added many of the milder forms of scrofula,—to which indeed some of the above may be often referred,—which are often materially benefitted by the use of these waters. The effect of the baths and douches upon such lameness or crippled conditions as often result from sprains, dislocations, fractures, and other similar surgical injuries, is in most cases so great and immediate, as to render their use eminently advisable under such circumstances.

The diet, during the course of the waters, should be regulated, and in some degree restricted. But usually this ought not to be carried to such an extent, as to interfere greatly with the individual's habits, or to weaken his system. It should be borne in mind, that after the first few baths have been taken, and the risk of undue stimulation, which has chiefly to be dreaded at the beginning of the course, has been avoided, the secondary effect of the waters should be looked forward to, and, as far as may be, prepared for; and, therefore, that although a little extra care in the diet, and perhaps even some diminution of the usual quantity, or some lowering of the usual quality of the food, may be necessary during the first week or ten days, this may be very far from right or necessary afterwards; and that even a more generous diet than the system may have been accustomed to, is sometimes required. The same observations apply to the use of stimulants. A man used to take three or

four glasses of wine a day, might perhaps advisedly take a glass or even two glasses less during the first week of the course of the Buxton waters, but would seldom be justified in discontinuing the use of wine altogether; and, during the latter periods of the course, should probably return to the maximum allowance per day, or even in some cases might do well to take more towards the end of the course, to bolster up the system, and help it to sustain the debilitating effects of the waters.

To prevent, however, as far as may be, any crudity of stomach or bowels, is most important; and with this view, it is well to avoid the use of cheese altogether during the course of these waters, and to eat little or none of either turnips, carrots, greens, or cabbage, new potatoes, peas, stone-fruits, hot butter, or rich and greasy articles of food.

Regularity of hours is important at all times, and especially so during the course of the waters. Early hours of going to bed at night and rising in the morning,—the latter being indeed quite necessary when either the bath is to be used, or the waters to be drunk, or when both have to be accomplished, at least half-an-hour before the breakfast,—and regular hours for the meals, are of much importance; late hours of dinner being avoided as far as is consistent with the habits of the individual; and suppers being, if possible, abjured altogether.

Exercise in the open air, and especially walking exercise, should be carried as far as the strength and other circumstances will permit; and the spending a large part of every day in the open air, weather permitting, is justly to be regarded as important to almost every invalid, and as ministering largely to the chances of restoration to health and strength.

To leave the mind as far as possible free from the cares and anxieties of life, to give it a full and complete holiday from its labours, and to be surrounded wherever it is possible by members of the family circle, are matters that are apt to be lost sight of, but which are really of primary importance, in enabling the system to realise all the good derivable from the use of these, or any mineral waters.

It may be useful to conclude these observations on the waters of Buxton with some account of "The Buxton

Bath Charity," which was established many years ago to afford to the poor the gratuitous use of the baths, to supply them with needful medicines and proper medical advice, and, if in want of pecuniary assistance, to furnish them with a weekly allowance of money.* It was stated in the fuller account of these waters already published that, of 14,905 patients admitted to the full benefit of the Charity in the eighteen years preceding 1838, 12,608 were dismissed "cured, or much relieved," the remainder having been either "little relieved" or "no better" at the time of dismissal. From that time to the beginning of September, 1858, 23,319 patients have been on the books of the Institution; and of these it may be gathered from the report that 16,575 were cured or much relieved, 5,859 persons having been dismissed only relieved in some degree, the small number of 885 having been dismissed as no better. To appreciate fully this result it should be understood that a large majority of these cases had been of some standing, and essentially chronic in their character; for which the ordinary appliances of medicine, whether by hospitals or dispensaries, or the efforts of the private practitioners, had been tried, and tried in vain; and that usually in three weeks, and seldom in a longer period than four weeks, these most satisfactory results had been obtained. If it be added to these considerations that the cases, for the most part cases of chronic rheumatism, by no means in general yield readily to remedial agents, but, on the contrary, are cases that, of curable diseases, are perhaps the most intractable and unyielding of all complaints,—the Buxton waters will have advanced for them the strongest proof that could be

* There is suspended in the Board-room of the Hospital a printed document, bearing the date of 1785, which states that the pecuniary fund for the relief of the poorer patients of the Buxton Bath Charity, originated in the year 1779: and it is added that the Charity Baths had been devoted to the gratuitous use of the poor by "the munificence of the noble proprietor and his ancestors." This shows that the Charity Baths must have been devoted to the poor from a much more remote time; and, if this be considered as synonymous, as it well may, with the Buxton Bath Charity, the Institution may be regarded as being of considerable antiquity. It is curious and interesting to find that, whereas at its origin as a pecuniary fund for the relief of the poor bathers, the number receiving such relief was limited to "sixteen objects at one time," and it was only given during the six summer months, the number of persons who receive relief at the present time is quite unlimited, and the period of the year is no longer restricted.

afforded of their effect on disease,—and the Buxton Bath Charity will need no further argument in its favour to be laid before the public. To this may be added that the expense of medicines, &c., is comparatively inconsiderable,—that the medical officers give their services gratuitously,—and that the Charity Baths are devoted to the purposes of this Institution by the liberality of the Duke of Devonshire.

There is a Charity Bath of the waters at the natural temperature. This is a bath between four and five feet deep, lined with porcelain-covered bricks, and furnished with douches, and every obtainable comfort and appliance as to dressing-boxes, &c. New hot baths have been constructed for the uses of the Charity. These baths are provided with all the details of comfortable and useful accommodation.

During the last thirty-two years the patients of this Charity have been most comfortably lodged and provided for in the Devonshire Hospital, with spacious, well-warmed, and well-ventilated day-rooms and dormitories, a liberal diet, well-ordered household and medical care, regular hours, and kindly supervision.

In the thirty-two years, the Buxton Devonshire Hospital has had 53,869 patients under treatment; the cases of 47,684 were relieved; only 6,185 of the patients having derived no benefit during their stay; although 6,114 or about one-ninth of the whole, were not suffering from any of the forms of rheumatism, but were such cases as are ordinarily met with in hospitals; so that the value of the Buxton mineral water as a medicinal agent, and the character of this important charitable institution can need no farther commentary. On the average of the thirty-two years the patients remained under treatment nearly 24 days; and 47,635 cases of rheumatism, embracing every conceivable variety of this distressing malady, and for the most part cases of severe and obstinate character, for the relief of which ordinary medical means had been used in vain, before these poor people had been sent to Buxton, were, in a time comparatively so short, and with so little aid from other means than the Buxton water, discharged with results so satisfactory. Patients are recommended by casual, annual, and life subscribers. Within the last ten years

the Hospital has been extended to the whole range of buildings connected with it. It is a matter of curious history that the interior façade of the building is an almost exact copy of "The Palace of Christian Kings, at Grenada." I have before me a print of the interior area of this ancient or mediæval palace, with its great insulated supporting columns, which might almost have been drawn from the interior of the Buxton Hospital. It does appear to be an extreme turn of what we may surely think to be Providential fortune, that such a building should have been used as the design for stables, and the stables have become, little more than eighty years after their erection, a magnificent hospital for the reception and care of the poor afflicted sufferers resorting to Buxton for the use of its mineral waters. The print of the Palace at Grenada is contained in a work entitled "Les Delices de L'Espagne et du Portugal," published at Leyden in the year 1707. The date of the erection of the Palace is not given, but is probably much more ancient. The Devonshire Hospital is perhaps visited year after year by a greater number of strangers and tourists, as well as more beneficially occupied, than the ancient Palace from which its construction has been copied.

