**The thermal waters of Bath / by Gilbert A. Bannatyne.**

# THE THERMAL WATERS OF BATH

G. A. BANNATYNE, M.D.

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BY

GILBERT A. BANNATYNE, M.D., M.R.C.P.

*Honorary Physician to the Royal Mineral Water Hospital, and to the Royal United Hospital, Bath; Medical Officer Combe Down Convalescent Home;*
*Author of "Rheumatoid Arthritis, General and Special Pathology," etc.*

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BRISTOL: JOHN WRIGHT & CO.
LONDON: SIMPKIN, MARSHALL, HAMILTON, KENT & CO., LTD.

1899.

BY THE SAME AUTHOR.

*Second Edition. 7/6 net. With numerous Plates and Illustrations.*

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# THE THERMAL WATERS OF BATH.

## CHAPTER I.

### *BATH: ITS HISTORY, SITUATION, CLIMATE AND DEATH-RATE.*

BATH, as is clear from its name, has from the first been more especially a place of resort for those requiring the healing properties of its waters, but not entirely so, for its fame as a place of residence has for many generations spread far and wide. And although its wondrous springs are still as much sought after and as efficacious as when in the pre-historic past the royal swine-herd discovered their healing powers, yet, if we look around us we see how succeeding generations have erected terrace after terrace of houses, famed both for their external architectural beauty as well as for their internal artistic embellishment. The city, originally erected on the lower spurs of the hills and by the banks of the Avon, has gradually spread and spread upwards on the three hills which enclose the valley, and it is formed not merely of the temporary homes of those seeking health but also of the permanent ones of many who find Bath an agreeable and beautiful place of residence.

If for a moment we glance at the ancient history of Bath we see how closely it is connected with all that is great in England, and if we follow its ups and downs we see how, in a great measure, they follow the vicissitudes

of our national history. Bath history really commences with the arrival of the Romans about the middle of the first century of the Christian era, but legend points to a much older discovery of the virtues of its thermal springs, and the romantic story of Prince Bladud has been handed down from generation to generation. It runs briefly as follows. Bladud, son of King Hudibras, being afflicted with leprosy, was banished from his father's court, and after many wanderings he sank to the post of swine-herd a few miles from Bath. His charges, by infection, became similarly afflicted, and dreading the wrath of his employer, he removed his herd to the valleys near this city, where the hot springs had formed a wide morass. In the hot oozy bed of this the pigs wallowed, with the result that after a time those afflicted with leprosy recovered. Pondering on this strange cure he came to the conclusion that what was good for the pigs would be good for him also. He accordingly immersed himself daily in the slime until he found that he had achieved a perfect cure. In course of time he succeeded to the throne of his father, and being desirous that his subjects should have the benefit of the healing waters he built a great city, supplied with baths, on the spot where he had derived so much benefit. Although very pretty, this legend cannot be regarded as anything but a legend, although it is more than probable that the hot springs were discovered by some wandering shepherd or swine-herd. That it was a civilized place long before the time of the Romans there can be no doubt, although it is on the hills more than in the valleys that traces of former habitations and fortifications have been found. On Lansdown, Beacon Hill, Claverton and Solsbury there are still traces pointing to the habitations of a large population of the Stone Age. But with the arrival of the Romans history becomes more definite and more precise. It relates and recent discoveries show how they erected a splendid suite of baths close round the springs, and to the town which sprang up they gave the name "Aquæ Sulis." Vast and solid as these buildings

were, they were completely demolished on the withdrawal of the Romans, and it is only recently that their magnificent remains have been unearthed, although from time to time evidence of their existence had been found. For many years after the Romans had left, Bath disappears from all historical notice, and it only reappeared under the new name of Æt Bathum. In the eighth century we find King Offa founded the Abbey, and round this a new city arose which after many changes and vicissitudes came to form the Bath of to-day. The early ecclesiastics were fully alive to the virtues of the waters, and in 1138 the then Bishop of Bath founded a hospital for the poor lepers and provided it with a bath. In 1180 his successor erected the Hot and Cross Baths as well as St. John's Hospital ; but for many years after the fortunes of Bath remained at a very low ebb indeed, and although the baths were in Queen Elizabeth's reign vested in the hands of the Corporation, little or nothing seems to have been done either to the baths or to the city to render them more attractive or sanitary. Fortunately for its fortune, in 1704 the celebrated Beau Nash came to the city, and under his administration a great improvement took place not only in the buildings but in the manners of its visitors ; new streets were built, the grand Pump Room and the Baths in Stall Street were erected, and many other improvements effected, and from this moment the city commenced to grow in size, in prosperity and in population, until we see it as it now is—one of the most beautiful and prosperous of health resorts, with a population of about 52,600 inhabitants.

Bath, situated as it is in a sort of natural basin surrounded by hills, presents an aspect of great natural beauty. Owing to its sheltered situation from the north, east and south-east winds, it has many advantages as a health residence apart from its thermal waters. Being open to the south and south-west winds, which are the prevailing winds throughout the greater part of the year, a constant supply of fresh air is continually arriving from the Bristol Channel and Atlantic laden with the invigor-

ating properties of the sea breezes. And even in the hottest and calmest of weather stagnation is prevented by a current from east to west along the river course. Although the town lies in the valley of the Avon, many of the houses are built on the slopes of the hills, some forming terraces and crescents, while others are dotted about amidst gardens and woods, and from all, or nearly all, magnificent views are to be obtained which become finer the higher one goes. Beechen Cliff, which is nearly 400 feet above sea level, provides a lovely view of the city, which lies spread out at one's feet as in a map. Again, from Sham Castle the view is exceptionally fine, for not only have we the city below us, but one's gaze wanders further afield, away west until the Welsh Mountains meet the eye, and north and south our eyes roam over landscapes equally fine. Lansdown, 800 feet high, provides residences at all heights, and, if one may say so, of all climates. Hard, indeed, to suit must he be who cannot in this beautiful and unique city find a situation and climate to his choice.

The city of Bath was originally built on the flat close to the springs and river, and was enclosed within walls. Under the flourishing *régime* of Nash the increasing demand for more and better accommodation caused it to expand, and owing to various fortuitous circumstances it had to expand upwards, and it thus comes to present a magnificent conglomeration of a circus, crescents and terraces probably unique in the history of any modern city. The houses are all substantially built of freestone obtained in the neighbourhood, and in many instances were erected quite regardless of all expense in the heyday of Bath's fame as a city of gaiety and fashion. Internally the arrangements have mostly been re-modelled with a view to meeting the modern requirements of sanitation, with the result that probably no city of its size can show a lower death-rate from preventable zymotic disease. The public sanitary service is in the hands of able and enlightened men whose one endeavour is to insure as far as possible a healthy and sanitary condition

of the city generally. The main drains are well laid, trapped and ventilated, and owing to the gradients there is no possibility of blocking except in the lower part of the city, and there systematic flushings are carried out. All cesspools have been entirely abolished.

The Bath water supply is exceptionally good and is derived from numerous springs. The upper springs come from the clays of the Fuller's Earth underlying the Great or Bath Oolite. They are superficial and depend for their yield on the rainfall, but the lower ones come from the Upper Lias or Midford Sands and are more constant. Recently the Monkswood reservoir, with a capacity of 51,000,000 gallons, has been taken into use, and with the reservoirs at Batheaston, Bathwick, Charlcombe and Lansdown there is a total storage capacity of 500,000,000 gallons. The supply is constant, and even in the driest seasons there should be little chance of failure.

Dr. Symons, in his health report for 1897, says: On account of the numerous sources it is not easy to give exact information concerning the mineral constituents of the water. But it is a moderately hard water, and those samples I have examined contain about 23 grains total solids per gallon, namely, 16 grains calcium carbonate, 3 grains calcium or magnesium sulphate, about 2 grains of chlorine, about 1 grain of nitric acid as nitrates, traces of silicia, etc. The water is remarkably free from ammonia producing and deoxidizing substances.

In October, 1897, Mr. Gatehouse, F.I.C., Public Analyst for Bath, made analyses of water from four springs of the Charlcombe supply. The following were the results :—

| Grains per gallon | I. | II. | III. | IV. |
|---|---|---|---|---|
| Chlorine as Chlorides | 1·4 | 2·1 | 1·4 | 1·68 |
| Free Ammonia | None | None | None | None |
| Albumenoid ammonia | None | None | None | None |
| Total solids | 24 | 28 | 21·3 | 25·6 |
| Oxygen to oxidize decomposing matter | None | None | None | None |
| Nitrogen as nitrate | 1·28 | 82 | 1·11 | ·97 |
| Equal to nitrogen | ·28 | ·18 | ·24 | ·21 |
| Hardness | 14° | 15°5 | 14° | 16°5 |
| Lead and poisonous metals | None | None | None | None |

Concerning each one he wrote: "This is a good drinking water. The chemical analysis does not indicate the presence of any pollution which could be injurious to health."

Quantitative bacteriological examinations have also yielded a similar result, proving in every sense that the water is a pure, good drinking water.

The climate of Bath is exceptionally mild and equable. The course of the river and the circuit of hills by which the city is nearly surrounded, opening only to the west, has much influence on this. The action of the hills probably has an effect in moderating the heat in summer and the cold in winter by prolonging the interchange of heat due to radiation. The cold arising from full exposure to the sky on cold frosty nights would be checked, as would be the heat on a bright summer's day. On the other hand these hills may, by interfering with the free circulation of air, cause the atmosphere to be rather oppressive. The difference between night and day temperature is important, and Bath is found to have a slightly higher mean temperature than several other English towns in about the same latitude. Its extremes of cold and heat lie within a more contracted range than do those of any similar town. The Rev. Leonard Bloomefield has dealt thoroughly with the climate of Bath, and to him we are indebted for the most useful statistics.

It is the mean daily range of temperature, not the mean monthly range, that is of most importance to invalids, and we find that the ranges are greatest in summer and lowest in winter. The mean temperature of Bath is 50·4. With regard to the seasons the following table shows the mean of each season together with the highest and lowest means observed in each season, also the range :—

| Seasons. | Mean. | Highest. | Lowest. | Range. |
|---|---|---|---|---|
| Spring ... ... | 48·4 | 51·2 | 45·8 | 5·4 |
| Summer ... ... | 60·3 | 63·5 | 58 1 | 5 4 |
| Autumn ... ... | 50·7 | 52·3 | 48·5 | 3·8 |
| Winter ... ... | 41·4 | 46·3 | 36·4 | 9·9 |

If we compare Bath temperatures with such places as Oxford, Greenwich or Norwich we find the mean temperatures of Bath during the cold seasons of spring and winter are higher than theirs, but in summer they are nearly on an equality. In summer, though it is found that the mean may be nearly similar, yet the days are not so hot nor the nights so cold. In winter the mean of the highest is higher and that of the lowest not so low. Mr. Bloomefield sums up by saying that in spring the mean temperature is higher while the night temperatures are not so low, and the mean daily range is less when compared with Greenwich. In summer the mean temperature is not different, but the extreme night and day temperatures are both of them more moderate, the mean daily range being still more contracted than in spring. In autumn the mean is only very slightly higher than in other places, the extreme daily temperatures being scarcely as high nor the nights so cold. In winter the mean is decidedly higher, the extreme day and night temperatures also are higher, though the mean daily range shows scarcely any difference.

It is, therefore, clear that the Bath temperature is a moderate one both in summer and winter, and should it be desirable in summer one can always find a cooler atmosphere by ascending any of the surrounding hills. On Lansdown it has been found that in summer the mean temperature is less, as it is also in winter, the mean daily range being 1½ degrees in excess of that at the Institution Gardens. The most humid months are those of November and December, the least so being May. The mean rainfall taken in the Institute Gardens for thirty years is 31·25 inches. The following table gives the maximum and minimum in each of the four seasons during twenty years :—

| Seasons. | Mean. | Maximum. | Minimum. |
|---|---|---|---|
| Spring ... ... | 6·056 | 10·848 | 2·737 |
| Summer .. .. | 7·633 | 15·583 | 2·592 |
| Autumn ... ... | 10·008 | 14·302 | 4·227 |
| Winter ... ... | 8·785 | 13·388 | 4·830 |

The autumn, although the wettest season, does not differ materially from that of winter. The highest mean monthly fall is in January. There are variations in Bath itself, as the fall on Lansdown exceeds that in Bath by 1½ inches and the fall in Swainswick differs from that on Bathwick Hill. The average number of wet days (*i.e.*, days in which rain falls to the extent of $\frac{1}{100}$ of an inch) is about 161, but as much of the rain falls by night the fine days, as ordinarily reckoned, greatly exceed this. As the subsoil is of a nature to dry quickly, the roads seldom, except in winter, remain long wet.

With regard to the barometric readings at the Institution the average is 29·976 inches, and it differs hardly at all from those taken at Exeter and Cambridge. The highest reading was 30·978 and the lowest 28·337, the range being 2·641. The mean barometric readings on an average are :—

| | |
|---|---|
| Spring ... ... ... ... ... | 29·958 |
| Summer ... ... ... ... | 29·973 |
| Autumn ... ... ... ... | 29·961 |
| Winter ... ... ... ... ... | 30·010 |

The most prevalent winds at Bath are those from the N.W. quarter, those next in frequency being from the S.W., and those from the S.E. being the least frequent. Each class of wind gives the following results in the various seasons :—

| Seasons. | N.E. | S.E. | S.W. | N.W. |
|---|---|---|---|---|
| Spring ... ... | 26·1 | 17·7 | 18·4 | 29·4 |
| Summer ... ... | 20·2 | 10·3 | 22·1 | 37·5 |
| Autumn .. .. | 23·0 | 12·3 | 22·1 | 30·5 |
| Winter ... ... | 17·5 | 14·6 | 31·0 | 24·1 |

The N. and N.E. winds are most common in spring and less so in winter, whilst the S. and S.W. are most common in winter and least so in spring.

Bath not being a manufacturing town, the ozone of the air is not destroyed by smoke and other impurities, but there can be no doubt that the higher we go up the hills the better and purer and more invigorating becomes

the air. From the above it will be seen Bath offers peculiar climatic advantages as well as thermal water ones, as a winter and spring residence for invalids, and more especially to those requiring a mild climate, for such complaints as asthma and bronchitis, with slight variations between day and night temperatures and with a moderate amount of moisture in the air. It is also very suitable for delicate constitutions, and those suffering from low, nervous vitality, or from the effects of tropical climates.

The population of Bath may probably be taken as about 52,600, and the death-rate, as compared with that of England and Wales, is found to be considerably lower. As a whole it is lower, and if we examine each age group it is also lower. Dr. Symons gives the following table :—

Population of Bath in Age Groups. Age Distribution of 1000 persons compared. Deaths and Death-rate per 1000 each Age Group :—

| Age Group. | Standard Population | Bath Population. Proportion | Bath Population. Total. | Deaths 1897. | Death-rate per 1000. |
|---|---|---|---|---|---|
| Under 5 | 123 | 89 | 4,605 | 198 | 43·00 |
| 5 ,, 15 | 228 | 187 | 9,640 | 32 | 3·32 |
| 15 ,, 25 | 193 | 209 | 10,848 | 33 | 3·04 |
| 25 ,, 35 | 151 | 150 | 7,781 | 45 | 5·78 |
| 35 ,, 45 | 115 | 116 | 6,032 | 55 | 9·12 |
| 45 ,, 55 | 86 | 98 | 5,113 | 77 | 15·09 |
| 55 ,, 65 | 57 | 75 | 3,901 | 107 | 27·43 |
| 65 ,, 75 | 33 | 51 | 2,657 | 143 | 53·82 |
| 75 ,, 85 | 14 | 25 | 1,084 | 129 | 119·00 |
| 85 and over | | | 183 | 42 | 229·51 |
| All Ages ... | 1,000 | 1,000 | 51,844 | 861 | 16·39 |

The differences between the populations of England and Wales and of Bath are shown in the second and third columns. Thus in the general population among 1,000 persons 123 would be under 5 years of age and 47 over 65, while in Bath among the same number of persons 89 would be under 5 and 76 over 65 years.

In each age group the death-rate is slightly below the death-rate at the same age group for England and Wales for the quinquennium 1891-5. Statistics for a later period are not yet published.

The Bath annual death-rate is lower than that of the thirty-three great towns as well as for the whole of England and Wales, and it is specially remarkable when we glance at the zymotic mortality columns.

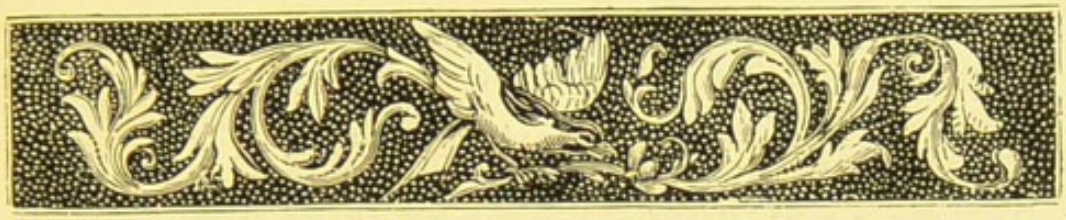
Annual Death-rates per 1000 from All Causes and from several Zymotic Diseases during the year 1897.

| | All causes. | Principal Zymotic Diseases. | Small Pox. | Measles. | Scarlet Fever. | Diphtheria. | Whooping Cough. | Fever. | Diarrhœa. | Deaths under 1 per 1000 Births. |
|---|---|---|---|---|---|---|---|---|---|---|
| England & Wales | 17·4 | 2·15 | 0·00 | 0·40 | 0·14 | 0·24 | 0·35 | 0·16 | 0·86 | 156 |
| 33 Great Towns | 19·1 | 2·87 | 0·00 | 0·55 | 0·18 | 0·31 | 0·41 | 0·18 | 1·24 | 177 |
| Bath ... ... | 16·4 | 1·20 | — | 0·21 | 0·10 | 0·30 | 0·29 | 0·06 | 0·25 | 128 |
| 67 Other Large Towns | 17·2 | 2·41 | 0·00 | 0·43 | 0·15 | 0·24 | 0·38 | 0·16 | 1·05 | 169 |
| England and Wales less the 100 Towns | 16·4 | 1·62 | 0·00 | 0·29 | 0·12 | 0·19 | 0·31 | 0·14 | 0·57 | 138 |

A glance at the above tables leads one to the conclusion that Bath is a place where the conditions are such as to be favourable to life. The following table, also compiled by Dr. Symons in his Health Report of 1897, is also of great interest as showing the seasonal death-rates.

SEASONAL DEATH-RATE—ENGLAND AND WALES.
Town and Country Districts compared with Bath corrected to Standard Population.

| | | Winter. | Spring. | Summer. | Autumn. | Annual. |
|---|---|---|---|---|---|---|
| 5 Years 1891 to 1895 | England & Wales | 21·9 | 18·5 | 16·5 | 18·1 | 18·7 |
| | Bath × 0·94 ... | 23·7 | 17·9 | 12·9 | 15·0 | 17·6 |
| | Town Districts... | 25·2 | 19·1 | 17·6 | 19·0 | 19·5 |
| | Country Districts | 21·2 | 17·4 | 14·3 | 16·4 | 17·3 |
| 1896 | England & Wales | 17·9 | 16·3 | 16·3 | 17·9 | 17·1 |
| | Bath × 0·94 ... | 16·5 | 14·7 | 15·3 | 17·7 | 16·2 |
| | Town Districts... | 18·5 | 17·2 | 17·6 | 18·6 | 18·0 |
| | Country Districts | 16·6 | 14·5 | 13·7 | 16·3 | 15·3 |
| 1897 | England & Wales | 18·8 | 16·3 | 17·8 | 17·0 | 17·4 |
| | Bath × 0·94 ... | 19·3 | 14·2 | 12·3 | 15·8 | 15·4 |
| | Town Districts... | 18·9 | 16·6 | 19·4 | 17·9 | 18·2 |
| | Country Districts | 18·4 | 15·6 | 14·3 | 14·9 | 15·8 |



## CHAPTER II.

### *THE THERMAL WATERS.*

The thermal waters of Bath arise by three springs at nearly the lowest level of the valley and not far from the river. These three springs, no matter what their common origin may be, are at their outflow quite distinct. The origin is unknown but various theories have, from time to time, been advanced to explain the phenomenon. The most reasonable is that of Sir Charles Lyell, who stated that in his opinion the Bath springs mark the sight of some great volcanic convulsion and fracture of the earth's crust. The uppermost part of the rent through which the hot water rises is situated in horizontal strata—the Lias and Trias—300 feet thick, which strata are probably more modern than the inclined and broken ones of the subjacent coal measures through which the lower part of the fissure passes. Thus we have the conditions which he points out exist where hot springs are usually found, namely, the junction of two different geological formations. To thoroughly understand this we must turn to the geology of the district. Here we see that the hills around the city and out of which the Bath basin has been carved, form the southern prolongation of that great irregular band of Jurassic rocks running diagonally across England from Lyme Regis in Dorset, on the S.W., to Redcar in Yorkshire, on the N.E. As spurs of the great Cotswold

range, they present the same peculiar features. The main line of our escarpment, jagged and indented with promontory and valley, faces the N.W., whilst the beds have generally a gentle dip to the S.E. The nearly horizontal beds of Clays, Limestones, and Sands on which the city is built, constitute a portion of the series of rocks to which the term Oolitic has been given, from the oviform grains in many of the limestones; and the city and its environs are indebted for their appearance to the limestone beds—named the Bath Oolite—extensively quarried in the neighbouring hills, especially on Claverton and Combe Down. To the beds of the Great Oolite succeeds a considerable thickness of clay, known as Fuller's Earth, much employed in the manufactories at Bradford, Trowbridge, Frome and Twerton. Richmond Hill and Mount Beacon, on the higher and northern side of Bath, are upon this clay. Beneath this appears the limestone known as the inferior Oolite. The upper part of Sion Hill, Lansdown Crescent, Springfield Place, Rock House, Lansdown Grove, and the land between St. Stephen's Church and the road above Camden Crescent are upon this limestone, which is based on sands known as Midford Sands, but which are not so thick at Bath as at some localities in the vicinity. They form steep ground ranging from under the escarpment behind Upper Camden Place. The lower part of Sion Hill, All Saints' Chapel, and part of Lansdown Road are also upon these sands, as well as Hampton Row and the land stretching above it and the Canal to the New Warminster Road, the upper part of Sydney Gardens, Darlington Place, and onwards to Cambridge Place and Widcombe Crescent, and from Forefield Place under Beechen Cliff to the top of Holloway. Descending in the order of the beds we come to the argillaceous limestones known as the Lias, on which stand Cavendish Crescent and Place, the higher part of Park Street, part of Lansdown Road, Camden Crescent, Upper Camden Place, the back of Prospect Place, with Stanley Villas. All the remaining

part of the city, and consequently the great mass of it, is also built on the Lias, with the exception of Pulteney Street, Sydney Place, Bathwick Street, and other streets and places adjacent to the left bank of the river; the North and South Parades, and the various buildings in the Dolemeads, the bottom of Avon Street and Milk Street, and Norfolk Buildings, and Norfolk Crescent, Kingsmead Terrace, Green Park Buildings, which stand on alluvial ground, in a great measure composed of clay; gravel is very abundant in the Villa Fields and at Larkhall. The buildings on the Oolitic Limestones and Sand are on dry ground. On the lower ground (including Bathwick), which might be supposed to be naturally damp, the accumulated buildings of centuries and the vaulting on which the houses are erected, greatly tend to prevent the damp character of the ground beneath from being injuriously felt above, and render this district a favourite resort for persons no longer young, and who do not like hills.

The late Charles Moore thought it probable that the heat of the waters was due to progressive chemical changes, but the Rev. H. H. Winwood thought it due to the subterranean heat of the interior, as the fissure through which the stream ascends appears to be in the Palæozoic Rocks. The waters probably find their way through one of those fissures or dislocations common in the older rocks, termed faults, in this case not improbably through the Coal Measures continued beneath the Sandstones and Marls (named the New Red Sandstones and Marls), and their covering of Lias and other members of the Oolite series, from adjacent rocks of the same kind. The fact that particles of coal are found amongst the sand thrown up, tends to give support to this impression. It has been shown that water from the Lower Lias, and coal measures in Somerset, contains an abundance of chloride of sodium, amounting to as much as 1·008 grains per gallon. And parenthetically it may be remarked that sulphur waters usually co-exist with thermal waters. And in this respect it is curious to note, a

hundred years or so ago, a cold sulphur spring appeared in Lyncombe Vale but disappeared as suddenly as it came. There is some reason to believe that the Bath waters originally contained sulphur.

What is peculiarly remarkable about the springs of Bath is the regularity of their temperature and the persistency of their flow. They are known to have been running for 2,000 years, and during the 300 years over which their literature extends there has been no appreciable variation in their temperature or character. No seismic disturbance ever seems to affect them. The yield yearly is about 1,000,000 tons and its maximum heat is 120° F., being by far the hottest spring in England. The three springs are (1,) The *King's Bath Spring*, and this was probably the supply of the most important of the sumptuous *thermæ* constructed by the Romans, and it rises over a surface of about 40 feet square. The Roman reservoir, octagonal in shape, and of massive construction, still serves its original purpose, the accumulated *débris* of ages having in recent times been effectually removed. The volume of water issuing from the spring is estimated at two hogsheads and a half per minute. The temperature is 117° F. A south window of the Grand Pump Room affords a view of the spring as it overflows in the centre of the "King's Bath." This capacious reservoir is 59 feet in length by 40 feet in breadth, and when filled is computed to contain 56,332 gallons of the mineral water. (2,) The *Hot Spring*, which rises 17 feet below the pavement of the Old Royal Baths. Its discharge is estimated at one and a half hogsheads per minute and the temperature is 120° F. (3,) The *Cross Bath Spring* rises 15 feet below the flooring of the bath, and its flow of water is half a hogshead per minute, and its temperature is 104° F.

The total volume of water issuing from all the springs exceeds half a million gallons a day, and the temperatures allow of the application of the waters, when used on the spot, at any required heat up to 120°. The

water, as drawn from the spring, is clear, colourless and sparkling. In large quantities it is of a greenish hue. It is free from odour, and in taste very slightly metallic. At the temperature at which it is now supplied in the Pump Room, about 114°, it is by no means an unpleasant beverage.

The analysis of the waters is thus given by Professor Attfield, F.R.S. :—

| | Grains per Imp. Gallon. |
|---|---|
| Carbonate of Calcium ... ... ... | 7·8402 |
| Sulphate of Calcium ... ... ... | 94·1080 |
| Nitrate of Calcium ... .. .. | ·5623 |
| Carbonate of Magnesium ... ... | ·5611 |
| Chloride of Magnesium ... ... ... | 15·2433 |
| Chloride of Sodium ... ... ... | 15·1555 |
| Sulphate of Sodium ... ... ... | 23·1400 |
| Sulphate of Potassium ... ... ... | 6·7020 |
| Nitrate of Potassium ... ... ... | 1·0540 |
| Carbonate of Iron ... ... ... ... | 1·2173 |
| Silica .. ... . ... ... | 2·7061 |
| Total Solids ... ... .. ... | 168·2898 |

Mr. J. W. Morris, F.L.S., has for some time been engaged upon the investigation of the sands deposited by the King's Bath springs and the contents of the hazel-nuts found in the conduits leading therefrom. The sands afford in their organic remains evidences of communication with marine sources, while the non-organic evidences of igneous action at high temperatures are abundant. Within the closed chambers of the nuts a process of endosmosis has produced from the infiltrating waters not only dog's-tooth crystals of carbonate lime of singular purity, but arragonite in various forms, and salts of strontium in remarkable perfection. Cuff is said to have detected iodine in the waters, but it probably exists in a proportion so minute as to defy chemical detection. Merck and Galloway found traces of both iodine and manganese. Gibbs found silex and Scudamore magnesia. More recently Daubeny has suspected bromine and phosphoric acid, and Roscoe discovered lithium and strontium.

The following is yet another analysis :—

| | Parts per Million. | Grains per Gallon. |
|---|---|---|
| Calcium ... ... .. | 377 | 26·36 |
| Magnesium ... ... ... | 47·4 | 3·31 |
| Potassium ... ... .. | 39·5 | 2·76 |
| Sodium ... ... ... ... | 129 | 9·03 |
| Lithium ... ... ... ... | Traces | Traces |
| Iron ... ... ... ... | 6·1 | ·427 |
| Sulphuric Acid ... ... | 869 | 60·83 |
| Carbonic Acid (combined) ... | 86 | 6·02 |
| Chlorine ... ... .. | 280 | 19·60 |
| Silica ... ... ... ... | 30 | 2·10 |
| Strontium ... ... ... | Traces | Traces |
| Alkaline Sulphides ... ... | Traces | Traces |
| Carbonic Acid Gas at normal temperature and pressure | Cubic centimetres. 62·2 | Cubic inches. 18·2 |
| Solid Residue ... ... ... | 1920 | 134·4 |
| Specific Gravity ... | ... ... 1·0015 | |

My friend, Dr. Blaxall, has examined the waters bacteriologically, and more especially for thermophilic bacteria, and found them to be sterile.

The most abundant ingredients then are: the sulphate of lime, chloride of soda, chloride of magnesia, and sulphate of soda, the proportion of iron being comparatively small, although its taste is quite perceptible and its effects on the system more decided than would be expected. The gases evolved are carbonic acid, nitrogen, oxygen, helium and argon. Lyell adopts the theory that the nitrogen is derived from the de-oxidation of the atmospheric air carried down by the rain water. He suggests that the rain water percolates down through rents and porous rocks till it encounters a mass of heated matter by which it is converted into steam and then drawn up through fissures by the expansive force of heat and steam or by hydrostatic pressure. In its downward journey it may acquire its sulphate of lime, chloride of calcium and other substances from the decomposition of the saline, gypseous, calcareous and other constituents of the rocks

through which it permeates. Bischoff, on the other hand, suggests that the nitrogen is due to the action of heat on stratified organic matter. The carbonic acid gas probably originates at great depth by decomposition of the oldest rocks. The gaseous constituents consist mainly of nitrogen, with a smaller quantity of oxygen and carbonic acid and traces of helium and argon.

As regards these gases the various analyses differ somewhat, both with regard to those free and those occurring in combination. Merck and Galloway give slightly more than Walcker and less than Phillips, and they all differ from that of Prof. Attfield, whose analysis I have given. It is to the carbonic acid gas that the sparkling appearance of the water is due, and the presence of this gas is of the utmost importance as it is a powerful stimulant of the nervous system, and its effects in restoring pliability to stiffened limbs is well known. Nitrogen also, although it is difficult to explain its mode of action, produces a beneficial effect on the system. But it is not to the presence of one or more particular mineral ingredient, except where found in large quantities, that any mineral spring's efficacy is due, or on which it is selected as a medicinal agent. It is rather to the union of the several substances contained in the water, and to its temperature, that we look for the benefit which the combined experience of those prescribing it and of those using it, would teach us to expect.

It may be mentioned that at certain periods of the year vegetable matter is found floating on the surface of the mineral water, adhering to small masses of its deposit, and occasionally to the walls of the baths. The vegetable matter is found to consist of the oscillatoria or conferva tenuissima. The following is a table of some of the best known thermal waters, and in some cases I have been enabled to give their elevation above sea level, a point of considerable importance :—

| Spa. | Country. | Elevation in Feet. | Temp. of Spring in Fahrenheit. |
|---|---|---|---|
| Karlsbad (Sprudel) | Austria | | 164·0 |
| Luxeuil ... ... | France | 1300 | 65-163 |
| Battaglia .. ... | Italy | | 160·0 |
| Plombières .. ... | France | 1300 | 65-156 |
| Baden-Baden (Hauptquelle) ... ... | Germany | | 155·4 |
| Wiesbaden ... ... | Taunus | | 153·0 |
| Hot Springs, Garland | America | | 93·0-150·0 |
| Des Chutes, Arkansas, Oregon ... ... | America | | 143-145·0 |
| Dax ... ... ... | France | 130 | 88-140 |
| Karlsbad (Mülbrunnen) ... ... | Austria | | 136·0 |
| Karlsbad (Schlossbrunnen) ... ... | Austria | | 134·4 |
| Aix-la-Chapelle ... | Germany | | 131·0 |
| Luchon ... ... | France | | 131·0 |
| Chalk Creek Springs | Colorado | | 130·0 |
| Néris ... ... | France | 800 | 114-125 |
| Leuk ... ... ... | Switzerland | 4600 | 102-122 |
| **Bath** ... ... | England | 100 | 104-120 |
| Lucca ... ... | Italy | 500 | 100-120 |
| Töplitz ... ... | Bohemia | 650 | 95-120 |
| Aix-les-Bains ... | Savoy | 1060 | 86-120 |
| Ems (Kesselbrunnen) | Germany | | 118 |
| Baréges ... .. | France | | 111 |
| Mont Dore ... ... | France | | 105·8 |
| Wildbad Gastein ... | Eastern Alps | 3300 | 104·8 |
| Bormio ... ... | Italy | 4300 | 90-104 |
| Warmbrunn .. | Germany (Silesia) | 1100 | 104 |
| Madison Co. Hot Springs ... ... | North Carolina | | 102 |
| Neuenahr (Mariensprudel) ... ... | Germany | | 101·7 |
| Wildbad ... ... | Wurtemberg | 1323 | 98·6 |
| Ragatz ... ... | Switzerland | 1700 | 98 |
| Neuhaus ... ... | Styria | 1200 | 95 |
| Bagnères-de-Bigorre | Pyrenees (France) | 1850 | 95 |
| Panticosa ... ... | Pyrenees (Spain) | 5000 | 98 |
| Johannisbad ... | Bohemia | 2000 | 86 |
| Schlangenbad ... | Nassau | 900 | 86 |
| Römerbad ... ... | Styria | 700–800 | 86 |
| Buxton ... .. | England | 1000 | 82 |
| Liebenzell ... ... | Wurtemberg | 1113 | 82 |
| Tobelbad ... ... | Styria | 1090 | 82 |

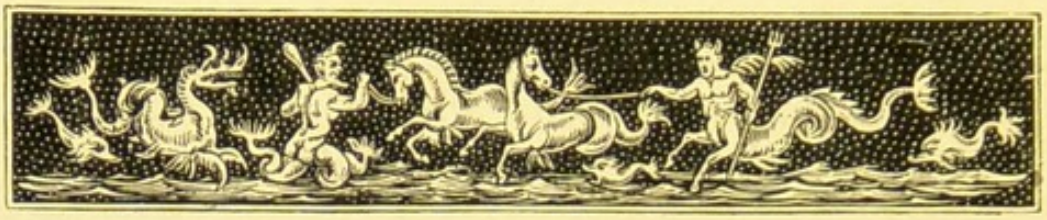
Bath waters being full of calcareous or earthy salts (carbonate and sulphate of lime and carbonate of magnesia) must be compared with the other waters of the same class in Europe, and we find that—

| | | Grains of Solids in each 16 ozs. of Water. | |
|---|---|---|---|
| Lucca | Tuscany | contains | 21· |
| Wildungen | Waldeck | ,, | 20· |
| Bagnères de Bigorre | Pyrenees | ,, | 20· |
| Lippspringe | Westphalia | ,, | 18· |
| Bath | England | ,, | 17·96 |
| Leuk | Switzerland | ,, | 14·6 |
| Weissenberg | ,, | ,, | 10· |
| Inselbach | Westphalia | ,, | 10· |
| Luxeuil | France | ,, | 8·5 |
| Bormio | Italy | ,, | 8· |
| Buxton | England | ,, | 2· |

With the indifferent thermal springs of Europe we find Bath compares very favourably with regard to its solid constituents

| | | Grains of Solids in each 16 ozs. of Water. | |
|---|---|---|---|
| Bath | England | contains | 17·96 |
| Dax | Auvergne | ,, | 7· |
| Töplitz | Bohemia | ,, | 4·8 |
| Warmbrunn | Silesia | ,, | 4·07 |
| Wildbad | Wurtemberg | ,, | 3·58 |
| Schlangenbad | Hesse Nassau | ,, | 2·8 |
| Gastein | Tyrol | ,, | 2·68 |
| Pfäffers | Switzerland | ,, | 2·61 |
| Romerbad | Styria | ,, | 2·239 |
| Plombières | France | ,, | 2·0069 |
| Panticosa | Spain | ,, | 1· |

It is thus seen that Bath compares most favourably with all the European waters of a similar class, and in the case of the thermal waters it takes a high place in the scale (seventeenth), even when one includes other than the purely indifferent thermal waters.



## CHAPTER III.

### *THE BATHING ESTABLISHMENT.*

THE whole of the mineral springs are vested in the hands of the Corporation, and the pump rooms and baths, which are situated close to the Abbey Church, show that the money which from time to time has been expended on them has kept them in touch with all the more recent developments of Balneological therapeutics. Although the baths are not all under one roof, yet they are so close to each other that they are readily accessible to all.

The *Grand Pump Room* is situated in the Abbey Yard, adjoining the King's Baths. It is a handsome building of local stone, its architecture being Corinthian. In the centre is a pediment supported by four three-quarter columns, the frieze of which bears the following inscription :—

ΑΡΙΣΤΟΝ ΜΕΝ ΥΔΩΡ,

a motto (the suggestion of Dr. Harington) taken from the first ode of Pindar, and meaning—"Water! of elements the best."

The Pump Room itself is 85 feet long by 56 in breadth and 34 in height. In the recess at the eastern end is a marble statue of Beau Nash, executed by Prince Hoare ; the right hand of the figure rests upon a pedestal, on the face of which is delineated a plan of the Royal Mineral Water Hospital, towards the establishment of

which charity he greatly contributed by his exertions in obtaining donations of money. Placed in this room, also, is the fine piece of statuary (by the late Warrington Wood) presented by the late Mr. H. W. Freeman to the corporation on the expiration of his mayoralty, and to commemorate the opening of the New Queen's Baths by H.R.H. the Duchess of Albany, in 1889. It is entitled "The Troubling of the Waters." At the western end is an orchestra for the band, but since the opening of the new Concert Room this is seldom used. There are three entrances on the northern side, and facing the principal one is an alcove in which a fountain is situated with a continuous stream of water supplied direct from the mineral spring, at a temperature of 114°F. The alcove is lighted by stained glass windows, private gifts. The subjects are—Bladud discovering the springs; Bath being built by the Romans; the crowning of King Edgar in the Abbey Church; Bath under King Charles II.; Bath under Queen Anne. The room is decorated with plants and curtains, comfortable seats and lounges, and tables covered with newspapers, as a resting-place for water drinkers, and for bathers before going into the outer air. In each of the vestibules will be found a tablet, one bearing a poetic appeal by Anstey on behalf of the Mineral Water Hospital, and the other an invitation of the Spenserian metre and style by Dr. Harington, invoking relief for those who use the waters. At the south western end of the Pump Room is a convenient entrance to the King's Baths, and at the eastern end is the entrance to a short corridor which leads to the New Concert Room, drawing rooms, and Roman promenade.

The *Concert Room*, which is 71 feet long by 39 wide and 53 high, was opened in October, 1897, by the Duke of Cambridge, and forms the finest possible addition to the already complete suite of baths. It is approached by a short corridor opening from the north east corner of the Pump Room. It is large, well lighted and ventilated, and is suitable in every way for its purpose,

which is to provide a room in which the daily concerts may be held without disturbing the peace and comfort of the water drinkers. An orchestra is arranged for at the north end, but the rest of the room is ordinarily taken up by chairs. The excellent band provided by the Corporation plays here twice a day during the winter season. The room is handsomely decorated and embellished, and provides in every way for the comfort of its occupants. East and west of it run two wide vestibules, 108 feet long, communicating with it by four doors at the four corners of the room. These vestibules, at their southern end, open on the wide, covered-in terrace 110 feet long by 12½ feet wide, overlooking the Roman baths. Seats are plentifully provided both here and in the vestibules, so that those not caring to sit actually in the Concert Room may do so here, and enjoy the music at the same time. Opening from the east vestibule are the handsomely fitted smoking and drawing rooms. At the north-east and south west ends of the corridors stairs lead to the Roman baths and museum; the whole being planned to meet every wish of visitors, their comfort being the prime object of those to whom the carrying out of this scheme has been so successfully entrusted.

*The King's Public and Private Baths* adjoin and open off from the Pump Room. They consist of the King's bath, which is an open bath on the south side of the Pump Room, and has the repute of being the oldest of the mediæval baths and is supposed to have derived its name from King Bladud, and a magnificent suite of public baths. The King's Bath measures 59 feet in length by 40 feet in breadth, and when filled to the depth of 4 feet 7 inches contains 364 tons 2 hogsheads and 36 gallons of water. It takes about eleven hours to fill, and the water can be seen bubbling up from the springs beneath. An effigy of Bladud is a conspicuous feature of the bath, and he is represented in a sitting position, and an inscription below tells who and what he was, stating also that he was "the founder of these

baths 863 years before Christ." A second inscription records the gift by Sir Francis Stonor, in 1624, of the Balustrade that once entirely surrounded the bath, as a thank offering. A third inscription records the fact that on July 23rd, 1886, Mr. J. J. Wilkinson laid the corner stone of the new baths on Roman walls eighteen hundred years old, thus connecting in work and object the modern with the ancient world. Adjoining this bath was a similar but smaller bath, named the Queen's Bath, after Queen Anne, the wife of King James I., but it was removed in 1886 in order that the Roman circular bath, discovered beneath, might be exposed to view.

The King's, or rather the Queen's, Bath establishment was much enlarged in 1888 at a cost of £20,000, from designs by the City Architect, Major Davis, the result being to enable the city to compete with the foreign spas, not only by excellent and luxurious appointments, but also by scientific and modern appliances. Entrance may be had either from the Pump Room, or through the old King's and Queen's entrance in Stall Street. A short passage leads to the central hall, a spacious apartment, 42 ft. by 15 ft. 9 in., used as a cooling room for the whole building. All the doors leading out of this hall are of walnut with ebony mouldings, the walls are covered with leather paper, and it is lighted by an open timber roof. It is fitted with two large, comfortable settees, with clear plate-glass backs which, cutting off all draughts, enclose a small area, where easy chairs, tables and lounges await the bather. All the furniture is of walnut, and the hall is heated by steam. On three sides of this apartment, practically speaking, there are entrances to various baths or dressing rooms, while on the fourth or west side there are stained glass windows overlooking the great staircase, the centre light being composed of an elaborate design in Renaissance glass depicting medallions of Titus, Vespasian and Constantine, Roman Emperors connected with the foundation of the baths.

The pavement is a precise reproduction of a Roman

tesselated pavement of the early part of the second century which was found in Bridewell Lane, and is now fixed on the wall of the smoking room at the Royal Mineral Water Hospital. It consists of large tesseræ of various colours, the pattern being composed of the ordinary octagon combined with the square. In the centre of each octagon are varied patterns; one is composed of a cross enclosed within a circle, the arms of the cross forming also a part of the circle, while foliation spreads from it marked out in black lines. A second pattern is formed of leaves, converging from the circumference to the centre, alternating with leaves springing from the centre, and a third pattern is a quatrefoil flower surrounded by a pattern of black and white tesseræ. The peculiarity of the work is the large size of the pieces of marble employed, and the fact that the white ground is interspersed with coloured marbles of marked brilliancy. The border, instead of being in large pieces of local stone, is formed of small pieces of black and white marble.

On the east side of the cooling room are the Aix-les-Bains Douches. They are lofty, and elaborately fitted with various apparatus for douching, beautifully tiled and admirably ventilated. They are fitted with ordinary douches giving a varied pressure of water at any temperature desired, and also with shower and feather douches, all the fittings being either nickel-plated or aluminium. The baths and dressing rooms are fitted with electric bells placed within easy reach of the patient. They are heated by steam, water or gas, and each is laid with a different tesselated pattern pavement. Adjoining are the pulverising and inhalation rooms, fitted with atomising apparatus for the pulverisation of the hot water, and Siegle's sprays for inhalation, such as are used at Marlioz and at Aix-les-Bains. On the south and west sides are three reclining and two deep baths, with dressing rooms, a needle douche and lavement fitted up with hot and cold douches, sprays, etc., such as are used at Wildbad and Gastein. There is also a Bouillon or

combined vapour and douche bath, for treatment with the natural vapour bath, and for the application of the douche, or *vice versa*, as may be expedient; this is a favourite method of bathing at Aix-les-Bains. Quite recently baths have been arranged in this part of the building on the Nauheim system, and the following varieties may be had:—(1,) A simple saline Thermalbad; (2,) A flowing Thermalbad, brine flowing but not gaseous; (3,) A mild Sprudelbad, brine partially flowing and gaseous; (4,) An ordinary Sprudelbad, brine flowing and gaseous, and (5,) The Sprudelstrombad, brine flowing and gaseous.

The remainder of the baths are upon a lower floor, the descent to which is made either by the grand staircase, or a lift which will take a wheel chair and two or three persons at the same time. The staircase is interesting inasmuch as it is over the old Roman hypocaust and is so arranged as to enable the visitor to have a complete view of the remains beneath. The baths in the lower floor are scarcely so elaborate as those above, but the whole of this portion of the new establishment is of great interest from the fact that it is a happy combination of modern and ancient work, for here the architect has had to overcome many difficulties in order not to destroy, but to expose as much as possible, the interesting and extensive discoveries of the remains of the Roman bathing system. There are six baths on this floor, including a Carlsbad reclining bath, an Aix douche for one doucher, a Ragatz and other reclining baths, and here also are the Berthollet or natural vapour baths. These may be general or local, and may consist of the vapour bath only or may have combined with it douching.

The *Royal Private Baths* are situated in Bath Street, and consist of seven luxurious baths, one lined with marble and the rest with white glazed tiles. A corridor affords access to the apartments, each suite including a dressing room, lofty, well lighted from above, carpeted, with a fire-place, sofa, etc. Each bath contains about fourteen hogsheads, and can be filled in five

minutes. Over one of the baths an arm chair is suspended from a crane, by means of which those who are unequal to a descent in the usual way are gently lowered into the water. Reclining and shower baths, the enema, a lavement apparatus, and douche are likewise here provided. The baths were renovated and improved in 1884, when a well furnished cooling-room was added. Adjoining this establishment is a large tepid swimming bath. It is reached by turning to the right after leaving the Private Baths. This swimming bath was built in 1829, after a design by Mr. Decimus Burton. Its form is an oblong of sixty-two feet by twenty-three. On the eastern side are arranged six small dressing rooms, and one large common dressing room. From each of these rooms a flight of steps leads into the bath, which contains about 37,225 gallons of water, and is four and a half feet deep. The water is supplied from the spring in the King's Bath, and from the cold water reservoir; its temperature is 88° F. The bath is lighted during the day by windows at the side, and from above by three lantern domes, with openings to the external air; at night the dressing rooms and the bath are lighted by gas. There is a separate entrance to this bath through the Piazza in Bath Street, opposite St. Catherine's Hospital.

The *Hot Bath*, which is an open bath, is situated in the centre of the Royal Private Baths. The entrance to it is at the southern end of Hot Bath Street. This bath is of an octagonal form, and its architectural embellishments are well deserving of notice. At the four corners of the bath there are small seats for the bathers, and there is also a Douche Pump on its northern side. The temperature of the spring, which rises seventeen feet below the pavement of the bath, is 120° F., while the temperature of the water of the bath varies in different parts from 105° F. to 120° F. The spring yields one hogshead and a half of water a minute, and supplies the Royal Private Baths, as well as the Hot Bath, and also baths in the Bath United and Bellott's Hospitals, in the immediate vicinity. When full, the Hot Bath is com-

puted to contain about 9,570 gallons of water, having a depth of four feet and a half.

The *Cross Bath* is situated at the west end of Bath Street, and it is a cheap public bath. The bath has been repaired, much improved, and made one-third larger, under the supervision of Major Davis. The reservoir was almost filled with the accumulated rubbish of ages, which has been removed, and the waters, as in the King's Bath, rise straight up from the Roman spring. When filled to a depth of 4½ feet it contains 11,350 gallons. The spring supplying it rises from a depth of fourteen feet below the flooring of the bath, and yields half a hogshead of water a minute. The temperature of the water at the depth above mentioned is 104° F.; that of the bath generally 84° or 90° F. The present edifice was erected from plans by Mr. Baldwin, the City Architect.

The *New Royal Baths* are situated in the southern wing of the Grand Pump Room Hotel. They were erected by the Corporation in 1870, at a cost of £12,000. The ground plan of these buildings is a long parallelogram, divided in the centre by a corridor lighted at the top, with baths and dressing rooms arranged on each side. Passing through the vestibule we enter a spacious waiting-room, and thence to the long corridor, which is 200 ft. long by 8 ft. wide and 14 ft. high. It is lighted by a skylight supported on light wrought-iron trusses. The floor is laid with encaustic tiles, and the entire area as well as the vestibule is heated by the waste steam from the engines in Swallow Street. The various baths are approached right and left from this corridor. They consist of six private baths, capable of holding about 780 gallons of water; three reclining or slipper baths, capable of holding about 220 gallons of water; Aix massage douche baths, Nauheim baths, dry douche bath, a lavement or enema bath; and also a vapour or steam bath, with a shower attached. To each of the six private baths the wet douche can be applied from continuous or intermittent small jets, or roses suited to the special case of the bather, and an elegantly furnished dressing room,

with w.c., is attached to each of them, as well as to the reclining and dry douche baths. From the end of this long corridor a flight of steps leads to the *Ladies' and Gentlemen's Swimming Bath*, with a private entrance from St. Michael's Place. This bath, which was considerably enlarged in 1884, under the direction of Major Davis, is now 80 ft. long by 35 ft. wide, and contains 40,000 gallons of water, supplied by means of a syphon from the King's Bath spring, at a temperature of 82°–94° F. There are seventeen dressing rooms with waiting rooms on a level with the bath. Above there is a drawing room for ladies, used by bathers frequenting the private baths, where they may cool themselves before going into the open air. Next this room is one for gentlemen, and a doorway from it conducts to a balcony overlooking the bath and leading to a smoking room. A small staircase leads to the basement through a loggia open to the bath. The roof is open timbered, supported by wrought-iron principals, and glazed with coloured glass, the centre rising to a considerable height to ensure sufficient ventilation. The ladies' days for bathing are Monday, Wednesday and Friday, the gentlemen's days being Tuesday, Thursday and Saturday. There is a communication on the basement with the King's Private and Public Baths, by means of a subway running under the street, so that there is ready access to these baths. There is also a communication from the Pump Room Hotel, on the ground floor, with the entrance lobby of these suites of baths, and a lift, by means of which infirm invalids can be brought down from the landings of the Hotel to a level with the corridor, through which, in a chair, an invalid may be wheeled to the baths or douches.

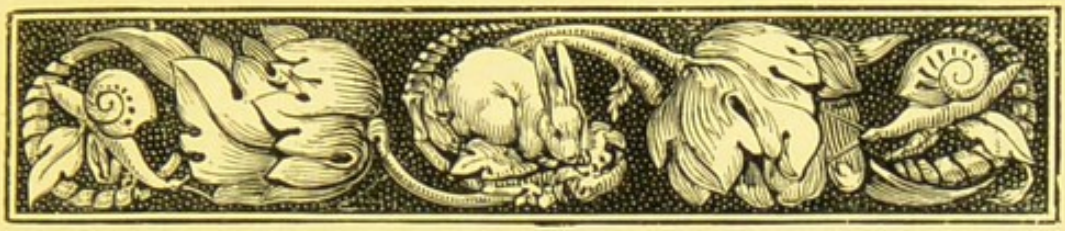
While on the subject of the bathing establishment, it is impossible to leave it without a few words on the subject of the Roman remains which from time to time have been unearthed. It is not my intention to say more than a few words to indicate the principal points of interest, but I would specially recommend, to all who care

for such things, a visit to the museum which has been arranged for the exhibition of all the fragments of Roman architecture found for many years past. This museum is placed beneath the New Concert Room, and it will be found to contain a very fine collection. In 1755 extensive remains of Roman baths were uncovered, and although they then suffered much damage, they were carefully described. When the Corporation acquired in 1877 one spring which had hitherto been private property, they were able to undertake various subterranean works to prevent a waste of the water from the springs, in the course of which the City Architect, Major Davis, explored many of the Roman remains. A committee was consequently formed in 1880 to effect, by voluntary subscription, the uncovering of the principal bath which he had proved to exist, and the work was subsequently taken up by the Corporation. There is nothing to approach these remains in interest known to be extant, except the baths of Caracalla at Rome.

The Roman baths which have been uncovered are in the rear of the Pump Room. They consist of a large rectangular bath in the centre of a hall 110 ft. 4 in. long by 68 ft. 5 in. wide. There are three recesses for seats on both the longer sides of this bath. A stone platform and steps surround the bath on all sides. The depth of the bath is about 6 ft. 8 in., and the floor, 73 ft. 2 in. by 29 ft. 6 in. is covered with thick sheets of lead. To the east of this are, or were, a complete system of the dry-heat baths, and another large bath of somewhat different construction from the last described bath. On the west of the great rectangular bath is another great hall enclosing a circular bath of 29 ft. diameter. This is a particularly interesting portion of these antiquities, and rendered, if possible, still more interesting from its having been vaulted over to support the new baths erected above. To the south is the remnant of an arcade, and to the west a system of hypocausts as in the eastern wing, but differing somewhat in their distribution. Unfortunately, upon their discovery as a whole in 1886, it was found

that mediæval and eighteenth century builders had much destroyed and mutilated the buildings; but such of the remnants as were found have been carefully preserved, although the walls have been pressed into the service of the modern building.

This extremely brief account will suffice to show how much has been done, and also of how great interest the whole subject is, but it hardly comes within the scope of my work to enter more fully into the subject. I would refer those who may be more deeply interested in it to the many papers of Major Davis, the City Architect, and to whom we are chiefly indebted for these discoveries, and for their careful preservation.



## CHAPTER IV.

### *THE METHODS OF APPLICATION OF THE WATERS.*

The waters of Bath are of use taken (*a*,) internally, or (*b*,) applied externally.

(*a*,) *Drinking the Waters.*—The waters may either be drunk as part of a course of treatment which includes baths or may form a course by themselves. There are many conditions which render it impossible for patients to bathe, but which do not prevent them obtaining much temporary as well as permanent benefit by simply drinking the waters. When fresh the water is clear and sparkling, without odour, and with a slightly saline chalybeate taste, in no wise unpleasant, and, after a time, distinctly pleasant. The quantity to be drunk daily should be divided into two portions, one to be taken early in the day, before breakfast if possible, and the other an hour before lunch or early in the afternoon. On the amount taken will depend the result. The old writers ordered the waters in very large doses, as much as three quarts daily being given with the result that they acted as a purgative, on the other hand small doses were found to produce constipation. It is now the custom to order from half a pint to one and a half pints daily, and this quantity should keep the bowels in regular action. To begin with the dose should not exceed 4 ozs.

to 6 ozs. at a time, and if this is found to agree it should be gradually increased till the full quantity is reached. At the Grand Pump Room the water is served for drinking at a temperature of 114° F., and should be sipped slowly till the stomach becomes accustomed to its use, otherwise nausea may occur. To derive the full benefit gentle exercise should be taken after each drinking. During the past few years a method of raising the temperature of the water to 150° F. has been adopted at the Hetling Pump Room, and this hotter water may be ordered also with or without the baths. It has succeeded in certain cases most admirably. The method employed for raising the heat of the water is as follows: The water of 120° F. during its descent into the drinking fountain passes over a steam coil which raises the temperature to 150°, without any admixture or interference with its inherent properties. A chemical analysis by Ekin and Appleby has shown that no chemical alteration takes place during the super-heating. The clinical effect of the increased temperature is to dissolve and wash out the contents of the stomach, gall ducts, and the upper portions of the small intestine rapidly, whereas the natural cooler water of 114° at the Grand Pump Room is much more tardy. Especially in gouty flatulent distension, epigastric pain and eructation of food, much relief follows a strict diet with doses of the 150° mineral water, in six, eight, or ten ounces, twice or thrice a day, according to the orders of the physician.

Dr. Falconer has ably described the action of the waters in his book on "The Baths of Bath." He says: When the waters are drunk fresh from the spring their immediate effect is to raise and accelerate the pulse, increase the temperature of the body, and excite the secretions. The tendency is to produce constipation when taken in small quantities (six to eight ounces); the older writers, however, mention their purgative effects, but the quantity they administered was sometimes as much as one, two, three, and often four quarts daily, which produced two or three copious evacuations. Their power of quenching

thirst, and their effects on the urinary secretions were regarded as the best criteria of their importance and utility as an internal therapeutic.

The effects of the waters which indicate that they will prove beneficial are, a glow of warmth in the stomach, an increased appetite, an improvement of the spirits, an augmented secretion of the saliva, and an excitement of the urinary discharge, the latter constituting one of the best indications of their being likely to produce a good effect; next to which may be placed the rapidity with which they quench thirst. If, however, they produce headache, thirst, a dry tongue, a sense of weight in the stomach, diminish rather than improve the appetite, induce nausea and sickness, and fail to improve the flow of urine, they will be of no advantage unless this tendency to cause these effects can be obviated. This may in many cases be brought about by diminishing the dose, by altering the period of day at which they are taken, by allowing the water to cool before drinking it, and especially by relinquishing their use before breakfast. The employment for a short time of some diuretic remedy, conjointly with the water, will aid in deciding its effects so as to augment the flow of urine. But if these changes are unattended by any corresponding result, no benefit can be expected from persisting in their use.

In certain forms of disease the Bath waters have been found most useful when drunk cold. This is so in surgical urinary conditions. Large quantities can be taken without producing the inconveniences that follow when drunk in their normal condition. In vesical catarrh the results are most encouraging and are due probably to the large proportion of lime sulphate in the water. Be the *modus operandi* what it may, Bath mineral water in its cold state, *minus* its volatile constituents, will be found to have as great a therapeutic value as many similar cold springs of known repute on the Continent.

Another method may, in certain cases, be employed with great advantage, if not with complete success, namely, the employment for a short time in connection

with the dose of Bath water, some diuretic and laxative remedy, taken fasting early in the morning, such as Citrate of Lithia, or mild doses of Carlsbad Sprüdel crystals, Rubinat water, or the crystals of the Elizabethan Spa of Homburg. But if this alternate treatment, should produce no favourable results, it will be clear that no benefit can be expected from persisting in the internal use of the Bath waters. As an invariable rule it may be laid down that the quantity of water prescribed should never be taken in a hurry or in large gulps. Nor is there any objection to drinking the waters on the same days when a bath or baths are taken. At the same time a protest must be entered against the indiscriminate use of the waters, for two reasons : On the one hand it is calculated to bring them into disrepute ; and on the other, many persons may be deterred from their beneficial use by unjust and undeserved prejudice. It may be broadly stated that in most acute inflammatory diseases the Bath waters should never be prescribed, whereas at the beginning of chronic conditions the most happy results may be expected. It is found that the hotter the water is drunk the more rapidly it is absorbed, and this is especially so when it is taken before breakfast.

(*b*,) *Bathing, or External Use of the Waters.*—The methods of applying the waters in Bath are most varied in their character and arrangements, and I herewith append a list of the more commonly employed :—

(1,) Aix massage douche bath (King's and New Royal).
(2,) Berthollet natural vapour bath (King's).
(3,) Chair bath (King's and New Royal).
(4,) Challes and La Bourboule spray (King's).
(5,) Deep bath, with or without douche (King's, New Royal and Old Royal).
(6,) Douche bath, rose, needle, vertebral, ladies', Scottish, etc. (King's, New Royal and Old Royal).
(7,) Enema bath.
(8,) Massage douche or in reclining bath (King's, New Royal and Old Royal).

(9,) Medicated baths (Old Royal).
(10,) Moist or dry heat, with or without deep bath or douche (King's).
(11,) Reclining bath, with or without douche, and with or without massage (King's, New Royal and Old Royal).
(12,) Sitz bath (King's).
(13,) Sprays for throat, eyes, nose, ears and face (King's).
(14,) Thermalsoolbäder, Nauheim system (King's and New Royal).

As is thus seen, the number and variety and combination of baths is most perfect. Everything that can be done to make them complete has been done, and all the newest appliances demanded by existing medical science are fully supplied. Before proceeding to the consideration of the individual forms of baths, I would give the following details as to the result and method of taking the baths. Having engaged a bath, the invalid quietly undresses and the attendant having filled the bath at the desired temperature, is in a position to render any necessary assistance. In the case of nervous subjects or great invalids who are unable to help themselves it is well to have a servant in attendance, to remain in the dressing-room if not in the bath-room. Then the bath should be entered slowly, one step at a time, the water being laved over the upper part of the body before it is immersed. In this way the shock which would otherwise occur is lessened. The shock, or thrill, is momentary and a matter only of mere physiological interest. To lessen this effect a warm cotton wool cap may be worn during the immersion. It is found, practically, that by keeping the head warm and dry the regularity of the cardiac action is pretty well maintained. This especially applies to the use of the deep, reclining, and crane chair baths. The frequency of the pulse and the temperature of the body are increased, and as a consequence the amount of the urinary discharge augmented. When the bottom of the

bath is reached, the bather should at once sit down on the *sedilia* provided for the purpose. After the use of the mineral bath there is a consciousness of increased elasticity and vigour of frame, the appetite is improved, and the exhausting perspiration and fainting which often follow the use of warm baths of ordinary water, rarely, if ever occur; nor is its use under ordinary circumstances productive of the copious perspiration consequent upon common hot baths. In cases of rheumatism, in which the limbs are stiffened or contracted, in many the power of using them is soon restored, but which in others may only come after prolonged treatment. In certain cases of paralysis the employment of the bath is attended with similar results. In sciatica the pain is often relieved during the process of bathing, and though at first the stiffness of the limbs, as well as the pain, often return soon after leaving the bath, yet it will be observed that the recurrence of pain or stiffness gradually ceases, and finally disappears. Then there are cases in which bathing, while not disagreeing, yet is not productive of any appreciable effect, and when this is so it may be advisable to give it up for a time. It frequently happens after such cessation that recovery follows. When, however, this result does not occur, bathing may be resumed with manifest advantage. After the withdrawal of the stimulating effects of the waters, nature reasserts itself, and permanent recovery may ensue.

When the use of the bath is attended with marked redness of the skin, flushing of the face, throbbing of the temples and giddiness, the temperature of the bath should be lowered, and the time of immersion diminished until, in fact, both are adapted to the requirements of the case. If, after taking these precautions, similar effects be still produced, it will be evident that the use of the waters must be relinquished. The temperature at which the bath should be taken is a matter of great importance. For the first two or three baths it should not exceed 96° to 99° F. If it be then found that it causes no inconvenience the temperature may be gradually raised to 100°

or 101° F. In no case should a bath be taken at a greater heat without special direction. Experience has proved that more benefit is derived by a continuance of the baths at moderate temperatures than by a short course at higher ranges. The diseases for which they are employed are often of long standing and cannot be expected to yield to their influence at once.

The proper time for remaining in the bath varies according to the nature of the case; ten minutes is a good time to start with, but full-blooded patients may find five minutes enough for a first bath. As the bather becomes accustomed to the treatment the time may be extended to fifteen or twenty minutes. Longer periods are not, as a rule, desirable, though I have known a patient remain some hours in a bath without discomfort.

On leaving the bath the attendant will "pack" the bather in warm sheets and towels and wrap him in a blanket spread for the purpose on a couch in the dressing-room, where he should repose for five or ten minutes. By this time the moisture is absorbed, and the wraps should, one by one, be put aside and dressing slowly proceeded with. It is not, as a rule, advisable for free perspiration to take place after the bath, so that, if there is a tendency to it during dressing the bather should lie down and wait till he cools before completing his toilet. In cases where it is desirable that free perspiration should take place this is very easily brought about by lengthening the time in the pack. Before proceeding into the outer air it is always well to remain twenty to thirty minutes in the cooling-room provided for the purpose.

Great care should be observed by bathers on leaving the bath. If the weather permit, they may walk for a short time after the bath, or else return home in a covered vehicle, and if so ordered at once go to bed. The best time for taking a bath during the summer months is early in the morning, especially for those who are strong, but any other hour may be chosen so that it be not too near a meal. Under ordinary circumstances a bath may be taken three or four times a week. Three

to five weeks may be considered a fair course. A course of less than eight to twelve baths is mere waste of time, and by failing to effect a cure in a disease which has probably lasted for years, is apt to bring the waters into disrepute, where a continuance of their use would, in all probability, have given satisfactory results. Improvement is often slow in manifesting itself, and some patients do not derive the full advantage of the treatment till a considerable period after it has been discontinued. In gouty and rheumatic subjects, where the waters fail to effect a cure, their use should still be persevered with in annual and biannual courses, as they tend greatly to retard the further inroads of the disease; a result unattainable by any form of drug treatment.

(1,) *The Aix Massage Bath.*—The Aix douche massage apparatus, as used at Aix, consists of: (1,) A metal box (Boîte de Mélange) fixed to the wall about six feet from the floor, and in which is mixed the hot and cold streams of water. It is connected by an indiarubber hose fitted with a rose which plays on the back, shoulders and hinder parts of the body, and gives a gentle and unvarying strength. (2,) A strong douche (Cullotte de Jumelle) of hot water flows from an elastic hose with a bent nozzle straight from a large cistern, and it directs the water at full pressure on to the legs and front of the body. To finish, a strong douche is thrown on the body while the patient stands in a corner grasping a rail. (3,) A shower bath (Appareil de Grande Chute) with hot or cold water descends over the person if desired from the same height as the Mélange and with the pressure of the Jumelle. A manometer is usually employed to regulate the force of the water, and this is a point to which some attention must be paid.

In Bath there is a double water supply, one consisting of the thermal water at its natural temperature, the other of cooled thermal water. The Aix-les-Bains plan of cooling with ordinary town water is discarded, as the resulting dilution of the thermal water must detract from its efficacy. The water pipes terminate in a mixing ball,

to which a thermometer and pressure gauge are attached, so that the temperature and pressure of the douches are entirely under the control of the attendants acting on medical orders. When in use the floor of the bath-room is covered to the depth of two to three inches with hot water. The furnishings consist of a simple wooden chair and stool, both of which should be sprayed with hot water before being used. In some cases two attendants are necessary, in others only one

The different kinds of apparati being arranged, the patient is seated between the Boîte de Mélange and the Jumelle, and if with two doucheurs, one of them proceeds from behind to use the rose from the Mélange, which is directed to the shoulders and back, the other in front directs the hotter water from the Jumelle with more force, first over the feet and legs, then over the trunk and arms, on each side alternately, the hands of the doucheurs following the action of the water in a rapid way—pressing, kneading, stroking and rolling. This constitutes what is known as wet massage. If one doucheur only is employed the system is the same, but, naturally, less time can be devoted to each part. Then, if required, the Scottish douche (or shower) is applied to the back, the patient leaning forward with the hands over the back of a low chair ; this being followed by a powerful jet of warm or cold water propelled from the further end of the douche chamber. To end up with, the patient may have a needle douche, during which the temperature of the water may be greatly diminished so as to act as a powerful nervine tonic.

The process of massage should not last more than from twelve to fifteen minutes, after which the patient passes into a dressing-room of moderate temperature for another fifteen minutes, then the process of cooling is judiciously effected prior to dressing. Then the patient returns to his or her hotel, goes to bed for a short time, perspires, is rubbed dry, and gets up refreshed, experiencing, in fact, a keen sense of renewed vigour and health.

From the nature of the climate in Bath during the

winter the massage douche cannot be given as at Aix in the early morning with sufficient time to allow the invalid a long rest before breakfast. In summer it may be possible, but not in winter, and, therefore, the afternoon is the best time for the bath during certain months. For the weakly, however, the morning is probably preferable. In such cases the patient must have a light breakfast first, and, about an hour after the bath, a small glass of wine. It is always essential that the patient should lie down for some time after the bath to cool, rest and recuperate. About three baths per week is the average, although the strong may take as many as four or five. After the bath the patients, one and all, should spend some time in the cooling room. The administration of the douche must necessarily vary according to the nature and severity of the complaint, its duration and complications, and the strength and immediate state of the patient. In some cases it is necessary to give the bath at a temperature of 96° F., in others 100° to 103° F. can be borne; no definite hard and fast line can be laid down. For example, a convalescent from an acute attack with cardiac complications cannot stand a greater heat than 97° F. at first, and the administration must be gentle and limited in duration. Cold douches, together with general exposure, must be avoided. On the other hand, old chronic rheumatic joints can bear a high temperature—102° or 104° F.—strong massage, friction, and prolonged douching. In these cases patient and persevering efforts are necessary, and a course of three weeks or a month twice a year for massage and deep bathing will not be too much. As a rule, it may be observed that wet, as well as dry, massage assiduously applied is calculated to produce marked improvement.

In connection with the massage system there is, as at Aix, a Bouillon, or general vapour bath, annexed to a douche or douches, in which invalids can have a natural vapour bath, followed by the thermal douche or the cold douche, in conjunction with massage when necessary.

While studying this form of bath it is appropriate that

we should consider the effects of massage as an adjunct to the baths, and also its effect when given dry. Massage consists of certain movements in which not only strength but skill are required. In France and Germany massage comprises *Effleurage*, *Pétrissage*, *Tapotement* and *Massage à Friction*, and we in Bath have adopted these systems with only slight modifications.

EFFLEURAGE is a stroking movement, made with the tips of the fingers and the palm of the hand; it may be done softly and gently or with considerable force. This form of massage is suited to the superficial circulation of the body, especially influencing the veins and lymphatics. The manipulator works from the extremities towards the trunk along the fibres of the muscles, and always in the direction of the returning circulation. Beuster, of Berlin, speaking of effleurage, suggests slow gentle strokes in a centripetal direction along the course of the veins and lymphatics; these should be made with the palm of the hand, with the pressure intermitting. Dr. Stretch Dowse, of London, demonstrates that the finger and thumb should be fully extended, the tips slowly and lightly drawn along the surface and returning in an opposite direction with the palm of the hand, the hands being always kept on the patient's body, the wrists rotating like a pivot. The upward movements should be the more energetic, the tips of the fingers and outer side of the thumb being used in one direction, the knuckles and palm in the other. Massage of this kind has the effect of inducing sleep of a tranquil nature rather than a mere state of repose. Friction is commonly used with effleurage.

PÉTRISSAGE.—This form of manipulation in a patient by whom it can be borne produces marked effects; the essential virtues being produced by punching, pressing, squeezing, firmly rolling and kneading between the fingers and thumb of one or both hands, at the same time moving slowly onward in the direction of the venous current. As someone has said, it is a movement very similar to that which would be employed in emptying a

sausage of its contents. Where a muscle or group of muscles is being manipulated, the whole, or as much of it as possible, should be gripped in the hand, and the kneading, begun at the lower end, be carried on throughout its entire length before the hand is relaxed. In large and deep parts it is best to use both hands, carrying one just in front of the other. This and the last movement are nearly always used in conjunction, the one alternating with the other.

Massage à Friction, not of so much consequence as effleurage or pétrissage, is used chiefly for the joints, and consists of a double movement, one hand making rapid circular strokes across the part, while the other performs strong friction in the long axis of the limb. The movement requires to be very quick to have much effect.

Tapotement, or Percussion, very nearly describes itself. A number of sharp, light blows are made over the part, in rapid succession, either with the tips of the fingers, the outer edge of the hand, the hand closed, or held semi-flexed, so that a cushion of air intervenes between the part struck and the hand of the operator.

The advantages of ordinary rubbing or friction, whilst it must not be despised, is the least important part of true massage, which has acquired a far more extended range of influence. Massage proper is manipulation, deep-rubbing and kneading all combined. It requires an expert adaptation of the fingers and hands to the various parts, working the tissues beneath in a rotatory way by a sort of kneading, rolling, squeezing process from the extremities to the trunk. The same sub-division of surface, however, is desirable for friction and will be found most convenient. Moreover, the fingers should not be allowed to slip on the skin.

In massage of the fingers and hand the operator's thumb should be placed on one of the fingers of the patient and parallel to it, and on the opposite surface the second phalanx of the index finger will be placed at right angles to it ; and between the two the finger of the patient will be manipulated from 75 to 100 times a

minute. If possible, both hands should be used, each finger and thumb in turn going over the hand and wrist; finally, the palm of the hand should be done by stretching the tissues apart vigorously. Each part included in a single grasp may receive three or four manipulations. In massage of the upper part of the arm one hand should seize and squeeze the biceps, while the other takes the triceps. The middle portion of the deltoid muscle requires close attention from the thumbs placed parallel to its fibres, the palms and fingers being engaged with the anterior and posterior aspects of the muscle. The whole muscle requires strong working and the shoulder joints will probably demand circular friction. In massage of the leg, below the knee there are three divisions: (*a*,) The outside along the peroneal muscles over the fibula; (*b*,) The front of the leg over the shin; (*c*,) And posteriorly over the muscles. Massage here consists of rolling and stretching the tissues away from the bone and from each other, and insinuating the points of the thumb between the muscular fibres. If the limb be small it can be done at one time with the two hands. In massage above the knee the adductors should be grasped on the inner side of the thigh with one hand, while the other embraces the large extensors in front, alternately relaxing and contracting the hands so as to stretch those muscles away from the line of the femoral artery. The rate of these manœuvres varies from 60 to 90 movements of each hand on the legs, and 40 to 80 on the thighs, where much force is necessary to extend the strong fascia.

In massage of the back the direction should be from the nape of the neck downwards with sweeping curves, the patient lying on one side while the reverse side is being done, stretching the tissues away from the spinal column, and, if much force be necessary, one hand being placed on the other, the operator working them circularly with great force. Dr. Graham significantly points out that the position of the shoulder blades is important, for if the upper arm be parallel with the side, then the

posterior border of the shoulder blade will be too near the spinal column, and there will be no room for working upon the muscles between scapula and spine, and if the upper arm be stretched forward at full length the superficial muscles between the spine and the scapula will be so tense that those beneath cannot be reached ; the arm, therefore, should be placed midway between those positions.

In massage of the abdomen the procedure is similar to that in friction already described, the difference being that the manipulations must be more gentle than those on the back and limbs, the tissues not bearing the same vigorous movements. Moderate pressure and movement with the palms rolling and grasping the skin and superficial structures are used, while firm, deep kneading along the ascending, transverse, and descending colon, the palm of the hand being kept on the side of the abdomen next the operator, are also used. On the opposite side stronger efforts with the fingers are required.

Before leaving the technique of massage there are one or two questions which naturally suggest themselves to every physician who orders his patients to be treated in this manner, and which may appropriately be discussed here : *First.*—What should be the frequency of the massage? This must depend much on the nature of the affection under treatment. As a rule it shou'd be given not less frequently than daily. It is a mistake to suppose that the treatment is so exhausting that a day of rest is needed after each day on which massage has been administered. If this is the case it shows that the manipulations have been either too severe or too long continued. Twenty-four hours is ample time for recuperation in any condition in which massage is justifiable. An interval of double that extent will only retard the recovery and make the treatment more irksome. There is generally a sense of relief and refreshment after the application, which makes the patient look forward anxiously to the arrival of the next application. In no case should it be employed less frequently than every other day. Such a use of it is

not only time and money thrown away, but may do positive injury and bring discredit on the system. Anyone who asks to have massage once a week for the relief of any disease shows an entire ignorance of the laws which govern the effects of exercise on the human body. The rest of the one day in seven will be of inestimable value to the masseur and of no injury to the patient. The effect of the manipulations of the six preceding days will not have had time to wear off before the impression is renewed on the eighth. The only exceptions to this rule are where the affection is a very painful one, or where insomnia is a prominent and distressing feature of the case. In either of these instances the patient may petition for a Sunday application, which should be granted if possible.

*Second:* What should the duration of each application be? Here the requirements and limitations of each individual case must be considered. If the treatment is given two or three times daily, each application may be shorter than if it be used but once a day. General massage demands from thirty to forty minutes. A sprain may be well and thoroughly manipulated in fifteen minutes. Patients are very apt to make the mistake of supposing that because a treatment of half an hour will produce a certain amount of benefit one of an hour will produce twice as much. In point of fact, in the majority of cases, all the manipulating that is done beyond forty minutes is either useless or harmful.

*Third:* What amount of force shall the masseur use? This must be proportioned to the nature of the case, the age of the patient, the sensitiveness of the part, and the temperament of the individual. The experienced manipulator acquires great sagacity in judging of all these points. He likewise learns to discriminate between actual suffering and imagined pain as the result of his manipulations. He finds that a pressure or movement which, anticipated by a nervous, hysterical, wayward, timid, or capricious patient, is received with every manifestation of acute agony, will if he succeeds in engaging

the attention of the patient or fixing it on some other part of the body, be borne almost uncomplainingly. When he finds, as a result of excessive zeal, black and blue spots all over his patient's limbs, he may consider it wise to moderate his energy. These little extravasations are usually the result of too forcible massage administered with too little flexibility of the wrist, and are not calculated, as Schreiber considers, to shorten the duration of the treatment or aid in the cure of the case. The more expert the manipulator becomes, the more rarely will he be called upon to see such marks. It is true that if we have to deal with fungous or spongy tissues or masses of exudation of a low degree of organisation, it is difficult to avoid the rupture of small vessels. But these cases are rare, and, except in the instance of individual idiosyncrasy in which there is a hæmorrhagic diathesis strongly marked, if we simply desire to disgorge blood and lymph-channels in order to remove inflammatory products, it is entirely unnecessary to use sufficient force to produce ecchymotic spots. It is needless to say that they often create an impression unfavourable to the masseur and to the continuance of his care of the case in the minds of the sufferer and of his friends. Moderately firm, gentle, and well-distributed massage is in most cases both more acceptable to the patient and easier for the operator. It will of course be understood that after a course of massage has been persisted in for a time the tissues will have acquired a firmness and resistance which they did not at first possess, and will therefore be less liable to these accidents. It is especially at the commencement of the treatment of a case that caution is requisite in this particular.

The physiological effects of general massage are very decided and apparent. The immediate results are a fine sense of well-being, a feeling of comfortable tiredness without exhaustion, and a pleasant drowsiness. In rare cases hysterical patients are aroused and excited by it; more rarely still, persons are found whom massage leaves chilled, irritated, and uncomfortable. In such cases the

experiment may be tried of reversing in part the order of procedure, rubbing the abdomen first instead of last, then the chest and back, and finally the arms and legs. Occasionally it may be found that massage has been overdone, and that lighter applications are needed to give good results. Very seldom indeed do we find patients to whom massage is so disagreeable as to make its application entirely impossible.

The later effects are also well-marked; the skin softens and shows a better colour; the appetite is improved as well as the digestion; the bowels act more freely; sleep is more prolonged and sounder, and the muscles become larger and firmer. The immediate effect of massage is to increase the amount of blood in the region rubbed; the skin is flushed, the vessels in the muscles receive a larger amount of blood, and the flow of blood is greater through the part for some time subsequently. Accompanying this there is a fall of general blood-pressure and a slowing of the pulse, if the manipulation has been a deep muscular stimulation. Superficial skin stimulation increases blood pressure. An increased activity in the movement of the lymph-stream has also been accurately demonstrated. It is obvious that we have here a useful indication for the treatment of recent local inflammatory conditions, such as result from sprains, luxations, etc. The increased circulation will not only prevent stasis and the migration of white corpuscles into the tissues, but will rapidly remove the corpuscles and lymph which have been already thrown out. Again, the secondary effect of the larger amount of blood passing through the region is valuable in case of any local disturbances of nutrition, indolent ulcers, undue amount of deposit following fractures, contusions, and myositis. Besides these and such effects other general consequences are perceived. One result of the changes in blood pressure is an increased secretion of urine, another is that fatigue—whether local, as in an over-used group of muscles, or general—may be rapidly and pleasantly removed by massage, that is, by the removal of fatigue-products and

by the flushing of the muscles and nerve-centres with quantities of fresh blood. Lombard, Mosso, Maggiora, and Zabludowsky have shown by experiments in their own persons, or upon animals, the prompt power of massage to restore functional ability to exhausted muscles. Maggiora found that this improvement did not take place in muscles whose blood-supply had been shut off. He further concluded that tapotement and friction were less effectual than kneading, and this again not so useful as mixed massage; and that the beneficial effects of manipulation were, within certain limits, directly proportional to its duration. That more blood actually flows through the tissues during and after the rubbing has been proved by the careful experiments of Lauder Brunton and Tunnicliffe. A series of clinical examinations of the blood before and after massage, under very varied conditions of health and disease, have recently been made. In sixty observations upon thirty patients only three failed to show an increased number of red corpuscles after general massage. The conclusions reached were as follows: In health massage increases the number of red corpuscles, and in less proportion, and not so constantly, their hæmoglobin value. In all forms and grades of anæmia there is a very large and constant increase in the number of red corpuscles after massage; this is greatest about an hour after treatment, slowly decreasing from that time. This decrease is, however, postponed further and further if the manipulation be daily repeated. There is an occasional but inconstant increase in the hæmoglobin value, an increase proportionately less great than that of the cellular elements. The additional red corpuscles discovered by the Thoma-Zeiss hæmocytometer after an hour's massage was often as great as 20 per cent., and in some cases reached 50 per cent. of the number originally observed.

The increased activity of the superficial circulation does not suffice to account for so great a change; moreover, if the increase arise merely from an addition to the number of red cells in the peripheral vessels at the

expense of the rest of the circulating fluid, there should be an increase of hæmoglobin directly proportional to the increase in the red globules; yet in no case did the hæmoglobin-increment exceed 15 per cent., even when the cell-increase reached 50 per cent. It can scarcely be supposed that an hour's massage, much as it hurries the current in the vessels, can actually cause a greatly increased production of blood-cells; although the repetition of treatment no doubt stimulates cell-making. Still, the effect of this new activity and movement of the cells upon metabolic processes must, at any rate for the time, be much the same as if a considerable addition were made to their number. Further, these examinations make it seem in every way probable that, in health, there are vast numbers of corpuscles ready for use if called for, and also probable that a part of the trouble in anæmic diseases may be a lack of availability or of activity in the corpuscles, that many of them are sluggishly lingering in the bye-ways of the circulation, and only forced or pushed into greater activity and usefulness by the direct stimulus of massage.

Massage, either with or without the waters, is of use in many and various complaints, but it will be noticed that it is in the more chronic rather than in the acute that it is chiefly of use. Chief amongst them all is RHEUMATISM. In all its forms massage will be found a useful and reliable aid to thermal and other forms of treatment in shortening the attack, and hastening the recovery of the patient. In acute rheumatism, while inflammatory symptoms remain, it is not admissible, but when these have disappeared it is most valuable in removing swelling, thickening, and effusion, and also in restoring the function of the part. In chronic rheumatism it has a powerful effect in lessening deformity, and restoring pliability to the thickened and stiffened joints. Where anchylosis or bony union has taken place in a joint, massage or any other treatment save an operation must fail to restore movement, but in anything short of this perseverance will bring about improvement, and the most

gratifying results are often obtained in the most unpromising cases. In these cases, massage in or after a hot bath, or in combination with douching, is often more beneficial than dry massage. In muscular rheumatism care must be exercised not to use too much force. To begin with, mild effleurage is quite sufficient; firm effleurage and pétrissage may be employed as improvement takes place, and when their employment is found not to cause pain. During acute rheumatism, the high temperature and confinement to bed play great havoc with the muscular system; in this condition and in chronic rheumatism when want of exercise has had the same effect, massage is found most useful in restoring loss of tone.

RHEUMATOID ARTHRITIS in its acute but more especially in its chronic or osteo-arthritic form derives much benefit. When the joint movements are much limited a great deal can be done by judicious rubbing to loosen and diminish the tension of the contracted muscles, also in cases with pain gentle massage often gives great relief.

GOUT in all its chronic forms may be greatly benefited. Even after an acute attack it may hasten the removal of all the tenderness, effusion and swelling, but must be employed with the very greatest care.

CHOREA, HYSTERIA AND ANÆMIA are all benefited by massage. The variety in these diseases is so great that special directions are impossible without entering into great detail. Each case must be judged by itself and treated accordingly.

LUMBAGO, SCIATICA, TIC-DOULOUREUX, in fact all kinds of neuralgic nerve pains, both acute and chronic, are greatly relieved by massage. In acute cases very gentle manipulations must be employed at first. Begin at some distance from the seat of pain, and gradually work towards it, increasing the pressure as the pain subsides, and the patient can bear it. The treatment should be sedative; an amount of force which causes pain is more likely to do harm than good.

In headache, especially of a congestive type, massage is a useful treatment. Begin with firm pétrissage and effleurage of the shoulders and upper part of the back, and finish with effleurage of the neck in a downward direction, especially over the jugular veins.

Locomotor Ataxia.—Cases of this disease may be benefited by a course of massage from time to time as it improves the tone of the muscles, and sometimes relieves the lightning pains as well as the girdle ones. Schreiber used massage assiduously with good results, and Türk proved that slight anæsthesia was got rid of by rubbing alone.

Dr. Mortimer Granville says, in commencing sclerosis of the cord, with loss of tendon reflex, the application of percussion over the spinous processes of the appropriate vertebræ produces remarkable effects. In some cases locomotor ataxy has been removed or sensibly ameliorated, and the general improvement was considerable.

In Paralysis of the Deltoid Muscle, after dislocation or injury, massage (with Faradisation) is more useful than drugs, especially if the atrophy be due to pressure on the circumflex nerve.

Lead Paralysis.—Nothing in such cases can be more useful than massage, especially when combined with the Bath thermal waters, and the use of the Berthollet natural vapour bath. The blue line along the margin of the gums will disappear, *pari passu*, with absorption of the waters and by perseverance with special massage.

In Infantile Paralysis (Poliomyelitis Anterior Acuta) a warm bath should be given, followed by deep pétrissage and friction; and if there be marked paralysis passive movements may be used. Sometimes the movement of opponent groups of muscles is productive of benefit, while massage of intact healthy muscles may stimulate the nutrition of neighbouring impaired muscles. In these cases it is well that the patients should be compelled to help themselves as far as possible.

In Spinal Tenderness, massage does great good. Mr. Teale, of Leeds, has shown that irritation of the lower portions of the cervical spinal cord gives rise to morbid activity and pains of the nerves of the arms, shoulders, and superficial portions of the chest. These pains are of an erratic character, sometimes shooting down the arms and chest, resembling angina pectoris, and at other times darting all over the chest walls and breasts. Palpitation, nausea, and sickness may be present, together with many other symptoms, which, if not diagnosed correctly, give rise to considerable anxiety. Counter irritants, blisters and so forth may be applied, but careful and diligent massage is the most potent agency to effect a cure.

Dyspepsia, Constipation and flatulence, whether in conjunction or as separate troubles, derive benefit from massage. Pétrissage of the abdominal muscles, and a combination of this movement with effleurage of the bowels, special attention being directed to the ascending, transverse and descending colon, will generally disperse flatulence, and cause the bowels to act in about fifteen minutes, and, after a time, will induce regularity of action. This result is brought about by increased peristaltic action, augmented glandular secretion, including that from the liver, and mechanical movement of the intestinal contents. A great deal may be done to educate the bowels, by trying to obtain relief at the same hour daily.

Sprains give most successful results with massage. While acutely painful, only the lightest and softest of touch can be allowed, but soon effleurage and pétrissage may be employed and give to the patient much relief. If seen only after adhesions have formed more forcible massage and passive movements will be required to bring about the desired result.

Chronic Synovitis.—Massage applied energetically is an excellent remedy, preferable in some respects to compression. It induces an increase of the blood and lymph circulation, and absorption of the fluid in the

joint. Massage and compression may be combined if desirable.

In Contusions about the head, if massaged within the first twenty-four hours rapid absorption of the blood and serum is induced. From ten to fifteen minutes will be found sufficient to produce these effects.

Uterine Diseases.—Massage in these diseases has been successfully used by many physicians in America and Europe. Its uses also in amenorrhœa and dysmenorrhœa, in functional disorders of the catamenia, ovarian neuralgias, and chronic fibroid enlargement of the uterus, have been strikingly exemplified.

(2,) The *Berthollet* or *Natural Vapour* bath may be general or local It can be applied with or without the tepid shower bath. Its great value consists in the fact that the chemical constituents of the mineral waters are absorbed into the system by the skin, and thus their value as medicinal agents is incalculably enhanced. Some of the subacute and chronic forms of eczema, in which bathing is forbidden, are treated by the natural vapour with admirable results, as also are cases of anæmia, which, contrary to experience, bear the vapour well, especially if the anæmia has arisen from tropical fevers. In the latter case the vapour has proved successful after long courses of arsenic, iron, cinchona, and quinine have proved of no avail. In cases of acute gout wonderfully successful cases are recorded. The limb having been steamed twice or three times a day for a definite period, swathed in absorbent wool, and then bound up firmly with a flannel bandage, it is found that in the space of forty-eight hours great relief is experienced, and there may be a marked and general subsidence of the attack. The vapour bath is certainly the best form of treatment in cases of old chronic joints, gouty or rheumatic synovitis, chronic, subacute or recent sprains, or indurated tissues, after fracture or contusions. It should be pointed out that no joint or limb having a tendency to inflammation should go into the ordinary bath, but always into the natural vapour one. Cases of lichen, acne, psoriasis and

senile prurigo are also best treated by the thermal vapours rather than by the ordinary application of hot mineral waters. In prurigo the intense irritation is often markedly relieved and it may be used generally, should the circulation be capable of bearing the increased blood tension caused by the bath. The question of general *versus* local vapour baths must be decided in each individual case on its merits. No hard and fast rule can be laid down.

(3,) The *Chair Bath* is a deep bath with a chair fitted so that crippled and helpless invalids may be lowered into the bath in comfort. It is so arranged that an undercurrent douche can be easily applied to any affected part.

(4,) The *Deep Baths* are usually given at a temperature of from 96° to 100° F. The patient stands in the water as a rule but should he find it desirable may sit down. Under-current douches are arranged in these baths.

(5,) *The Douche Bath* is more stimulating than the ordinary bath. It has been pointed out by Fleischner that douches act as powerful lymphatic stimulants, promoting absorption of chronic inflammatory products and specific exudations. The dry and wet douche (or the under-current), are very favourite modes of treatment in Bath. They were originally instituted by Dr. Jorden, under whose direction, to ensure their success, pumps were first erected, but previous to this "bucketing," or the "douse" was practised. This form of the douche was simple enough; two of the tallest and strongest attendants stood in the bath with a bucket over the patient, upon whom, or the parts affected, they poured the water with great force. The Romans used something similar to the "douse" as a mode of external bathing.

The *dry douche*, as now used, is a powerful agent for good when judiciously applied. It is adapted to local complaints, chiefly of the joints, the part to be douched being laid under the rose, the force of the water spray being graduated to a nicety, *i.e.*, a quarter, third, or half strength, as may be deemed necessary. The duration of

the process and the heat of the water are determined according to the nature of the case. The temperature is rarely ordered over 100° F., the time not often exceeding ten minutes. Cold, tepid, or hot dry douches, may be had at any given temperature, and may be taken at any period of the day—the forenoon, however, is suggested for them. A few minutes' application usually suffices, but exceptional cases may require twenty minutes and occasionally longer.

The *wet douche* is used after the bather has already for awhile been in a bath. Usually during the last five minutes spent in the bath, the hot water, at about 100° to 105° F., is turned on under water, through a tube with a nozzle, and directed from a short distance on to the part to be douched. The process is applicable for the most part to certain affections of the abdomen and to local affections of the joints, and nothing can exceed the relief and comfort such applications afford. The resistance of the water of the bath necessarily breaks the force of the spray, which is quite powerful enough for its intended purpose After the douche the patient should leave the bath without delay. This wet douche treatment is carried out in the ordinary deep as well as in the reclining baths in all parts of the establishment. The Wildbad bath, at the massage baths, is most complete in the arrangements necessary for douching.

The *douche ascendante* is arranged chiefly on the Merlioz principle. It is used principally in cases of leucorrhœa and interrupted or painful menstruation. In uterine congestion it may be used at a temperature of 120° *F.* with much success.

(6,) *Sitz baths* (enema, etc.) are provided and can be used with or without the douche ascendante, or with the lavement. The lavement is generally used with marked effect before breakfast, and it may be also used an hour or two after that meal. In cases of habitual constipation, and where the regular action of the bowels has been, from whatever cause, disturbed, the lavement is of inestimable service. It may be observed, *en passant*,

that the time at which the douche of all kinds, and the lavement, should be used depends very much on the circumstances of each individual.

(7,) *Medicated baths* can always be obtained, the various ingredients, such as pine, sulphur, pumiline, etc., being ordered by the physician. These baths are given at the Old Royal baths as also are the bran or oatmeal baths.

(8,) The *Reclining baths* are usually ordered for those who cannot stand a deep bath and for whom the Aix treatment may not be suitable. It may be combined with the undercurrent douche and with wet or dry massage. If this be ordered the invalid is first massaged in a reclining bath under water by an attendant for about two-thirds of the time allowed for the bath; the remaining third is occupied by the administration locally, of the undercurrent at a temperature varying from 100° to 104° F., and the best possible results are produced by these combined methods of treatment. It will be well to remind the reader that the forms of wet massage in use at the baths of Bath are massage in connection with the Aix Douche, massage under water in the reclining, or in exceptional cases in the deep bath, and massage in connection with the Nauheim bath. A considerable number of invalids who cannot bear the force and volume of the Aix sprays, find the latter method less fatiguing and it is frequently used at most of the German spas.

(9,) The *Needle bath* or *Douche en circle* is composed of tiers of pipes, forming two-thirds of a circle, perforated with minute holes, and emitting very fine jets of water. The temperature of the spray being under perfect control, alternating shocks of hot and cold water can be given which have a very stimulating effect on the nervous system. It is very useful in various forms of functional disorders, in ordinary cases of hysteria and general neurasthenia. It is fitted up for use with the Vichy baths and quite recently as an adjunct to the Aix Massage baths.

(10,) *Sprays* for throat, eyes, ears, nose, and *Inhalation* sprays are carried out in two large rooms, supplied

with hot and cold thermal waters, the spray used being in the form of Siegle's spray. Pulverisation and atomisation in various forms may be had, whilst the apparatus of inhalation (Humage) is as at Aix and the gases of the hot water are inhaled as at Lippspringe. An umbrella spray is also used. Chronic bronchial, laryngeal and pharyngeal catarrhal diseases will find great relief from its use. The pulverisation process is found useful in bronchorrhœa and gives relief also in diseases of the throat, nose, and pharyngeal passages.

(11,) The *Nauheim system* of baths has only recently been adopted. It was introduced two years ago at the King's bath, and may now be had there or in the new Royal baths. The Bath thermal Sprudelbad is charged with one to three per cent. of common salt with a certain amount of free carbonic acid gas. The still stronger Strombad contains larger quantities of salt and a pretty complete saturation of carbonic acid gas. The first mentioned may be partially still or flowing, the latter is always flowing and always gaseous. The temperature varies from 90° to 94° F.

The Nauheim system as used by us at the King's baths has been tabulated as follows :—

(1,) A simple saline Thermalbad, brine not flowing.
(2,) A flowing Thermalbad, brine flowing, not gaseous.
(3,) A mild Sprudelbad, brine partially flowing and gaseous.
(4,) An ordinary Sprudelbad, brine flowing and gaseous.
(5,) The Sprudelstrombad, brine flowing and gaseous.

The ordinary Sprudelbad has delivered into it during fifteen minutes ten gallons of cold Bath mineral waters saturated with carbonic acid gas, and the bath is so arranged that a warm current is delivered simultaneously into the bath surrounding this gaseous solution in order to prevent a lowering of its temperature, thus protecting the patient against a cold undercurrent. As before stated, a solution of one to three per cent. of chloride of sodium is added, and when necessary, in order to strengthen the bath, one or two litres of the Nauheim Mutterlauge, which is the mother lye of Nauheim and contains

chloride of calcium to the extent of twenty per cent.

The temperature of the bath, the period of immersion, still or flowing, reclining or sitting, gaseous or non-gaseous, will depend upon the nature of the case and the general strength of the patient, and many nice points have to be observed to meet the varied types of disease for which this class of bath is ordered. Here our chief experience is derived from the Sprudelbad, flowing and gaseous, more or less, and the results are found in unison with those communicated by Sir Grainger Stewart to the British Medical Association at Carlisle. The greatest benefit derived from the Nauheim bathing system being obtained from those baths which are abundantly charged with carbonic acid gas, moderately cool, and to this we will add, flowing.

A simple and flowing Thermalbad may be given in those nerve cases where the gaseous current is regarded with apprehension, and as a preliminary condition it is useful when there is no object for rapid prosecution of the cure; in weakly females and the young it has been used with comfort before the more serious Sprudelbad has been attempted. At Nauheim this bath is usually prescribed to start with. In England, however, we are, as a rule, compelled to start with the Sprudelbad if it be possible, and so far no obvious bad result has arisen. The duration of the bath is six to eight minutes, the temperature of the water being 95°. A rest of an hour is enjoined after each bath.

The periods of immersion are increased during the course of treatment to twenty or thirty minutes, and the temperature is lowered by degrees to 85·5° F. The water used is allowed to retain its carbonic acid in lesser or greater proportion, as it is exposed for longer or shorter periods to the air, or used as the Strombad foaming with its full supply of gas. The effects of the various agencies put in force by the Nauheim baths have been studied experimentally by Dr. R. F. C. Leith and others. In regard to temperature, simple thermal baths

at 90° F., or under, commonly tend to reduce the pulse-rate by five or seven beats a minute. The effect of the addition of sodium chloride to the bath is generally to emphasize the change in the pulse, and to make the bath more agreeable to the patient; when the bath is charged with carbonic acid gas the pulse-rate is further reduced, whilst the force of the heart's action is increased; the pleasantness and buoyancy of the bath are also enhanced, and the patient experiences an agreeable sensation of warmth. The result of a bath at a temperature below body-heat is contraction of the cutaneous vessels of the area immersed, higher temperatures cause their relaxation; the lymph-circulation is necessarily modified, the internal vascular conditions are changed, dilatations of the vessels occur in various regions—notably in vascular regions such as the brain, and probably there is some rhythmic alternation of dilatation and contraction. Furthermore, there are reflex effects upon the vaso-motor and cardio-inhibitory centres. When the bath contains free carbonic acid gas the fine bubbles adhering to the skin protect the body from the colder surrounding water, and constantly impinging upon the surface stimulate the cutaneous nerve-endings. Probably also some of the gas permeates the skin; carbonic acid has been shown to be a notable and valuable local anæsthetic (Ozanam).

The effects of the combined treatment by baths and muscular exercises as carried out at Nauheim are said to be increased strength of the pulse with diminution of its abnormal frequency, decreased rate of respiration, together with fuller inspirations and greater ease and comfort in breathing, and diminution in the size of the dilated heart. There is sufficient testimony to show that in a large number of cases there has been a great improvement in the subjective conditions. The evidence is less generally conclusive as to the reduction in size of the heart. From examination of a considerable number of outlines purporting to be those of the heart before and after the Nauheim treatment, one comes

irresistibly to the conclusion that many are the results of a fallacious plan of physical examination, and cannot be held to represent with any degree of accuracy the true size and position of the heart. On the other hand, there is a very high probability that in some cases the situation and shape of the heart have become changed, and the right chambers reduced in volume. It must not be forgotten that the bulk of the heart may change under varying conditions quite unassociated with special therapeutic measures. All the same, the effects of the baths in many instances are remarkable, but whether the Nauheim system of baths has a more specific action than our own natural waters is open to a considerable amount of doubt. The following appears in the late Mr. Freeman's book on the Nauheim baths as carried out in Bath:—

"The late Dr. Falconer, in 1866, worked out rheumatic heart affections treated by the plain Bath mineral water at a temperature of 91° to 92°, and in the course of 500 cases, with accurate observations made with the assistance of the writer with Marey's sphygmograph, substantial progress was made towards the clinical results as are now obtained by the Thermalbad at the Queen's baths. Circumstances, unfortunately, never allowed these observations to be recorded, and they have been lost to the profession."

Personally, I have the records of a very large number of cases which have been carefully watched at the Royal Mineral Water Hospital giving every bit as good results with the ordinary Bath treatment as I have obtained with the Nauheim. The exercises associated with the baths seem to me to be probably at the bottom of the larger proportion of good said to be derived by this special system—employ them with the Bath waters and the results will be just as surprising. These exercises are passive and resistive, and while massage has for long been of great value these movements tend, even more, to remove venous stagnation, stimulating the heart and increasing the circulation generally, and can be used

alone or combined with ordinary massage. The resistive exercises consist of slowly conducted flexion, extension, adduction, abduction and rotation in regular succession. They are not athletic. The late Dr. Auguste Schott recognising the effects of certain movements upon the circulatory apparatus formulated a series of movements, known as Schott's Resistive Exercises, which have been published to the world by his brother, Dr. Theodore Schott, who has utilized and developed them to the scale on which they are now used. They are known in Germany as the Widerstands-Gymnastik. There is a great deal more in Schott's movements than appears at once to the eye of the observer. The general results are similar to the results of the bath, but it is held that usually they are the necessary corollary of the bathing system. The movements are made slowly, without effort or spasmodic action of the limbs, the action being smooth and even; a momentary pause after each movement, and after each successive series of limb movements a pause for two or three minutes, is necessary. The operator directs the patient to make certain movements in certain directions, due resistance being made with the hands and counter resistance offered by the patient. The breathing in these conditions should always be free. The degree of strength determines the duration of these movements, and whether the upper limbs only are to be moved and the lower limbs omitted, whether the arms are to be raised above the level of the shoulders, and whether the patient is to be recumbent or standing. Features that require to be watched carefully, are whether the breathing is increased, the pulse altered, and the heart's action accelerated; or whether there be pallor or duskiness of the face, and cold perspiration. The length of the exercises may extend to ten, fifteen, twenty or thirty minutes, including the pauses, according to the result and strength of the patient. These rules apply to chronic heart cases, and the frequency of their administration depends upon whether the baths are used or not.

The baths may be given without the movements, and the movements without the baths. At Bath we generally give the bath, followed the next day by the movements, or in exceptional cases the movements daily with baths three times a week. Occasionally, in extreme cases, baths and exercises have to be given in the same day. Often in apparently the most incurable cases movements are the only method of treatment adopted, the patient having to rest absolutely in bed.

All movements should be avoided in extensively developed arterial sclerosis, advanced atheroma, aortic incompetency and fatty degeneration of the heart. In gouty, granular kidneys, and aneurism of the aorta, neither the exercises nor baths are to be thought of.

The best results obtained are in cases of smoker's heart or of weakened muscular walls of that organ. Wherever there is deficient compensation arising from valvular lesions, defective nerve power, loss of tone through shock, or from some infective disease, such as influenza, with all its weakening effects on the cardiac nerve centres, as well as in the neurotic forms of angina pectoris, the results work out so satisfactorily that we hope by these Schott's movements alone many a patient will be enabled to follow his vocation in comfort.

There are numerous cases in which all kinds of drugs have failed to relieve, when by the free use of the baths, or movements, or movements alone, apparent recovery has occurred, and the patients have enjoyed, with care and subsequent judicious management of themselves, an immunity from their troubles for a more or less lengthened period. On the other hand, it is only fair to say that with rigid arteries, rigid valves, and myocarditis, with degenerated coronary arteries, compensation is not to be expected and cannot be hoped for. Some of these cases undoubtedly improve under treatment, and local relief ensues from judicious bathing and movements. Further, I have even seen the dicrotic pulse of renal albuminuria materially altered by a course of exercises and gaseous baths.

On the whole, therefore, I am strongly of the opinion that in suitable cases we have here an agent (Passive and Resistive movements) capable of much good, but I cannot say that the weight of evidence is so strongly in favour of the Nauheim baths over our own Thermal ones as to make me abandon the latter altogether in favour of the former.

Although not exactly belonging to the Thermal baths of Bath, yet as an important adjunct thereto comes the important question of—

The *Hot Air Bath.*—On this much vexed question time alone will allow us to arrive at some definite conclusions. Superheated hot air is as old as the hills in theory and practice, yet within the last few years many new forms of apparati for its application have come into the market and many and marvellous are the astounding tales of recovery. Hot air from time immemorial, in certain cases, has given marked temporary relief, and there can be no reasonable doubt that it still can and does so. The new apparati have made it possible to raise the heat of the air to a much higher point than it has ever been possible heretofore to do without injury to the patient. They have arrived at this very desirable point by certain means which has enabled the air to be freed from its moisture, and on account of this it is found that temperatures of 350° to 400° F. are quite easily borne for prolonged periods of time (forty to sixty minutes) without any appreciable harm arising to the skin beyond the mottling so often seen on the legs of those who toast themselves before a fire. Some of the apparati are closed and some, more or less, open, some heated by gas and some by electricity, but the one point successfully reached by them all, is to raise the temperature to as high a point as can be borne without injury to the human body. Of course this bath must be local, and it is found that when a limb or portion of a limb is inserted into the apparatus and the heat quickly raised to, say, 350°, that the limb itself breaks into a profuse perspiration and then the body generally follows. As the heat

rises quickly the limb becomes dry, and the general body temperature rises 1 to 5 degrees, but returns to normal on the heat being stopped. There is little or no effect on the pulse and no discomfort experienced by the patient. The effect of the bath is to relieve pain, to soften and loosen stiff joints, to encourage the absorption of thickenings and deposits round joints and generally to overcome the sequelæ of chronic rheumatism, rheumatoid arthritis, gout, lumbago, neuralgia, sciatica, sprains, etc. Its greatest virtue is the relief from pain which sometimes follows its use. It is principally of use in local conditions but not entirely so. It is maintained by its partisans that it cures most of the above mentioned diseases. Unfortunately, with this I cannot agree. It does relieve—often in a marvellous way, but it has no permanent general effect on the system. The pain, crippling, stiffening and distortions will, in ninety-nine cases out of a hundred, return, just as they do in all other forms of treatment unless the patient submits to periodic "cookings." The general system is not treated as it is by thermal mineral waters and it is only as a valuable adjunct to these that it is used in Bath. And, of course, there are many conditions quite unsuitable to the use of these high temperatures. Within the last few months Bath has seen many of the failures of this system and it is, therefore, with a good deal of diffidence that one recommends their patients to try the effect. Personally, I only use it in conjunction with the Bath Waters, and it has in many cases been useful. We have in Bath two rival systems of applying the superheated air (I hope shortly one method will be installed in the Corporation baths). In one form we have the closed cylinder with its air heated by gas, and in the other we have the, more or less, open radiators heated by a strong electric current passing through incandescent lamps. In one case one method may be thought more suitable and in another the other, but they both are the same in principle although applied differently. But I would again remind my readers that this

form of bath can never supersede mineral waters, and baths must for ever remain an aid and only an aid to the more perfect results to be obtained from the latter. Massage, once vaunted as the cure for all the ills to which human flesh is heir, has now assumed its proper sphere in the treatment of disease, and so before long with the hot-air bath.

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## CHAPTER V.

### *ACTION OF THE BATHS, AND DISEASES IN WHICH THE WATERS ARE OF USE.*

BEFORE discussing the various diseases in which the thermal waters of Bath are of use, I would like to say a few words on the physiological effect produced by the baths. I have already mentioned the effect of the waters when taken internally but not those of the baths. The Bath thermal treatment depends for its results on the reaction of the organism to heat and cold as well as to a mechanical stimulation by the impetus of the water applied in douches, and to some extent by the bubbles of carbonic acid gas. What has been called the hydro-therapeutic reaction has been deeply studied by Dr. Weber, and to him we are indebted for the rationale of the treatment. He describes it as the natural reaction of the organism to heat and cold; the organism thus endeavouring to protect itself against the action of these agents. On account of the greater specific gravity and greater co-efficient of heat conductivity, water is much more active than air of the same temperature in inducing the reaction, and on the proper bringing about of this reaction depends largely the result of hydrotherapeutic treatment. When a healthy man is immersed in cold water, he receives an impression of cold, shivers, and after an involuntary pause in breathing, takes a very deep

inspiration; the skin is pale, and owing to the contraction of the unstriped muscle fibres, presents the appearance called "goose skin." When the man gets out of the bath, or sometimes even whilst he still remains in it, these effects give place to the phenomena of the "reaction." The skin then becomes slightly reddened, and an agreeable subjective sensation of warmth is experienced. He breaths more easily, and has a general feeling of comfort and capability for exertion. This is the "hydrotherapeutic reaction" to cold; and depends in degree and intensity on the temperature of the water, the length of the application, and, in the case of a douche, on the force with which it is applied. The reaction is assisted by voluntary movements and friction of the skin, and varies much with the health and strength of the individual and with his previous habits in respect to cold bathing. To those already accustomed to cold baths the initial shock is not unpleasant, and the reaction sets in much more easily.

Many physiological experiments have been made to explain scientifically what takes place when the whole body is exposed to cold water. The pallor of the skin during the initial shock is due to the contraction of the superficial blood-vessels, which sets up a corresponding dilatation of the internal vessels of the body. As the blood is the great distributor of heat in the body, the central temperature, measured by a thermometer in the rectum, may rise slightly at first The contraction of the superficial blood-vessels of the body prevents excessive loss of heat until heat production is increased. Owing to this contraction of the superficial blood-vessels the general blood-pressure rises and the heart's action is increased. When the reaction sets in, the superficial vessels dilate, the flow of blood through the skin is much increased, and affects the sensory nerve terminations so as to give rise to a sense of warmth in the skin. Accompanying the reaction a thermometer in the rectum shows a slight lowering of the central temperature, which then gradually regains its initial level or slightly surpasses

it. The vascular phenomena consequent on the hydrotherapeutic application are clearly proved to be due mainly, if not entirely, to nervous vaso-motor action; for, although the muscular walls of the arterioles, like other unstriped muscle, can certainly react to direct stimuli, the phenomena follow a stimulus too fleeting to act directly on the muscle fibres. The phenomena are not, to any considerable extent at least, due to the peripheral nervous mechanism, but to a reflex mechanism including the central nervous system: in animals they are absent from parts in which the nerves have been experimentally cut; and in the case of men the phenomena may be diminished or absent in paralysed and anæsthetic limbs.

The respiratory phenomena observed after the application of cold water to the skin are also due to a nervous (reflex) action; they consist in increased amplitude of the respiratory movements, with increased liberation of carbon dioxide and absorption of oxygen by the blood circulating through the pulmonary capillaries. Increased combustion in the tissues is due to the need for increased heat production to compensate for the heat given up to the cold water. Shivering must be regarded as part of the means whereby nature causes increased heat production. As is the case during muscular exercise, this increased combustion is shown by the increase of carbon dioxide given off by the lungs. Increase of urea and diminution of uric acid are sometimes observed in the urine of patients under hydrotherapeutic treatment; and, when observed, show that the nitrogenous catabolism in the body is increased. When, owing to the continued application of cold, the muscular layer of the body becomes cooled, catabolism is diminished, but it is again increased when the reaction takes place after the application. The flow of urine is increased and the action of the bowels promoted, the latter probably being due partly to increased peristaltic action, partly to increased intestinal secretion. The appetite is stimulated, the digestion of food aided, and the tonic effects on the

nervous and muscular systems increase the desire for physical exertion and make work feel lighter. Whereas the chief ultimate effect of cold stimuli to the skin is tonic, that of warm stimuli is sedative. The effect of the warm treatment is not, however, exactly the opposite of that of the cold; indeed, all cutaneous stimuli, whether mechanical, electrical, chemical, or thermic, show certain points of analogy. Like cold applications, hot ones probably produce an initial vaso-contraction; this, however, passes off quickly and gives place to vaso-dilatation, which lasts during the rest of the application, and then slowly passes off. The dilatation of the superficial vessels is the characteristic effect of hot applications. This superficial vaso-dilatation is associated with an increase in perspiration and in the frequency of respiration. The whole constitutes the reaction of the body to heat, and, as will be seen, the animal mechanism increases the loss of heat to counteract the heating effects of the application. Owing to superficial vaso-dilatation more heat radiates from the body; by increased perspiration the loss of heat by evaporation is augmented and by increased respiration more heat is given off in the air and watery vapour expired.

In addition to the local sedative action on the sensory nerves there is a general sedative action exercised by heat when the application is general and sufficiently prolonged. This general action is shown by diminished desire for exertion and is probably explained by the partial emptying of the deeper blood-vessels and by the slowing of the blood stream, which is seen in dilatation of the superficial vessels and which cause a certain amount of anæmia of the brain and viscera. If the loss of heat be partly prevented by immersing the whole body in a bath of hot water, the central temperature, as measured by a thermometer in the rectum, rises somewhat, but doubtless in such cases diminution of the heat production in the body assists the loss of the heat by respiration and prevents undue rise of the body's temperature. Hot applications tend to constipation. This may

perhaps be due to diminished peristalsis, perhaps to a diminution in the intestinal secretion on the increased excretion of sweat. The local applications of hot water, like local cold applications but to a lesser degree, have been found to cause certain distant reactions. Thus when one lower limb was heated, vaso-dilatation, increase in volume, and sweating were observed in the other lower limb. Hot-air and vapour baths differ from hot-water baths chiefly in their action on the skin; the greatest amount of perspiration is obtained by hot-air baths.

The question of absorption by the skin during bathing is a complex one. The clinical results of immersion in the case of the chlorotic, anæmic girl, prompt one to declare that absorption must occur, but chemical laws declare against it. Beneke and Rohrig have proved that in brine baths no increase of sodium chloride is excreted by the kidneys; and what is true of this salt is equally true of the salts of iron or of lime. The general consensus of opinion is certainly towards the theory of non-absorption. Nevertheless it is accepted as true that the skin is capable of absorbing substances that are volatile in the form of gas or vapour. Rohrig proved that by applying finely pulverized water to the skin by force of rubbing some absorption took place into the corium; and this of course has to be borne in mind with the Aix massage.

The diseases in which the Bath waters have proved of service are many and varied. To give some idea of the diseases treated and the results obtained, I cannot do better than give the results of the Royal Mineral Water Hospital for the last few years. In this institution the most careful notes are taken, and the results of the various methods of treatment are a very reliable index of what can be done by the waters to alleviate suffering. It will be noticed that few, if any, patients should go away unrelieved if not cured, but in hospital results it must always be remembered that it is the most severe and difficult cases that, as a rule, find

their way into hospital, and not those slight and more easily cured cases seen in private practice.

| Disease. | Cured. | Relieved. | No Better. | Improver. | Dismissed at Own Request. | Died. | Total. |
|---|---|---|---|---|---|---|---|
| Rheumatism ... ... | 408 | 2439 | 111 | 22 | 45 | 5 | 3030 |
| Rheumatoid Arthritis | 71 | 1198 | 106 | 11 | 17 | 5 | 1408 |
| Gout ... ... ... | 102 | 550 | 19 | 8 | 7 | 2 | 688 |
| Sciatica and Lumbago | 45 | 332 | 17 | 1 | 10 | 1 | 406 |
| Paralysis (Brain and Spine) | 2 | 32 | 9 | 3 | — | — | 46 |
| Peripheral Neuritis and Lead Poisoning | 5 | 62 | 4 | 1 | 1 | — | 73 |
| Eczema, Psoriasis, etc. | 18 | 64 | 5 | — | 1 | — | 88 |
| Chorea... ... ... | 10 | 9 | 2 | — | — | — | 21 |
| Miscellaneous Affections ... ... | 4 | 158 | 37 | 25 | 5 | 1 | 230 |
| | 665 | 4844 | 310 | 71 | 86 | 14 | 5990 |

The total percentage of cases cured is somewhat small, being less than 10 per cent., but that of those relieved is large. Under the term "relieved" many left the hospital quite free from all pain, but owing to the somewhat strict definition of "cured" adopted at the hospital they could not be included in that category. The small percentage of cured in rheumatoid arthritis must be noted and accounted for by the fact that they seldom come for treatment until late on in the course of the disease. The cures in gout compare very favourably with the other classes of disease treated.

(1,) Rheumatism.—All the various forms of so-called chronic rheumatism derive benefit from the waters here (chronic articular rheumatism, muscular rheumatism, senile arthritis, morbus coxæ senilis, etc., and especially those convalescing from acute and sub-acute attacks). The percentage of cured is about 12·8 per cent., whilst that of the relieved is 75·3 per cent. The waters may be applied warm, locally or generally, either in the deep or reclining bath, with or without douching when the

patient is weak, and which, as he becomes stronger, may be changed to the Aix massage, hot douching, vapour baths, with massage and assistive and resistive movements. No hard and fast rule can be laid down as to which bath will be most suitable, and the medical attendant must judge each individual case on its merits. The value of the baths is chiefly to relieve pain and cause the structural changes to subside. The baths seem to excite the nutritive processes, especially exciting secretion, and to dilate the blood-vessels, thus modifying the circulation of the affected part. The constituents of the bath act by stimulating the sensory nerve ends of the skin also, and this in turn exerts an influence on the functions of circulation and respiration. These influences may be increased by friction of the affected joints in suitable cases. The Bath waters have a soothing effect and specially seem to alleviate pain. The effect of local baths, although confined to a small portion of the body, may serve to assist the action of the body generally in promoting absorption, or may be of use in those cases where general baths are inadmissible, and, in short, in any condition that forbids a general bath at a high temperature.

General vapour baths are principally used in rheumatic conditions to cause perspiration and thereby promote absorption, and local ones by softening the tissues around a joint enable it to be moved more freely and also alleviate pain. In both objects it is usually wonderfully successful. Muscular rheumatism, as a rule, will require the Aix massage douche, together with the dry massage, and if these fail to give relief the Berthollet vapour and the massage reclining bath should follow. The Bouillon also will be found a very useful bath in many cases.

(2,) RHEUMATOID ARTHRITIS.—The statistics of rheumatoid arthritis give 5 per cent. only cured and 80·7 relieved, thus giving a lower percentage than either gout or rheumatism, but considering the nature of the disease this may be looked on as an exceptionally favourable result.

The Bath thermal waters have been used for ages in

this complaint, and have come to possess a name and repute for alleviating the symptoms second to none—in fact so much so that due discretion is not always observed either by the bathers or their medical advisers. Beyond all doubt they are most useful in the early stages, and again when the disease is subdued they come to be almost equally invaluable. But no greater mistake can be made than to imagine that they will cure all and every condition. I hold that *alone*, during certain stages, they, like all other mineral waters, are not of the smallest use, but given a proper and successful medication we derive much help and good from them not only in alleviating symptoms, but in counteracting the effects of stiffness, deformity, and muscular weakness. I know of no waters, in this disease, of more avail than those of Bath. It has been said more than once that patients have derived no benefit from our waters, but so it may be said of any waters. Combined with suitable internal treatment, which must often be of a prolonged nature, no case should leave Bath unrelieved if not cured. But we must make it clear that once a joint is disorganised no power on earth can renew the diseased tissues. We may alleviate and relieve pain, give greater movement, and, in short, make life bearable, but we cannot make a joint quite perfect—there must always remain some symptoms to show how severe the attack has been. In severe and advanced cases improvement can only be obtained after months of treatment, a period often most trying both to the patient and the physician in charge.

At first, immersion in the waters acts as a gentle counter-irritant—the gentle excitation of the cuticle being passed by reflex action throughout the body—an increased oxidation and production of heat being the result. The circulation improves, and the tissues receive fresh supplies of blood to reinforce their vital powers. Again, wet and dry douching stimulates and exhilarates. The latter has to be used with care, as where the joints are sensitive it may do much harm. If practised as in Bath, where this system has been carried to high perfection,

and where the attendants are not only highly qualified, but do their work with a thoroughness and care not often met with, the massage or shampooing combined with the douching has often a marvellous effect in the chronic stages. By its means the muscles are strengthened and further atrophy prevented, and it also seems to have a soothing effect on the joint pains and nerves. It is also of use in the insomnia which so often accompanies rheumatoid arthritis. When practised dry it appears to have a more exciting effect, and its results are not altogether so good. Massage again, where walking is difficult or impossible, keeps the muscles healthy and the skin in a condition of activity. It may be employed along with electricity, but certainly its best results are obtained when it is carried out in a bath by a skilful operator. When the attack is acute, only the lightest and slightest massage is permissible. As the joints stiffen it may become more forcible and deeper, and should be combined with passive movements, under which treatment deformities and ankylosis often improve and do well.

(3,) GOUT.—In all its many forms gout may be successfully treated by the Bath waters, for we find 13·9 per cent. of those treated at the Royal Mineral Water Hospital are cured and 80·7 per cent. relieved. In using these, like many other thermal waters, it must never be forgotten that latent gout may readily be turned into an acute attack. This, unless the patient be warned beforehand, is not unlikely to be resented on his part and to bring the reputation of the waters into disrepute. Treatment by mineral waters is at once suitable and effective, for not only is the disease itself attacked, but the patient's habits are regulated and a certain amount of restraint in diet readily submitted to, and there are other adjuncts of life at a watering place which all contribute their share to the total result. The waters themselves, when taken internally, stimulate the secreting organs, especially the bowels and kidneys, and also increase the solvent power of the blood by diluting it. They also tend to remove the various disorders which stand in a more or less close

degree of casual relationship to gout, either as antecedents or concomitants, such as gastric irregularities, gastric and intestinal catarrh, acidity, constipation and portal congestion, and urinary disorders. The removal of these must always be our chief object. Having put our patient fairly on the road to do this, we turn our attention to the local changes, such as deposits in and around the joints (chalk stones), together with the inflammatory thickening of the tissues and the consequent articular stiffness, dislocations, contraction of tendons, etc. Here it is that the mineral waters exert such a powerful influence in promoting absorption of the morbid products, and this result is much accelerated by baths, either local or general, according to the case.

In an acute attack of gout in the extremities little can be done beyond treatment by the Berthollet vapour bath to aid the general and internal treatment. But during the intervals between the paroxysm everything should be done in the way of massage and the use of the baths, douches, etc., to effect a cure. In the atonic form of gout, absorption is promoted by bathing, douching, and using the natural vapour, and occasionally, where there is œdema, massage is of use. In gouty dyspepsia the waters should be drunk at the spring (preferably at a temp. of 117° or more), sipping them while hot, beginning with a small dose but rapidly increasing it to the largest. In the more chronic forms of gout, besides the vapour baths, deep and reclining baths and douches, the Aix massage bath is of great use, but, as in all gouty cases, massage has to be used with care. In gouty sciatica the Bouillon will be found most serviceable. A vapour bath, followed by a warm douche, or an occasional hot bath, with the under current, may be desirable. It may be necessary to diagnose how far an arthritis may be bringing about the sciatica for it may be the commencement of *morbus coxæ senilis*, or a symptom of an acute inflammatory condition of the sheath of the nerve. Drs. Brachet and Blanc, of Aix, lay great stress on the necessity of defining if possible at the onset the cause of

the pain. Real sciatica, they assert, derives great benefit from a vigorous course, whilst its counterfeits are intensified under a similar treatment.

(4,) SCIATICA and LUMBAGO give a percentage of 92·8 cured or relieved. It is found in cases of sciatica, in the acutely painful stage, that the simple bath only can be borne with, later on, the warm under current. If it be of long standing, the dry douche, reduced in force, followed by the Aix douche may be tried. Massage cannot be used in the acute stages. Galvanism often gives marked relief. In lumbago the dry douche is usually recommended, and is very potent; the force, however, requires careful regulation. If the large Aix massage douche cannot be borne, quiet immersion in a reclining bath, the hot under current being applied to the loins at short intervals, does good, and, in certain cases, massage under water in a reclining bath will produce most satisfactory results. This class of patient, more especially if gouty may require some Carlsbad salts dissolved in their first (fasting) glass of hot mineral water. When dry massage can be borne, with strong friction, it is desirable to apply it.

(5,) NEURALGIA.—In this painful affection the waters in the form of a douche or vapour bath are extremely serviceable. Young women in whom the disease has induced habits of indolence will find the swimming bath, at 84°, of much service. If the case be one of unusual obstinacy, then the warm reclining bath, wet douche, and the Faradaic current will, as a rule, be effective remedies.

(6,) DISORDERS OF THE DIGESTIVE ORGANS are often much improved. If we find patients suffering from pale yellow or bilious complexions, furred dirty tongues, with a foul taste in the mouth, and diminished or entire loss of appetite, accompanied by weight and oppression, constipation or diarrhœa, with cold hands and feet, and an indisposition to enter upon occupation of any kind, these are the cases in which the Bath waters invariably produce very beneficial effects. Where constipation is present the occasional use of the lavement may be desirable.

(7,) Diseases of the Skin.—The chief are lepra, psoriasis, eczema, acne, prurigo, lichen, pemphigus, nettle rash, and many other chronic cutaneous diseases. The method of keeping patients with chronic psoriasis and lepra for prolonged periods in tepid baths may be followed with good results. Should the case happen to be rheumatic or gouty in its origin, it is usually completely cured, but when the strumous forms of psoriasis have to be dealt with, the results are less favourable. From the mild mineralisation of the waters their efficacy is limited; but the Berthollet natural vapour bath is a powerful therapeutic means of treating many obstinate chronic scaly skin eruptions. A good general rule to follow is to begin with reclining tepid baths, at gradually increasing temperatures and with prolongation of immersion, and later on vapour baths. Much benefit may be had from this line of treatment.

(8,) Anæmia, Chlorosis and Malarial Cachexia.—As has been mentioned, anæmic patients often bear the natural water baths well. And for them the tepid reclining bath with gentle wet massage is probably the best, while judicious drinking of the water in small quantities reveals the effects by increased colour and a diminished feeling of lassitude. Malarial patients are rapidly benefited by the Berthollet; whether this result arises from the minute elements of the iron and arsenic—contained in the vapour—being absorbed by the skin, may, perhaps, be open to question, but there cannot be two opinions as to the benefit derived.

(9,) Peripheral Neuritis.—The following are the most commonly treated forms of peripheral nerve disease: Paralysis due to the poisons of diphtheria, ague, and typhoid fever, that due to cold or exposure, whether involving a limb or a portion of a limb, or a special nerve or set of nerves, such as the facial, that due to hysteria, or lead, mercury, copper, or arsenic, etc. The treatment at first should consist of a warm reclining bath combined with the under current douche and wet massage, and, when the patient increases in strength, the Aix douche. When

it is deemed prudent, the steam Berthollet with dry massage may follow. The Bouillon will be found very beneficial when prostration is not a prominent feature, faradisation and galvanism being also appropriate. Muscular atrophy of all forms is much benefited by massage and galvanism. For the local paralysis of blood poisoning and infective fevers, the dry douche at 100° or 102° F., the Aix massage douche and the continuous as well as the interrupted current may all be thought advisable, while the cold douche may be used in the paralysis of hysteria.

(10,) CENTRAL NERVE DISEASES.—(*a*,) *Hemiplegia.*—In the acute stages no water treatment can be thought of, but there is a consensus of opinion amongst the French physicians at Aix that in certain later stages the employment of baths and douches is beneficial. The extent of the brain lesion and the general condition of the patient must determine the treatment to be adopted and the prognosis. For these cases the reclining bath and the douche at gentle pressures are alone permissible. (*b*,) *Tabes dorsalis.*—In these cases Charcot recommended tepid bathing, the reclining bath, and the Berthollet at 90° or 92° F., with the gentle spinal spray. Sometimes the girdle pains and the lightning flashes down the legs undergo favourable change in their character; but at best these are unfavourable cases for the use of any kind of mineral water. If the vapour treatment cannot with certainty be recommended, at any rate it may be tried. (*c*,) *Chronic Spinal Paralysis.*—In chronic myelitis, from whatever cause, when the inflammatory conditions have subsided, vapour baths, douches and sprays in their mildest form are singularly agreeable and beneficial. In some cases a patient may be ordered a reclining bath and the interrupted or continuous current with wet massage. Dry massage also can be very successfully pursued. (*d*), *Chorea.*—Where the symptoms have become chronic and not severe, chorea may be treated by reclining baths, with the warm under current to the spine, and gentle massage. The most satisfactory cases, however, are those associated

with a rheumatic history, the elimination of the rheumatic poison being followed by rapid improvement and restoration to health. The heart when defective recovers in many cases its normal tone. The patients may drink the waters and use the reclining bath with under current up to 104° F., and also in most instances dry douching and shampooing.

(11,) GONORRHŒAL RHEUMATISM is found to be very successfully treated by the various thermal applications. The patients, mostly young men, can well stand reclining or deep baths, Aix douche, dry or wet douche, and the vapour bath with dry or wet massage as is indicated. Under treatment the patient will assuredly experience relief and permanent benefit. Usually, with the foregoing are combined copious doses of the water, to which, if necessary, iron may be added, whilst a generous diet, without stimulants, is of the first importance.

(12,) IN DEBILITY from protracted illnesses much benefit may be got from the Bath waters aided by its sheltered locality, its warm westerly breezes, and its social and other advantages.

(13,) DISEASES OF THE RESPIRATORY TRACT.—Chronic bronchitis and asthma, bronchorrhœa, chronic laryngitis, pharyngitis (rheumatic and otherwise), and general catarrhs of the mucous tracts are treated by the inhalation and pulverization processes in combination with the thermal spray, thermal vapour, and sulphur water spray. In certain cases those means are aided by Siegle's steam spray. In cases of dyspnœa, especially with expectoration in the gouty and rheumatic, thermal steam inhalations, such as were recommended by Sir Morrell Mackenzie in some inflammatory conditions of the throat, are followed by beneficial results. The Bath waters are highly charged with nitrogen gas, and its hygienic properties and effects have been abundantly proved by long experience in such cases.

(14,) DISEASES OF THE HEART.—In fully 70 per cent. of the cases presenting themselves at the Mineral Water Hospital do we find some cardiac flaw, and in nearly all

do we, after a course of treatment, find some material improvement. The results obtained by the ordinary Bath treatment rivals that obtained by the special system as employed at Nauheim. The baths ordered usually consist of tepid and hot reclining baths with under-current douches, with massage and possibly exercises, and, except in aortic and very advanced mitral disease, do we almost invariably find after a time that some degree of improvement has occurred. Patients with aneurism of the aorta, of course, should never be bathed, and I make it a rule never to permit any but the slightest aortic cases ever to enter the water. Cardiac disease complicated by chronic kidney disease must also never bathe. But apart from these conditions I have found that almost without exception the cardiac tone has improved, and that compensation becomes more perfect and that the patient's general health and bodily comfort are altered for the better.

(15,) Diseases of Women.—In the distressing and painful diseases peculiar to women which render many of their lives a burden, Bath has earned a just reputation. Various forms of disease give good results, but perhaps the best are got in amenorrhœa or dysmenorrhœa. These conditions may be suitably treated by the reclining bath with local hot under-current douches to the sacrum, lumbar and ovarian regions, while the ascending hot douche will materially aid the treatment. Leucorrhœa, if from no organic disease, may also give good results. Chronic inflammation of the ovaries in certain cases are greatly benefited by reclining baths and hot under-current douches, with, now and then, local massage. For hysteria the Scottish douche and needle bath, with or without Aix massage douche, are the most successful. Dry massage and faradization may also help. In obstinate cases alternating hot and cold douches to the spine may be recommended. Congestion of the ovaries and subinvolution of the uterus have all been successfully bathed and douched, and, in fact, unless there be serious organic mischief, no class of case receives more benefit from the Bath waters than do these.

# APPENDIX.

## *SCALE OF CHARGES AT THE BATHS.*

### NEW ROYAL BATHS.

ADJOINING THE GRAND HOTEL.

Open from 7 a.m. till 7 p.m. Sundays till 9.30 a.m.

| | | | | | |
|---|---|---|---|---|---|
| 1 | Deep bath .. | **2/6** | fee **3d.** | 3 Reclining bath | **2/-** fee **3d.** |
| 2 | Chair bath .. | **2/6** | ,, **3d.** | 4 Local Douche | **2/-** ,, **3d.** |
| 5 | Deep or Reclining bath with Douche or Shower, | | | | **3/-** & **2/6** ,, **3d.** |
| 6 | Rose or Needle Douche (with Local Douche) .. | | | | **2/6** ,, **3d.** |
| 7 | Ladies' Special Douche .. .. .. .. | | | | **1/-** ,, **3d.** |
| 8 | Massage given in a Reclining bath (15 min. or less) | | | | **1/-** ,, **3d.** |
| 9 | Massage Douche (Aix-les-Bains system), 1 doucheur | | | | **2/9** ,, **3d.** |
| 10 | Ditto ditto and Reclining bath | | | | **3/6** ,, **6d.** |

*Attached to these baths is a First-class Mineral Water Swimming Bath, Temp. 82° to 89°. For LADIES, Monday and Friday.*

| | | | |
|---|---|---|---|
| 11 | Private Room, for 1 lady .. .. .. .. | **1/-** | fee **1d.** |
| 12 | Ditto for 2 ladies .. .. .. | **1/6** | ,, **2d.** |
| 13 | Ditto for 3 ladies .. .. .. | **2/-** | ,, **3d.** |

*This bath is available for GENTLEMEN at* **1/-** *each. Fee* **1d.**
*Tuesday till 12 noon. Wednesday, Thursday and Saturday till 9 p.m. Sunday till 9 30 a.m.*

Two children, under 12, using the same private room pay as one adult. A child bathing with its parent occupying same room pays **6d.** and fee **1d.**

### THE KING'S BATH.

ADJOINING THE GRAND PUMP ROOM.

FIRST FLOOR.

Open from 7 a.m. till 7 p.m. Sundays till 9.30 a.m.

| | | | | | |
|---|---|---|---|---|---|
| 14 | Deep bath .. | **2/6** | fee **3d.** | 19 Deep bath and Needle Douche | **3/-** fee **3d.** |
| 15 | Chair bath .. | **2/6** | ,, **3d.** | 20 Vertebral Douche | **2/-** ,, **3d.** |
| 16 | Reclining bath | **2/-** | ,, **3d.** | 21 Moist or Dry heat | **2/6** ,, **3d.** |
| 17 | Douche (local) | **2/-** | ,, **3d.** | 22 Moist or Dry heat & Deep bath combined | **3/6** ,, **3d.** |
| 18 | Needle Douche | **2/-** | ,, **3d.** | | |

Douche, Shower, Lumbar Douche, Ascending or Rose Douche, each **6d.** extra. Ladies' Specal Douche, **1/-**, fee **3d.**

23 Massage Douche (Aix-les-Bains), 2 doucheurs .. **3/6** fee **6d.**
24 Ditto ditto 1 doucheur .. **2/9** ,, **3d.**
25 Sprays for Throat, Eyes, Nose, Ears, or Face .. .. **1/-** fee **3d.**
26 Challes & La Bourboule Spray .. **1/6** ,, **3d.**

GROUND FLOOR.

27 Berthollet Natural Vapour .. **2/6** fee **3d.**
28 Sitz bath .. **2/-** ,, **3d.**
29 Reclining bath **1/6** ,, **3d.**
30 Ditto 2nd cl. .. **1/-** ,, **1d.**
31 Reclining bath with massage in bath .. **1/9** ,, **6d.**
32 Massage Douche, 2nd cl., 1 douch'r **1/6** ,, **3d.**
33 Scottish Douche in Reclining bath **2/6** fee **3d.**
34 Reclining bath with Massage in bath & Scottish Douche .. **3/-** ,, **6d.**
35 Reclining bath (ladies') .. **6d.** ,, **1d.**
36 King's Public bath .. **6d.** & **1/-** ,, **1d.**

Douche or Shower, **6d.** extra.
Massage in any Reclining, Sitz, or Vapour bath, **1/-** extra, fee **3d.**

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## OLD ROYAL BATHS.

Open from 7 a.m. till 9 p.m. Week Days.

37 First-cl. Massage **2/9** fee **3d.**
38 Second-cl. ,, **2/-** ,, **3d.**
39 Deep bath, 1st cl. **2/-** ,, **3d.**
40 ,, ,, 2nd cl. **1/6** ,, **2d.**
41 Reclining bath **1/6** ,, **2d.**
42 Local Douche .. **1/6** fee **2d.**
43 Enema bath .. **1/6** ,, **2d.**
44 Shower bath .. **1/6** ,, **2d.**
45 Medicated bath **2/9** ,, **3d.**
46 Vapour Natural **1/6** ,, **2d.**

Shower, Rose, or Needle Douche, 6d. extra.

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## THERMALSOOLBÄDER.

(NAUHEIM SYSTEM.)

47 Thermalbad, No. 1 .. .. .. .. **3/-** fee **3d.**
48 Sprudelbad, No. 2 .. .. .. .. **4/-** ,, **3d.**

Local Massage when prescribed, **1/-** extra, fee **3d.**
Given at the King's and the New Royal Baths.

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## TEPID SWIMMING BATH, BATH STREET.

GENTLEMEN ONLY.

With use of private room, **9d.**, no fee.
Use of public room, **6d.**, no fee.

In Summer this bath is open at 6 a.m., and Winter from 7 a.m till 9 p.m. Sundays till 9.30 a.m. Closed on Thursdays at 1 a.m.

## KINGSTON BATHS, YORK STREET.

GENTLEMEN ONLY.

Deep bath, with Hot Towel .. .. .. **6d.** fee **1d.**

This bath is open from 7 a.m. to 9 p.m. daily, and on Sundays till 9.30 a.m.

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## CROSS BATH, BATH STREET.

Open daily (Wednesdays excepted) in Summer from 6 a.m., and in Winter from 7 a.m. Sundays till 9 a.m.

| MALES. | | FEMALES. |
|---|---|---|
| Open bath .. | **1d.** No fee. | On Thursdays only, |
| Ditto, with towel | **2d.** ,, | Open bath, dress, &c. **2d.** |
| | | Under the charge of Female Attendant. |

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## ARRANGEMENTS FOR DRINKING THE WATERS.

The Grand and Hetling Pump Rooms are open each week-day from 8.30 till 6 p.m., and the Grand Pump Room on Sundays, after Morning Service, till 2 p.m.

| | | | |
|---|---|---|---|
| Single Glass .. .. | **2d.** | Single subscription, (12 months) .. .. | **£1** |
| Book of Coupons, 14 glasses .. .. .. | **1/6** | Family do. do. | **£2** |

# INDEX.

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