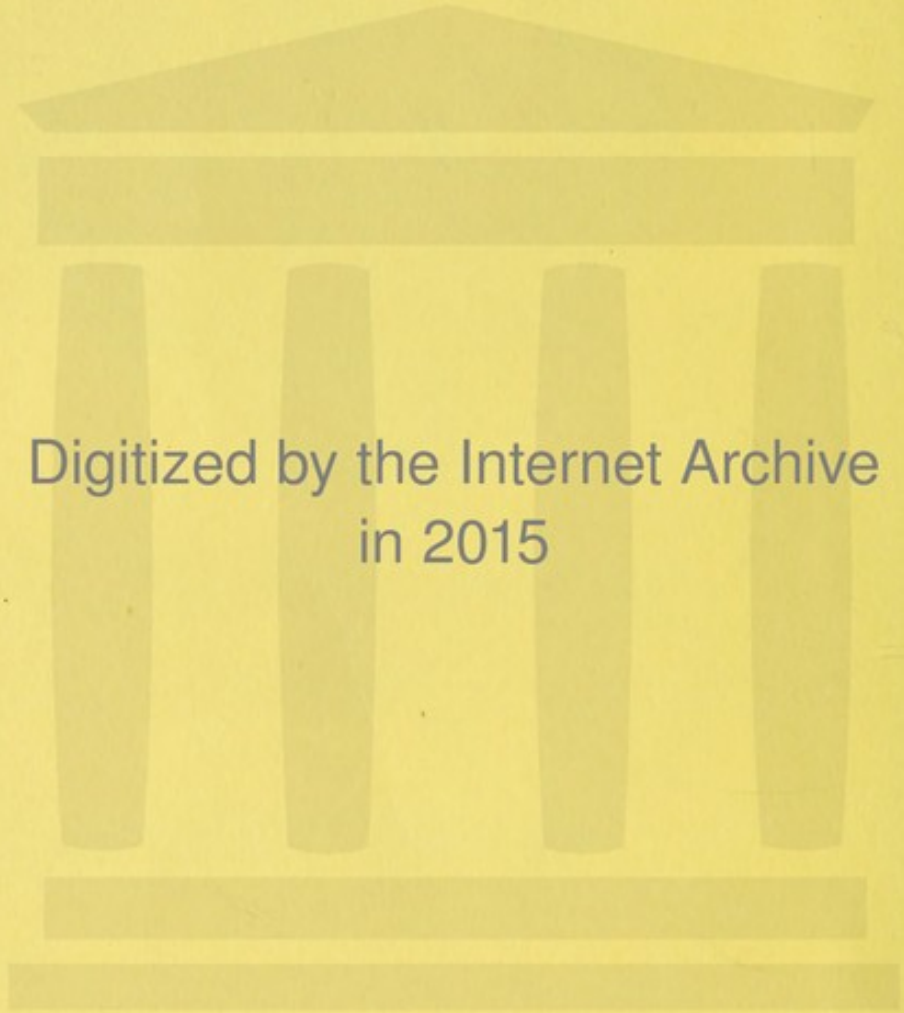
A treatise on the mineral waters of Harrogate : containing the history of these waters, their chemical analysis, medicinal properties, and plain directions for their use / by Thomas Garnett.



Thos Jefferson Junr
Harrogate 10th Octr 1821.

A

TREATISE

ON THE

MINERAL WATERS

OF

Harrogate:

CONTAINING THE HISTORY OF THESE WATERS,
THEIR CHYMICAL ANALYSIS, MEDICINAL PROPERTIES,
AND PLAIN DIRECTIONS FOR THEIR USE.

By T. GARNETT, M. D.,
Member of the royal Medical, royal Physical, and Natural History Societies, of Edinburgh; of the Literary and Philosophical Society, of Manchester; of the Medical Society, of London; and of the royal Irish Academy, &c.

Sixth Edition.

Sapientis medici est, eorum locorum aquas ubi medicinam facit, convenienti examine probe scrutari, quo postea cum fructu, tum præservandi quum sanandi gratia, iis uti posset. Hoffman.

With several additions and alterations, suggested by the practical experience of many years; together with

AN APPENDIX OF CASES,

By J. JAQUES, M. D.

Resident Physician at Horrogate, Member of the royal Medical Society, and a Graduate of Surgeons'-Hall, Edinburgh.

KNARESBROUGH:

PRINTED BY HARGROVE AND SON,

AND SOLD BY THEM, AT KNARESBROUGH AND HARROGATE;
BY J. JOHNSON, NO 72, ST. PAUL'S CHURCH-YARD;
T. KNOTT, NO. 47, LOMBARD-STREET, LONDON;
AND C. MUDIE, EDINBURGH.

1816.

ALTHOUGH the directions given by my late revered friend, Dr. Garnett, respecting the uses and applications of the Harrogate waters, are very full and valuable, as well as the Analysis of them very complete and worthy of such a Chymist, yet it has often occurred to me, that the addition of a few cases would render the work more acceptable to the public, and I hope it will not be less so, by the several additions and alterations which the practice of a series of years has enabled me to give in this present Edition.

It may not unfrequently happen, that by comparing the symptoms of cases with their own, patients will have an opportunity of more readily forming an opinion whether the Harrogate waters are likely to be beneficial to themselves. Those given in the following Appendix, are selected from very many which came under my own particular notice and observation: and to which, it would not be a matter of any great difficulty, to have subjoined a multitudinous catalogue, had not such as are here offered, been deemed sufficient for the present purpose and intention.

J. JAQUES.

HARROGATE, July 20, 1816.

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J. TAGUE.

HARROGATE, July 20, 1818.

PREFACE.

THE reputation which the mineral waters at Harrogate have acquired, is deservedly great; but I think, it will be readily allowed that their nature is not well known to the medical practitioners in general; and though great numbers resort to this watering place every year, yet, it is certain that more come upon the recommendation of friends who have been here, than in consequence of the advice of their physician. As no accurate analysis of these waters has yet appeared, it is not surprising that medical gentlemen, who have not been upon the spot, should be in a great measure ignorant of their nature, and consequently of the diseases for which they are proper. It is indeed generally known that they afford relief in herpetic cases, and other diseases of the skin, but it will appear, from the following pages, that they are no less useful in a great variety of complaints.

The principal object of this treatise, is to lay before professional gentlemen an analysis of these waters, and a short account of their medicinal properties, by which I am induced to hope that they may be rendered more extensively useful to mankind. Besides this, I have

thought it necessary to add a few plain directions for the use of those who come to drink the waters. The prosecution of this plan, rendered it necessary for me to treat the first and last parts in a very different manner, and perhaps requires an apology to the two classes of readers, for which the work is intended. The learned and professional reader will, I hope, excuse my being minute and particular in my directions, and pardon my mentioning many things, with which every medical man is acquainted, but which it is necessary for the unlearned drinker to know, for which reason I have endeavoured to render my language, in that part, as plain and as free from technical terms, as I could.

The reader who is unacquainted with chymistry or medicine, will, I hope, excuse the attention I have paid to the analysis, especially when he considers the principal design of this treatise. Though I have endeavoured to give as plain and particular directions as I could, yet it is almost impossible to lay down any general ones, to which exceptions will not daily occur. If all diseases were constant in their form and appearance, and the remedies for each known, the practice of medicine would be easy; but, it unfortunately happens that two cases are seldom found so similar, that the same remedies or the same directions are proper for both, for a difference in the constitution of the patient, and various other circumstances perhaps unknown, occasion different effects from the plainest and most simple remedies that can be prescribed.

Concerning the utility of a knowledge of the chymical properties of medicines, and particularly of the

analysis of mineral waters, no one can seriously doubt; and no one, in my opinion, ever affected to despise it, but by way of apology for his ignorance of chymistry. It is demonstrably evident, that the analysis of waters throws a very great degree of light upon their respective virtues, and the manner of administering them. The knowledge of their composition and constituent parts, leads the chymist to satisfactory conclusions with respect to their principal and predominant properties. To deny this, as M. Fourcroy observes, would be to strike at the foundation of the wisest theories, and to substitute a blind empiricism, in the place of a medical practice founded on reason and experience. The light which is obtained by the analysis in question, emboldens the practitioner to make trials of the efficacy of mineral waters in cases which a person ignorant of chymistry would never think of, and which it would be rash to attempt, without a previous knowledge of their properties and composition. Mere experience will never make a physician; and, a person who plumes himself upon the experience of a century, if he be not guided by the torch of science, is in the same situation as a blind man, who is acquainted with one track, which, by long habit, he can walk over with ease, nay, perhaps with the same boldness and assurance as a man who can see; but, he is incapable of avoiding the obstacles which chance may throw in his way; he is unable to shorten his journey, or to take a better road, let the old one be ever so much about and inconvenient; and, should it be necessary for him to go out of the accustomed path, he cannot proceed a step in safety, unless conducted by one who can see it. The physician who has nothing but experience to boast of, must be often at a loss, when it is

*necessary to pursue a different method in almost every case he meets with. I do not mean to deny the utility of experience, when directed and enlightened by science, but must maintain, that without these helps, experience is worth nothing. I shall here take the liberty of introducing the sentiments of the ingenious Chaptal, concerning the utility of a knowledge of chymistry to a physician. "Il ne faut pas cependant regarder la chimie comme etrangere a l'etude et a la pratique de la medicine ; elle seule peut nous apprendre l'art si necessaire de combinor les remedes ; elle seule peut nous enseigner a les manier avec prudence et fermete ; sans son secours, le practicien tremblant nese livre qu' avec peine a ces remedes heroiques dont le medicin-chimiste sait tirer un si grand advantage."**

If the reader should expect any apology for the introduction of the terms adopted by the french chymists in their new nomenclature ; I can only say, that admitting the truth of their system, it was necessary to make use of their terms, which are likewise more proper than the ancient ones The antiphlogistic, or as it has been called, the pneumatic system, is gaining ground daily, and will in all probability, soon become general ; it appears to me to be better founded than any other, and differs essentially from all the preceding chymical theories, since in it nothing is taken for granted or supposed ; it consists merely in a recital of facts in a particular language. M. Fourcroy observes, that of those who are engaged in chymical pursuits, more than three fourths have already adopted it ; and, that two chymists of the first

* Elemens de Chimie. Discours preliminaire, p. 69.

reputation in Europe, after having opposed it for a long time, have at last adopted it, and candidly owned their conviction of it's truth. I mean Dr. Black and Mr. Kirwan.

With regard to the medical part of my treatise, besides what has occurred to my own observation, I have freely availed myself of whatever I found useful in preceding writers, and by this method, without claiming much merit to myself, I hope I have been able to present the reader with more complete directions for the use of the Harrogate waters, and with such as are less liable to exceptions than have hitherto appeared; I have, however, been careful to acknowledge my obligation to the various authors on this subject, by quoting the works, from which their sentiments are taken.

HARROGATE, May 1, 1794.

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PART I.

The History

OF THE

Harrogate Waters.

MANKIND would undoubtedly become early acquainted with mineral waters: the savage, furnished with no other criterion than taste, would soon perceive a difference among the springs, to which he came to quench his thirst. But, besides this, as the illustrious Bergman observes, the preparation of food, and the various arts and manufactures which afterwards began to be studied, as mankind became more civilized, must gradually have suggested a difference in the properties and goodness of waters, with respect to certain purposes, although we may be at present ignorant of the manner and order in which these discoveries occurred. We may with propriety say, that we meet with no water

perfectly pure, and free from extraneous matters, on the surface of the earth; for, on account of the great dissolving power which this fluid possesses, it is every where impregnated with foreign substances, but in some places more so than others; hence proceeds the difference observed between snow-water, that of rain, springs and rivers, &c.. When water is so strongly impregnated with mineral substances, as to produce evident effects on the constitution, in relieving or curing diseases, it then obtains the name of *mineral water.* Since water is an element so universal, and of such extensive use in life, we might naturally expect that it would claim the early attention of physicians; and, accordingly we find this subject noticed by Hippocrates,* who observes that those waters are the most proper for use, which are clear, light, and void of taste and smell. We find, indeed, that the subject of mineral waters, has claimed the attention of almost all ages; and, so numerous have been the various writers on this subject, that we are informed by the ingenious Dr. Falconer, of Bath, upwards

* Lib, de aere, aquis, et locis.

of a thousand treatises have been written on mineral waters: notwithstanding which, we have scarcely one treatise before the time of Bergman, in which the principles of these waters are pointed out with any tolerable accuracy. The very low state of chymical knowledge, together with the many difficulties which attend the examination of mineral waters, which is undoubtedly the most difficult part of chymistry, have retarded discoveries on this subject; besides, in the last century, philosophers were much more accustomed, and found it more easy, to fabricate systems in the regions of hypothesis and fancy, than to investigate truth by a patient and laborious observation of the facts of nature. This spirit we find contaminating every source of philosophy, and extending even to the investigators of mineral waters; hence we have properties attributed to those waters, which they never possessed, and substances dissolved in them, which they never did or could contain. The mineral waters, at Harrogate, have shared the same fate as others; and, though they have engrossed the attention of numerous writers, yet we are not in possession of one accurate account of their

contents. This consideration induced me to undertake the analysis of them, which I have attempted to perform with all possible care; and, if I have come nearer the truth than any of my predecessors, I claim no other merit than that of having paid considerable attention to the subject, and having carefully repeated and varied my experiments, in almost every possible manner.

Though Harrogate be possessed of a greater number and variety of mineral waters than any place in Britain, or perhaps in Europe, yet the discovery of them has been made at many different and distant times. The most ancient mineral water, and the only one known for a considerable time, is the Tewhet, or Tewit-Spaw, so named from the great number of lapwings which formerly frequented that part of the forest: it was discovered in the year 1571, by Mr. William Slingsby, a branch of the ancient and respected family residing at Scriven park, near Knaresbrough. This gentleman had formerly visited the waters of Spa, in Germany, and, having accidentally seen this spring, perceived a strong resemblance

between it and the celebrated german chalybeates. He made several trials of it, and built a wall about it. The quantity or water discharged by it, was about the same as the Sauveniere-Fountain, at Spa, to which Mr. Slingsby thought it preferable, being more brisk and lively, and of more speedy operation;* he experienced much benefit from it, and having lived some time at a grange-house, near it, he removed to Bilton-park, where he spent the remainder of his days. About twenty-five years after the discovery of this spring, we find it noticed by Dr. Timothy Bright, who gave it the name of the *English-Spaw.* He having spent some time in Germany, must have been, as Dr. Dean observes, a good judge of both waters, and had so good an opinion of this, that he not only sent many patients hither yearly, but every summer drank the waters himself, upon the spot.

In the year 1626, Dr. Dean, of York, favored the public with a treatise on this water, entitled, "Spandarine Anglica; or, The English Spaw Fountain; being a

* See Dean's Spandarine Anglica, chap. vi.

brief treatise of the acid tart fountain in the forest of Knaresbrough, in the west-riding of Yorkshire: as also a relation of other medicinal waters, in the said forest." This book, as we might expect, contains many of the absurd and fanciful theories, which at that time prevailed in medicine; it is likewise here asserted, that this spaw contains a vitriol, which is it's predominant ingredient, and which, the author says, is evident from it's tartar, inky taste, and smell; a proof of the low state of chymical knowledge, at that time. The author however remarks, that as much powder of galls as will lie on a silver two-pence, turns a glassful of this water an exact claret-color, at the spring head, but not when it is carried; for it strikes a faint purple at York, and carried twenty or thirty miles farther, it differs not from common water. The reason why it does not keep so long, or bear carriage so well as the Sauveniere Spaw, he attributes to it's having more spirit, that is, fixed air; the contrary of which is the case, for, though it contains about the same quantity of iron, as the celebrated german fountain,* yet, not containing any thing

* Thirty-two ounce measures and a half of the Sau-

near the quantity of fixed air, or carbonic acid, and only about as much as will just keep the iron suspended; on the escape of the least quantity of this ærial fluid, the iron begins to be deposited; whereas, in the Sauveniere-spaw, though more fixed air should escape during the carriage of it, than is contained in the Tewit-Well, yet there still remains sufficient to keep part of the iron, or perhaps all of it dissolved for a considerable time. I have found, from repeated trials, that the water of the Tewit-Well and Old-Spaw, put in bottles, well corked and sealed at the springs, after being carried to Knaresbrough and kept three or four days, did not show any change on mixing it with tincture of galls, or prusian alkali.

Dr. Dean mentions several diseases in which this water has been found useful, and gives some very good directions concerning it's use, particularly with regard to diet. The quantity of water he recommends, is much greater than is at present

veniere spring, according to Dr. Ash, contain half a grain of ærated iron. See Ash's experiments and observations on the mineral waters of Spa & Aix-la-Chapelle, &c.

drank; he advises his patient to begin with a moderate dose, and to increase it daily to four or five pints, and towards the end to make a similar proportional abatement daily. Though the quantity here recommended, be more than is in general used, yet I am convinced, that in order to be successful, it should be drank in considerable quantities.

Though I have not been able to ascertain the exact time when the sulphur waters were discovered, yet we may learn from this treatise, that they were known in Dr. Dean's time, though not so generally used as the chalybeate waters. He mentions three sulphurous springs; one of them, he says, is in Bilton-park; another half way between Knaresbrough and Harrogate, both of which are to be seen at present, but are little used; the third he says, is two miles beyond Harrogate head, in a bottom on the right hand, and almost at the side of a little brook; this last is undoubtedly one of the sulphur wells at Low-Harrogate, now so much in use.

Though the sulphur wells were known when Dr. Dean wrote, yet it is probable

that they were very little used; and, though Harrogate was at that time much frequented, the Tewit-Spaw was the only one generally used; he says, indeed, that "the common people at that time drank them, and that they soon help to cure, by washing and bathing, itch, scab, tetters, ringworm, and the like," complaints in which a long experience hath shown them to be eminently useful. A remarkable reverse hath taken place—the sulphur wells are now deservedly the most esteemed; yet either from caprice or the indolence of medical practitioners, the chalybeates have been unmeritedly neglected, and we hear of few such cures being performed by them, as most certainly were at that time. Though Dr. Dean mentions bathing in the sulphur water, yet we are not informed by him, when the water first began to be used as a warm bath; but, from a treatise written by Dr. Neale, in the Year 1656, of which farther notice will soon be taken, it appears that warm bathing in the sulphur water, was first used the very year Dr. Dean wrote. Dr. Neale's words are as follow: "It is now 30 years ago since I first set up warm bathing in this water, and procured one such vessel, for a pat-

tern, as are used beyond the sea, for that purpose; and now there are above 20 bathing-houses kept here, with all necessary conveniences, and all full employed in the season.

Though none of the writers on the Harrogate waters mention the precise time when the sulphur water was discovered and first used, yet we may learn from it's being mentioned by Dr. Dean, and the discovery of the Old-Spaw being claimed by Dr. Stanhope of York, a subsequent writer, that the discovery of some of the sulphur wells was next in order to that of the Tewit-Spaw.

The writer who succeeded Dr. Dean was Dr. Stanhope, who, in the year 1632, published a treatise on those waters, with the following curious title-page—"Cures without care, or a summons to all such as find little or no help by the use of physick, to repair to the Northern-Spaw; wherein, by many precedents of a few late years, it is proved to the world, that infirmities, of their own nature desperate, and of long continuance, have received perfect cure, by virtue of mineral waters,

near Knaresbrough, in the west-riding of Yorkshire, by Michael Stanhope." In this work we are presented with a catalogue of cures, performed by these waters, some of which, as Dr. Short justly observes, "are perhaps the greatest and most remarkable, filed up in the authentic records of physic, from Hippocrates to this day." Though this quack-like title-page give, at first sight, no very favorable idea of the work: yet upon an attentive perusal, we find it written with candor, and the good sense of the author is every where obvious. The cures, though extraordinary, are seemingly authentic, the subjects of them being either persons of distinction then living, or people in the neighbourhood, whose names and places of residence are mentioned, and who might be easily applied to. The cure of the countess of Buckingham of a severe asthma, after "all other means had failed," contributed not a little to advance the reputation of Harrogate. This author acceding to the common error, says, that the Tewit-Well partakes of vitriol; and for reasons, which prove nothing but that it contains iron in some form or other. After observing that the whole soil where the water rises, con-

sists of iron-stone, he informs us, that in his time were to be seen, about half a mile from the spaw, the ruins of one of the large iron-works, which occasioned the total consumption of the wood in the forest, which Dr. Short observes, "was formerly so thick of wood, that he was thought a cunning fellow who could readily find out these spaws." Dr. Stanhope is the first writer who mentions the Old-Spaw, situated before the Granby, which he says he discovered in the year 1631, and which he prefers to the Tewit-Well; 1st, Because it's situation is more convenient; 2d, Because it changes sooner and deeper with galls; 3d, It is lighter, less nauseous, and goes sooner off than the other; 4th, It will carry farther and keep better and longer, being put in clean, new close bottles; 5th, Besides the iron and vitriol, it contains a little sulphur, which makes it more balsamic and healing." In this he differs from all other physicians, who have made experiments on these two waters, and though this spring be at present more used yet I do not know one good reason for the preference, excepting the convenience of the situation: for it will appear from the analysis of these waters, which I

have made with great care, that the Tew-it-Well is rather more strongly impregnated with the principles from which these waters derive their virtues, than the Old-Spaw. With regard to the latter's striking a deeper color with tincture of galls than the former, however that may have been in Dr. Stanhope's time (and it is very possible it might be so) the contrary is the case at present, of which any one may easily convince himself. The Old-Spaw is indeed rather lighter than the Tewit-Well, as it contains fewer ingredients, but this is by no means a proof of it's being better. With respect to the sulphur mentioned by the doctor, neither of these waters at present contain any. Notwithstanding what has been said, the difference in strength is so small, and as the Old-Spaw is more conveniently situated for the greater part of the company, there is no good reason why it should not continue to be used.

After enumerating a great many cures performed by the Harrogate waters, Dr. Stanhope very properly observes, that "if some, from prejudice, should say that some have gone away and reaped little or no be-

nefit, I will answer. 1. All distempers are not curable. 2, Did they take and follow proper advice for a sufficient time? 3. Did they use that water which was most suitable to their case? But, be sure let strangers that come for their health, take the following necessary rules along with them. 1. Take the advice of some ingenious physician, who is a judge of the nature and contents of these sundry waters, and of the patient's case. 2. For a day or two use such precautions as he shall judge convenient. 3. Be regular and moderate in diet, during the use of these waters. 4. Suit the degree of your present heat and cold, to the present season of the weather. 5. Be armed with patience, to wait the issue of those waters for a convenient time, which is at least a month. 6. If the waters work kindly, do not mix them with physic." I have mentioned these directions in full, because they are perhaps the best general ones that can be given, even at this day, and scarcely to be expected at the time this author wrote.

The next writer and patron of these waters, was Dr. John French, who, in the year 1651, published a treatise, enti-

tled, "The *Yorkshire-Spaw*: or, a treatise of four famous medicinal wells; viz., the Spaw, or Vitroiline-Well; the Stinking, or Sulphur-Well, the Dropping, or Petrifying-Well; and St. Mungo's-Well, near Knaresburgh, in Yorkshire; together with the causes, virtues, and uses thereof." Having given an animated and pleasing description of Knaresbrough, and it's neighbourhood, and pointed out the situations of the several springs alluded to in the title-page; our author proceeds to inquire into the origin of springs in general; in which, after having with considerable sagacity exploded the systems of that day, he endeavours to establish a theory of his own, which, though tinctured with the unmeaning jargon that then threw a shade over nature's works, and obstructed all true philosophical researches, is not destitute of ingenuity if we discover not the sagacity and patient investigating powers of a Newton, which in those times were scarce to be expected, we at least find much of the fancy and ingenuity of Des Cartes. It would be useless to enter at large into the author's theories, as they have been long since exploded; one passage however, though obscurely expressed,

is sufficiently curious, and from it's striking similarity to the new chymical system, deserves to be mentioned. In the sixth chapter, speaking of the origin of vitriol, (sulphat of iron,) he says, "Vitriol is an esurient salt of embryonated sulphur, which attracting an acidity from the air or water, is thereby opened and resolved, and then corrodes the parts of the metals with which it is connate." He made a great many experiments on both the chalybeate and sulphur waters, some of which are executed with judgment, and the conclusions drawn from them are sometimes very proper. He seems to have been the first who suspected that the impregnating principle of hepatized waters was not a real sulphur, but "the vapours or fine effluvia thereof mixed with the water," which the illustrious Bergman has since fully demonstrated. He likewise takes notice of St. Mongah's or St. Mungo's-Well, which in the dark and gloomy ages of superstition, when every spring or grove had it's tutelar saint or guardian divinity, was renowned for it's virtues, and celebrated for it's cures. But superstition, and the follies to which it gives birth, die tegether; and it often happens, that when

from such causes any wonderful effects are attributed to any particular spring, &c. as soon as the delusion is dissolved, we are apt to neglect the simple virtues which it may in reality possess. This has been particularly the case with St. Mungo's-Well, as well as several others which have been honored with the nominal protection of any particular saint. This well, which is situated about half a mile to the east of the sulphur wells,* is undoubted an excellent cold bath, the water being exceedingly pure and cold, and would certainly answer every intention that can be expected from the Ilkley-Spaw, which is nothing but a pure cold water. In that part of the work where the author treats of the virtues of the Harrogate waters, we meet with much of the scholastic jargon which at that time involved physic in unmeaning verbal altercations. Medicine has generally been influenced by the philosophy of the day, and we find the theories of this

* Though Mr. Hargrove thinks that the cold bath at Copgrove is most probably the well formerly dedicated to St. Mungo, yet every writer on these waters that I have seen, has described it as situated near Low-Harrogate, to the east of the sulphur wells —*See Hargrove's history of Knaresbrough, Harrogate, &c., 6th edition.*

writer, tinctured with the hypothesis of his time.

"When moist and dry held everlasting war."

The following will serve as a specimen; speaking of the chalybeate water, he says, "This water cools and moistens actually, but dries and heats potentially: whereby the diseases of the body which flow from an excess of these four qualifications, are tempered and reduced. It corroborates, astringes, and relaxes: yet, it's restriction occasions the retention of nothing that should be evacuated; and, by relaxation evacuates nothing that should be retained. It dries nothing but what is too moist and flaccid; it heats nothing but what is too cold, and e contra."

In the year 1656, Dr. George Neale, of Leeds, who attended this watering place, (which he and his son, Dr. John Neale, of Doncaster, did for 67 years*,) wrote a treatise on the nature and virtues of these waters; but, though at that time it would have been thought a valuable work, he never published it. His widow however gave to Dr. Short the principal part,

* Short's natural history of mineral waters.

which is inserted in his natural history of mineral waters. Viewing it in a chymical light, he has perhaps committed more mistakes than any of his predecessors; for he asserts that the Tewit-Well and Old-Spaw contain both vitriol and nitre; and that the sulphur-waters contain vitriol, nitre, and copper; none of which substances are, however, to be found in them. The directions concerning the use of the waters, are nevertheless valuable, and we likewise learn from this writer, that these waters were drunk in much larger quantities; at that time, than they are at present, particularly the chalybeates, and with the happyest effects. He advises his patients to begin with what he calls a moderate dose of the chalybeate-water, as three pints or two quarts, and to add to this, every day, for three days after, a glass or two more, which is to be the fixed quantity, provided it go readily off.

Of the sulphur water, he recommends three or four pints at a time, though some, he says, drink five or six; a proof, among many others, that the purgative power of these springs, is not weakened, as some have supposed.

About 10 years after Dr. French's treatise appeared, and five after the above-mentioned tract, of Dr. Neale's, was written, Dr. Simpson, in his *Hydrologiæ Chymicæ* gave an account of the Harrogate waters, or as they were then called The Knaresburgh spaws. This account contains nothing materially different from those of his predecessors: he made a great many experiments upon the different waters, with alkalies, dropping them alternately several times into the same glass of water, but does not draw any conclusions of consequence from them.

After this, the mineral waters at Harrogate seem not to have engaged the attention of any writer, for a considerable time, no publication appearing on the subject for near 70 years; when the ingenious and indefatigable Dr. Short, of Sheffield, in the year 1734, published his natural, experimental, and medicinal history of the mineral waters of Derbyshire, Lincolnshire, and Yorkshire. In this elaborate work, the author treats of 131 mineral waters, which he had examined with the greatest attention. His work at that time was the best extant, and was so much esteemed

by the royal society, that Dr. Short was requested to publish it, by that learned body, as we find in an extract from their records, prefixed to the work. It was not to be expected, that the celebrated mineral waters at Harrogate would escape the attention of this accurate observer: he made more experiments, and these were better conducted, than those of any author before him; but still, on account of the imperfect state of chymical knowledge at that time, his analysis is very deficient. Indeed, the æriform fluids, to which these, as well as other mineral waters owe many of their most valuable properties, were, till lately, either entirely unknown, or very imperfectly understood. What the early writers called the spirit of the waters, and which, Dr. Short says, never would be collected or confined in any vessels, is now known to be fixed air or carbonic acid, which we can collect and confine with the greatest ease. For want of this knowledge, Dr. Short thought, that the chalybeate waters at this place were impregnated with a vitriol of iron, but which was volatile, and escaped even through corks and glass vessels; and that the water then produces no longer a purple co-

lor, with tincture of galls. This writer mentions an alum well, in the bog above Low-Harrogate, which I cannot find at present: some old people in the neighbourhood remember the situation, and we have often attempted to find it, by digging in different parts of the bog, but have hitherto been disappointed. From his experiments, it seems to have been a chalybeate water, in which the iron was held in solution by the sulphuric acid. I have found two or three springs of this kind in the bog, very near some sulphur wells, though not in the least mixed with them: so astonishing is the variety and vicinity of the mineral waters of this place.

About 39 years after the publication of Dr. Short's work, Dr. William Alexander published a small pamphlet, entitled, "Plain and easy directions for the use of the Harrogate waters." This is entirely a popular treatise, containing no attempts to investigate the nature and properties of these waters: his directions are very plain, and sometimes very proper, though several of them are now disused, more proper rules having of late years been adopted. The pamphlet is, however, written in a

plain and easy style, and perfectly intelligible to the lowest capacity.

The sulphur water was analyzed by Dr. Higgins, in the year 1780; and though his analysis comes the nearest the truth of any that has yet appeared, yet it will be shown that some of the principles have escaped him, particularly the *azotic* gas: but, as there is not the least shadow of reason to suspect the accuracy of this excellent chymist, this defect must be attributed to the analysis being made in London, and it is most probable that the greatest part if not all the azotic gas would have escaped before the water could be carried to so great a distance. Another circumstance ought to be taken into the account, viz., that at that time the nature and properties of this elastic fluid were very little known.

In the year 1784, Dr. Walker, of Leeds, published an essay on the Harrogate waters, and those of Thorp-Arch; which, in the medical part, contains some very useful directions, and some excellent observations on cutaneous diseases, particularly *Herpes*, and *Lepra*; diseases in the

cure of which these waters have long been deservedly celebrated, but which, even by medical practitioners, have been almost universally termed scorbutic: and, so far has this absurd idea been carried, that where there was not the least appearance of eruption, and where the disease has been known to be exactly of a contrary nature, it has been confidently affirmed to depend upon a *scorbutic acrimony*, which the water, by some unknown magic power, would drive out of the body.

The chymical part, however, of Dr. Walker's work, though containing some very just remarks and accurate experiments, is deficient; and we are not furnished with, by any means, an accurate analysis of the sulphur water, which is the only one the doctor has attempted: but this undoubtedly proceeded from the author's not having seen the writings of the celebrated Bergman, neither could he be acquainted with the new chymical system which has been since published, and has thrown so great a light on this subject; otherwise, the abilities of the doctor are so well known to me, that if the avocations of an extensive practice would have

permitted him to repeat his analysis, this essay of mine would never have appeared.

In the Philosophical Transactions, we have an excellent dissertation on the Harrogate waters, by the bishop of Landaff; and though this eminent chymist has not attempted any analysis of those waters, yet he has presented us with several ingenious conjectures and observations concerning their sulphureous impregnation, which will be noticed afterwards. He observes, that "sulphur is rendered soluble in water, by it's being united to fixed air, or *some other volatile principle.*" How very near this conjecture came to the truth, will soon appear.

For a long time, the sulphur and chalybeate springs were the only waters known at Harrogate; but in the year 1783, the Crescent-Water was discovered, which being of a middle nature, and containing the ingredients of both, is peculiarly suited to some diseases, of which I have given an account in another part of this book; it has come into considerable use, and is certainly a valuable acquisition to Harrogate. I have, perhaps, consumed more

time on the history of these waters, than may be agreeable to some of my readers; yet, I hope, that to the greater part, it will be neither disgusting nor unprofitable. It is a pleasing, as well as useful task, to trace the progress of any science or literary subject, from the first dawnings of light, till it arrived at it's present state: but the principal reason that induced me to undertake this part, was, because most of the treatises which I have noticed, have become exceedingly scarce, and notwithstanding a full account of them is given by Dr. Short, yet his book is in the hands of few, and it is probable will never be reprinted: hence, in a few years, it might not have been in the power of any subsequent writer, for want of materials, to have given an historical account of the dicovery, &c., of these celebrated springs: on this account, I have noticed the early writers more fully, and have slightly passed over the more modern, but valuable publications, which it would have been unnecessary to have noticed on any other account, than to render the preceding history more complete.

PART II.

THE ANALYSIS OF THE Harrogate Waters.

SECT. I.

Of the Sulphur Water.

THERE are four sulphur wells, very near each other, at Low-Harrogate, which differ only in the quality of impregnating principles. That which is commonly used for drinking, is the strongest; the others supply water for the baths, which is collected as it springs, and poured into vessels kept for the purpose, from which it is pumped into casks, and conveyed to the different houses, as it is wanted.

Of these four sulphur wells, I shall call the Drinking-Well the first; that about a yard distant from it, to the right, the se-

cond; and proceeding still to the right, we meet with the third and fourth. My experiments on these different wells, lead to the same conclusions as those of the bishop of Landaff, viz., that the first is the most strongly impregnated, the third the next strongly; and, that the second and fourth are nearly of the same strength, but considerably weaker than the first and third. The second and fourth are not so clear as the first and third, being somewhat cloudy, which is most probably occasioned by their having some communication with the external air, before they make their appearance.

Though the second and fourth wells have been often frozen, yet the first and third have continued fluid in the most extreme frost, having a temperature several degrees below the freezing point, which proves, that it is the great quantity of salt, with which they are impregnated, which preserves them from being frozen, in the coldest seasons incident to the climate.

Since these four wells differ only in strength, I shall content myself with relating the experiments which I made upon

the Drinking-Well, being the only one used internally ; and shall begin with a few observations on it's physical properties.

This water, when taken up from the well, is perfectly clear and transparent, and sparkles when poured out of one glass into another. The taste is very saline, and at first disagreeable. It has a strong hepatic, or sulphureous smell, similar to bilge water, or scourings of a gun. When this water is exposed to the open air, it soon begins to grow turbid, and acquires in some degree a greenish tinge; a white powder is slowly deposited, and it gradually loses it's sulphureous smell.

By means of an accurate hydrometer, which displaced near a quart of water, the specific gravity of this water was found to be to that of distilled water as 10,064 to 10,000, the temperature of both being 60 degrees.

Experiment I. A piece of paper, on which characters were written with a pen dipped in a solution of *acetite of lead*, (saccharum saturni) being placed over a glass, nearly filled with the water, just

taken from the well; the characters soon became visible, and of a color nearly black. When such a paper is plunged into the water, the blackness is instantly produced and is more intense. This experiment was repeated with water which had been boiled for a few minutes, and also with water which had been exposed for 24 hours to the open air; but the characters were not in either case rendered visible.

This experiment shows, that this water is strongly impregnated with hepatic air, or *sulphurated hydrogen gas*; and that this gas escapes, or is decomposed on exposure to heat, or to the atmosphere.

Exper. II. *Nitrat of silver* being dropped into a glass of the water, just taken from the well, produced a very copious precipitate, of a dirty brown color. With water that had been boiled, it produced a copious white-colored precipitate, which was soluble in distilled vinegar.

The first part of this experiment likewise shows, that this water contains sulphurated hydrogen gas, which gives the precipitate formed by the nitrat of silver,

it's brown color. The second part shows, that this water contains a large quantity of muriatic acid united to some base, it being the property of the muriatic acid to separate the silver from the nitric acid, forming muriat of silver, which is distinguished from sulphat of silver, by being soluble in distilled vinegar.

Exper. III. *Muriat of barytes* being dropped into a glass of the water, no change was produced at first, but after standing about half an hour, the water became slightly turbid. This shows the presence of the sulphuric acid, though in a very small quantity.

Exper. IV. A few drops of an aqueous solution of *acid of sugar*, being mixed with a glass of the water, instantly produced a turbid appearance, and in a short time, a copious white precipitate fell to the bottom of the glass.

This experiment shows, that this water contains lime or calcareous earth, in a considerable quantity.

Exper. V. *Tincture of turnsole*, being

mixed with an equal quantity of this water, just taken from the well, the color inclined to red. The experiment being made with water which had been slightly boiled, the color was not perceptibly changed.

Hence we might conclude that this water contains a little *carbonic acid*, (fixed air,) though the quantity must be very small.

Exper. VI. *A solution of soap*, in equal parts of alcohol and distilled water, was instantly decomposed on being dropped into a glass of this water. The oil floated on the top, and a small quantity of white precipitate fell to the bottom.

Exper. VII. Neither *tincture of galls* nor *prussiat of potash* produced any effect upon the sulphur water.

Exper. VIII. I next endeavoured to ascertain the nature and quantity of æriform fluids, which this water might contain; for which purpose I made use of the machine described in my treatise on the Crescent-Water, which certainly is by

much the most convenient for such experiments of any I have seen. This machine which holds half a gallon, wine measure, being filled at the well, and a graduated phial of rain-water heated to about 100 degrees, being inverted over the pipe, the apparatus was placed on a fire, and made to boil gently. As soon as the water in the vessel became warm, bubbles of air began to rise into the inverted phial, which increased as the heat increased. When it had boiled for about a quarter of an hour, very slowly, the bubbles ceased to rise: and, after making the necessary allowance for rarefaction of the æriform fluid by heat, the quantity collected from the half gallon of water, was found to be exactly 17 cubic inches, or 34 from a gallon. This air being passed through a phial full of lime-water, caused a white turbid appearance, and communicated to the water a strong sulphureous smell, which shewed that in this mixture of airs were contained *carbonic acid gas*, or fixed air, and *sulphurated hydrogen gas*, or hepatic air. I endeavoured by agitation to dissolve this air in the water, and it was quickly reduced to three cubic inches and a half; but, though I repeatedly made it pass through fresh portions of

lime-water, and common water that had been boiled, and agitated it violently for more than two hours, the bulk was no farther diminished. A lighted wax-taper was plunged into this gas, but was instantly extinguished. It was suffered to stand over night in a vessel of water, which had been boiled; but, in the morning, it was not in the least diminished. I again endeavoured to combine it with water, by agitation, but without effect.

These circumstances occasioned no small surprise to me, as well as to some gentlemen who were present, when I made the experiments. We naturally concluded, that this gas was of the same nature with that which M. Lavoisier calls *azotic gas*; and, which has been described by Dr. Priestly, by the name of *phlogisticated air*; being that elastic fluid, which, with regard to quantity, forms a considerable part of our atmosphere. For, according to M. Lavoisier, the air of the atmosphere consists of nearly three fourths of *azotic gas*, and one fourth of *oxygen gas*, or pure vital air. But, as the existence of this gas was never suspected in any of the waters at Harrogate, I was determined

carefully to repeat the experiment; and, upon filling the machine with water, and placing it on the fire as before, I obtained exactly the same quantity of gas, viz., three cubic inches and a half from the half gallon, or seven cubic inches from the gallon, which water would not absorb, which did not precipitate lime from lime-water, but which immediately extinguished flame. This gas seemed more loosely attached to the particles of the water, than either the carbonic acid or sulphurated hydrogen, and almost the whole of it escaped before the water was heated to it's boiling point. This I ascertained by the application of three different graduated phials during the experiment; receiving an equal quantity of gas in each phial, before it was removed. The phial which was first applied, contained the largest quantity of gas, not absorbable by water; the second contained much less; and the third, which was applied almost at the time the water began to boil, contained scarcely any.

On standing some time near the sulphur wells, large bubbles of air are observed to rise from the opening, at the bottom of the bason, and break at the surface, frequently

two or three times in a minute. This air has almost universally been supposed to be fixed air; but, from the quantity which thus arises, and upon reflecting that none of these waters are so fully saturated with fixed air as to part with it so freely, I suspected it was azotic gas: I therefore filled a half pint glass with the water, and held it inverted in the well, directly over the opening at the bottom of the bason; in about a quarter of an hour the glass was half full of gas, though a great many bubbles escaped which I was not able to catch. This gas was put into a graduated phial, and found to measure eight cubic inches: it did not cause the least decomposition on being mixed with lime-water, neither could it be combined with water by agitation; and being allowed to stand over night in a phial inverted into water which had been boiled, it's bulk was not in the least diminished

Having observed bubbles of air rise in large quantities, from some of the sulphur waters in the bog above the village, I went to collect a quantity of it, and was astonished to find it so plentiful, that in one of the wells I collected a quart bottle full of these

bubbles, in less than five minutes, by holding the bottle filled with water inverted into the well, with a funnel in it's mouth to catch the bubbles as they rise. I found that this air exactly corresponded in it's properties, with that which I procured from the drinking sulphur well. From the wells in the bog I afterwards collected a large quantity of this gas, and made a number of experiments with it, which though made some time after these I have just related, and those which will soon follow, yet will, perhaps, be best introduced here.

Exper. IX. About 40 cubic inches of this gas were put into a wide-mouthed jar, and a sparrow introduced; it immediately showed signs of great uneasiness, in less than a minute was seized with convulsions, and expired in little more than two minutes. Another sparrow was allowed to remain in the same quantity of common air for 10 minutes, without showing any signs of uneasiness.

Exper. X. Four cubic inches of this gas were mixed with two of nitrous gas, in a graduated tube, but though they stood

mixed for more than an hour, no diminution of bulk was perceived.

Exper. XI. Four cubic inches of this gas being mixed with an equal quantity of atmospheric air, in a phial, and the mixture well agitated; it did not explode when a lighted wax taper was introduced, the taper being almost immediately extinguished.

Exper. XII. Six cubic inches of this gas being mixed with two of oxygen, or pure vital air, procured from nitre, by the application of heat, a lighted taper burned in this mixture nearly in the same manner and for the same length of time as it did in the same quantity of atmospheric air. These circumstances combined, certainly prove that this gas is the same with the azotic gas of M. Lavoisier, but which has never, that I know of, been suspected in the cold mineral waters. Dr. Pearson has found a similar permanently elastic fluid, in large quantity, in the warm waters of Buxton; and, in his ingenious treatise on those waters, he has been at great pains to determine it's properties, by a number of accurate experiments; he however thought

that it was peculiar to the Buxton water, and perhaps to the warm waters of Bath ;* but I am of opinion that it is contained in almost every chalybeate and sulphurated water.

Dr. Pearson, following Dr. Priestley, supposes this gas to be a compound of pure vital air and phlogiston, and therefore calls it *phlogisticated air*, but the theory of the french chymists seems more probable, who imagine this air to be a simple substance, at least one which has never been yet decompounded; and, that it is the basis of the nitrous acid and volatile alkali.

Having ascertained the nature of this gas, I hope in a satisfactory manner, I proceeded to separate the three gases contained in the sulphur water from each other, and determine the quantity of each, which was done by the following experiment.

Exper. XIII. I took a wine quart of milk of lime, which contained a much greater quantity of calcarious earth than

* See directions for impregnating the Buxton water with it's own and other gases, by George Pearson, M. D.

was sufficient to absorb the air contained in an equal quantity of the sulphur water, even if it had all been fixed air: this I put into the machine before-mentioned, and added to it a quart of the sulphur water, which exactly filled the vessel; the tube being stopped with a cork, and the shelving part being filled with water to a proper height, the mixture was allowed to stand for near an hour, before which time the fixed air must have been all absorbed by the lime. I then applied a graduated phial filled with water as before, and placed the apparatus on the fire. When the air had ceased to rise, I found the quantity contained in the inverted phial to be exactly six cubic inches and a half, which, if it had been procured from a gallon of water, would have been 26 cubic inches; but, the whole quantity of gases, procured from a gallon of this water, was found to be 34 cubic inches; the quantity of fixed air, absorbed by the lime, must therefore have been eight cubic inches. The remaining air being passed through lime-water, produced no decomposition, but impregnated the water with a sulphureous smell. We have here then 26 cubic inches of elastic fluid, consisting of sulphurated hydrogen and

azotic gas, of which, by experiment VIII, we know that seven cubic inches are azotic gas, the quantity of sulphurated hydrogen gas must consequently be 19 cubic inches. To be more certain of this, I agitated the mixture of hepatic and azotic gas in water, till the former was all absorbed, and there remained, more exactly than I expected, one cubic inch and three quarters of azotic gas, which was the quantity procured from a quart of the water, this quantity in a gallon, would be seven cubic inches, or exactly the same quantity procured by experiment VIII.

Exper. XIV. About a quart of the sulphur water was evaporated very slowly in an earthen vessel* to dryness, and a quantity of white-colored salt obtained. Upon part of this salt, I poured some concentrated sulphuric acid; I instantly perceived a grey smoke, attended with a peculiar smell, which I knew to be that of the muriatic acid. A wet paper being held over the salt, the vapour instantly surrounded it, in the form of a cloud, which was

* I used for evaporating, thin, unglazed, shallow earthen vessels, made by Mr. Wedgewood for that purpose, which I find to answer better than any other.

another proof that this salt contained the muriatic acid.*

Exper. XV. A little of this salt being dissolved in distilled water, and a few drops of muriat of barytes being mixed with it, the mixture became in some degree turbid, and a small quantity of a white precipitate fell to the bottom of the glass.

This experiment shows, that besides the muriatic acid, this salt contains a small quantity of sulphuric acid.

Exper. XVI. A wine gallon of the sulphur water was slowly evaporated to dryness, and the quantity of salt found at the bottom of the vessel, weighed 1 oz. 11 dwt. 10 gr.

Exper. XVII. This salt was put into a phial, and rectified spirit poured upon it, to the height of about three inches, the phial was allowed to stand 24 hours, being frequently shaken in the mean time: it was then filtered.

Exper. XVIII. To the residuum was

* Bergman's chymical essays, vol. I., p. 167.

then added about eight times it's weight of cold distilled water; the mixture was shaken, and after standing about 24 hours, it was filtered, and a white powder was left on the filter, which, when carefully dried, was found to weigh exactly one pennyweight. This was, as near as possible, the same quantity of powder obtained by filtration, from the water which had been boiled, till no farther precipitation took place; it was consequently held in solution by the gases, or mechanically mixed with the water, and easily separated from it.

I next proceed to examine the solution obtained by the rectified spirit, which was clear and void of color, but had a very bitter taste. Since this solution generally consists of muriat of lime, or muriat of magnesia,* to discover whether either or both of these substances were present here, I made the following experiment.

Exper. XIX. I took some of the salt, obtained from the water by experiment

* Bergman's physical and chymical essays, vol. I., p. 264.

XIV, and poured rectified spirit on it in the same manner as upon the salt procured from a gallon of the water. (Exper. XVII, A.) A little of this spirituous solution was evaporated to dryness, and upon pouring some concentrated sulphuric acid upon it, it was evident from the peculiar smell and grey smoke, that this salt contained the muriatic acid in it's composition.

Exper. XX. A little of this salt was dissolved in distilled water, and a few drops of nitrat of silver were mixed with it; a turbid appearance was produced, and a white precipitate fell to the bottom; this precipitate being collected by filtration, was soluble in distilled vinegar, and consequently was formed by the muriatic acid.

Exper. XXI. Into part of the remainder of this solution was dropped a small quantity of muriat of barytes, but no change was produced which indicated the presence of the sulphuric acid. The acid, therefore, contained in this salt, was evidently the muriatic. The next object was to determine the acidifiable base or bases,

which was attempted in the following manner.

Exper. XXII. To a little of this solution, I added an equal quantity of lime-water: a decomposition soon took place and a white precipitate in fine flakes, like snow, soon fell to the bottom of the vessel. The caustic volatile alkali produced the same effect: this precipitate being saturated with diluted sulphuric acid, and evaporated it gently till it began to show signs of crystalization, was suffered to stand about 40 hours; at the end of which time, several crystals where found, which, from their taste and figure, were undoubtedly sulphat of magnesia.

Exper. XXIII. Into another portion of the solution, a few crystals of acid of sugar where put; the mixture became turbid, and in the course of half an hour, a precipitate was formed; this showed that this salt contained lime as well as magnesia. To be more certain, a quantity of diluted sulphuric acid was gradually dropped into some of the solution; the mixture became turbid, and a precipitate was collected, which was found to be sulphat of lime, or

selenite, by precipitating the lime from the sulphuric acid, by carbonat of potash, calcining the precipitate, dissolving it in distilled water, and precipitating it again by fixed air. This salt then, which was dissolved by the alcohol, consists of muriat of magnesia, and muriat of lime. The quantity of each was next to be determined.

Exper. XXIV. I evaporated the first spirituous solution (exper. XVII.) to dryness, and obtained 4 dwt. 8 gr. of salt, which being exposed to the air, was very deliquescent. Having dissolved it in distilled water, diluted sulphuric acid mixed with tincture of turnsole, was added very slowly, till the bases were saturated with the acid, which could be judged of by the color of the tincture of turnsole. The sulphat of lime which fell to the bottom, was separated by filtration, and found to weigh 17 grains, which, according to Bergman, must have been produced from the decomposition of 13 grains of muriat of lime very nearly. A wine gallon of this water consequently contains 13 grains of muriat of lime, which subtracted from the 4 dwt. 8 gr. of salt dissolved by the alcohol, leaves 3 dwt. 19 gr., the quantity of

muriat of magnesia contained in a gallon of the water.

Exper. XXV. The solution made with cold distilled water, (exper. XVIII.) was next examined. Upon being evaporated very slowly to dryness, the weight of the salt was found to be 1 oz. 6 dwt. 2 gr. To discover the nature of this salt, I procured a quantity of it from a quart of the water in the same manner, which being set to crystalize, formed beautiful cubic crystals, which appeared to consist all of common salt. A little concentrated sulphuric acid, being poured on some of this salt, instantly indicated the presence of the muriatic acid by the peculiar smell and smoke which were produced: A little of the salt was dissolved in distilled water; acid of sugar produced no effect on being mixed with it, but muriat of barytes caused a turbid appearance, and a small quantity of precipitate. This showed, that besides the muriat of soda, or common salt, there was likewise a salt which contained the sulphuric acid. To determine base, lime-water was added to a little of this solution; the mixture soon became turbid, and a small quantity of

precipitate fell to the bottom. Caustic volatile alkali prduced the same effect: hence it was evident, that the base of the vitriolic salt, was magnesia. To determine the quantity of this earth, the whole quantity of salt amounting, as was before-noticed, to 1 oz. 6 dwt. 2 gr. was dissolved in distilled water, and perfectly caustic volatile alkali was gradually added, till no more precipitation took place; the precipitate was collected by filtration, and found to weigh exactly two grains. To determine the quantity of sulphat of magnesia, from which these two grains of magnesia had been precipitated, we must recollect, that according to Mr. Kirwan, 100 grains of crystalized sulphat of magnesia contained 23,75 of acid, 19 of earth, and 57,25 of water: The quantity of this salt, from which two grains of magnesia were produced, must therefore have been 10,5 grains very nearly. This subtracted from 1oz. 6dwts. 2gr. leaves 1oz. 5dwt. and 15,5 grains muriat of soda, or common sea-salt. To be certain that there was no sulphat of soda, (glauber's salt) mixed with this muriat of soda I took a quantity of salt which had been procured from the water, in the manner

mentioned in experiment XIV., and having dissolved it in distilled water, lime-water was added as long as any precipitate was formed; in this case, both the magnesia and the sulphat of lime produced by the lime-water, fell to the bottom; and, the only remaining salt containing the sulphuric acid, must have been sulphat of soda; but, upon mixing with the clear solution, a few drops of muriat of barytes; no signs of the presence of the sulphuric acid were discovered.

Exper. XXVI. The pennyweight of powder procured by experiment XVIII., was put into a phial, and distilled vinegar poured upon it, which after standing 24 hours, and being frequently shaken in the mean time, had dissolved the whole of the powder. This solution was evaporated to dryness, and left a filamentous substance, resembling moss of a very white color, and having an exceeding bitter taste. This substance being exposed to a moist air for about a week, became in some degree diliquescent, which made me suspect that besides acetite of lime, there was some acetite of magnesia; for Bergman

observes,* that "this substance is permanent in a moist air, if it only consists of lime; but diliquescent if it contain magnesia." To ascertain this more fully, a quantity of powder was procured from the sulphur water boiling; it was dissolved in distilled vinegar, and a little lime-water added to it, which immediately caused a decomposition. The same effect was produced by caustic volatile alkali, a white powder was in both cases precipitated, which was undoubtedly magnesia. A little acid of sugar added to some more of this, caused a very copious precipitation. Having thus satisfied myself, that this powder consisted of lime and magnesia, I took the whole powder dissolved in distilled vinegar, and having dissolved it in water, I added diluted sulphuric acid, which instantly caused a turbid appearance; this acid was added as long as any thing was precipitated; and by filtration, I obtained 30 grains of a white insipid powder, which I found to be selenite. Now, if we recollect, that, according to Bergman,† 100 parts of selenite contain 84 of pure lime, the 30 grains

* Chymical essays, vol. I, p. 161.

† Physical and chymical essays, vol. I., p. 162.

here obtained, will contain 10¼ of pure lime, which is equivalent to 18½ grains of carbonat of lime, very nearly: the remainder of the solution being evaporated very slowly, formed crystals of sulphat of magnesia.

The 18 grains and a half of carbonat of lime, being subtracted from 24 grains, the whole quantity of powder, we have 5½ grains of carbonat of magnesia.

From the preceding experiments we may therefore conclude, that a wine gallon of the sulphur water, taken from the Drinking-Well, contains

	oz.	dwt.	gr.
Of muriat of soda, or common salt . . .	1	5	15,5
Muriat of lime . . .	0	0	13
Muriat of magnesia . .	0	3	19
Carbonat of lime . . .	0	0	18,5
Carbonat of magnesia .	0	0	5,5
Sulphat of magnesia, or Epsom salt . .	0	0	10,5
	1	11	10

Of aeriform fluids:

	Cubic inches.
Carbonic acid gas, or fixed air . . .	8
Azotic gas	7
Sulphurated hydrogen gas, or hepatic air	19
	34

As 100 cubic inches of carbonic acid gas, according to Bergman,* can dissolve no more than 27 grains of carbonat of lime, the eight cubic inches procured from a gallon of this water, can scarcely take up more than two grains; the greatest part of the carbonat of lime found in this water, must therefore be either mechanically suspended in it, by the minuteness of it's parts, or held in solution by the other gases. Whether the other gases can hold this earth in solution, has not, I believe, been yet determined by experiment.

* See the treatise on the aerial acid, vol. I, of Bergman's chymical essays.

SECT. II.

Of the Old-Spaw.

THIS water has a pleasant chalybeate taste, is exceeding clear, and sparkles a little when poured from one glass into another.

It's specific gravity, at the temperature of 60°, is to that of distilled water, as 1,00014 to 1,00000.

Exper. I. Six drops of tincture of galls being mixed with a wine glass full of this water, just taken from the spring, a beautiful dark purple color was produced.

Exper. II. Prussiat of potash being mixed with the water, produced a very beautiful dark green color, and bubbles of air were seen to rise from the water in great quantity.

After the water had been kept near the boiling heat for almost half an hour, neither tincture of the galls, nor prussiat of potash produced an effect. The water deposited a brown flocculent sediment, and a great many bubbles adhered to the sides of the vessel.

From these experiments, it appears that this water contains *iron*, which is held in solution by a volatile substance, which substance readily escapes on the application of heat, in consequence of which the iron held in solution by it is deposited.

Exper. III. This water, on being mixed with tincture of turnsole, changed the color evidently to a red. The same quantity of distilled water did not occasion the least redness. This tincture produced no effect upon water which had been boiled, or exposed to the open air for 24 hours.

From this experiment it appears, that this water contains an acid which is of a volatile nature, since it escapes the application of heat, or exposure of the water to the air.

Exper. IV. Muriat of barytes produced no change of this water at first, but after the mixture had stood about two hours, a slight diminution of transparency was produced.

From this experiment it appears, that this water contains very little sulphuric acid; but, that it contains more than we should suspect from this experiment, will afterwards appear. The reason why it did not cause a more turbid appearance in this experiment is, because though the sulphat of barytes possess little solubility, yet a small quantity will be perfectly dissolved in a large quantity of water. The small quantity of sulphat of barytes here produced by the decomposition of the muriat by the sulphuric acid, is almost all dissolved in so large a quantity of water.

Exper. V. Acid of sugar being mixed with the water, produced no sensible effect.

Hence we might be induced to suspect that this water contains no calcarious earth, the contrary of which will afterwards appear. For the same reason men-

tioned in the last experiment, the saccharated lime here formed, being so small in quantity, is dissolved by the water as it is formed.

Exper. VI. The pneumatic machine, which I used to procure the airs from the sulphur water, being filled with water from the Old-Spaw, and the same method being followed as mentioned in the analysis of the sulphur water. (Exper. VIII.) Twenty cubic inches of elastic fluids were procured from a gallon, of which 15¾ were found to be fixed air, or carbonic acid gas, and 4¼ azotic gas.

Exper. VII. A wine-gallon of the water was put into an earthen vessel, and exposed to a degree of heat little short of boiling, in an oven, for 12 hours. A quantity of brown sediment fell to the bottom, which being collected by filtration, was found to weigh exactly two grains. The water from which this sediment had been procured, was not changed on being mixed with tincture of galls.

Exper. VIII. This powder having been exposed, for near a month, to the rays of

the sun, and frequently moistened in the mean time, was put into a phial containing some distilled vinegar. Though this method is recommended by Bergman for separating calcarious earth, and magnesia from the earth of iron, yet I do not find it sufficiently exact; for though the iron be ever so well oxygenated, yet the vinegar dissolves a little of it, as is evident on the addition of tincture of galls, which precipitates the iron from the vinegar, of a beautiful blue color; for which reason, I always precipitate the iron, which may be dissolved by the distilled vinegar, by tincture of the galls, before I evaporate the aceteous solution.

Having precipitated the iron from this solution, and filtered it, the clear solution was evaporated to dryness, but nothing was found at the bottom of the vessel; a proof that neither calcarious earth nor magnesia were mixed with this powder.

Some of this powder being mixed with powder of charcoal, and exposed to a red heat for half an hour, every particle of it was attracted by the point of a small needle, which had been rendered magne-

tic. The remainder of this powder was entirely dissolved by diluted sulphuric acid, and the solution was very clear and colorless. Tincture of galls being mixed with it, produced a dark color, almost as black as ink.

Hence we may conclude, that a wine gallon of the Old-Spaw water contains two grains of carbonat of iron, held in solution by carbonic acid, or fixed air.

Exper. IX. A quart of this water, from which the carbonat of iron had been separated by boiling and filtration, was evaporated slowly to about three ounces. Muriat of barytes being mixed with part of this residuum, produced a turbid appearance, and a very small quantity of white precipitate fell to the bottom. Nitrat of silver produced a slight decomposition, and let fall a white precipitate, which, by standing, was changed, in some measure, to a brown or pink color; this precipitate was not soluble in distilled vinegar, or in the nitric acid.

But these trials show that vitriolic acid is present in the water; the precipitate

caused by the union of this acid with silver is not soluble in the acetic or nitric acids, as that is which is caused by the muriatic acid.

Acid of sugar scarcely produced any perceptible change at first; but, after standing a considerable time, the mixture became slightly turbid. This shows that the quantity of lime contained in this water is very small. From these experiments we likewise learn, that we are not to conclude that there is no sulphuric acid, or calcarious earth present in a water, if no precipitate be produced by muriat of barytes or acid of sugar, though we may be certain that the quantity is very small; but, we must also evaporate a considerable quantity of the water almost to dryness, and then repeat our experiments with these tests, before we can draw any satisfactory conclusion.

Exper. X. Upon evaporating the gallon of water from which the carbonat of iron had been separated (exper. VII.) to dryness; I obtained 4½ grains of saline matter, of which three were sulphat of soda or Glauber's salt, and 1½, as nearly as I could

determine, sulphat of lime, or selenitè. The sulphat of lime was separated from the Glauber's salt, by pouring upon the saline matter 30 drops of distilled water; this dissolved all the latter salt, but scarcely any of the former, which was collected by filtration, and weighed. The sulphat of soda, after several trials, was obtained in crystals. This part of the analysis I found more troublesome and perplexing than all the rest.

We have, by these experiments, obtained from a wine gallon of the Old-Spaw water, the following substances.

	Grains.
Of carbonat of iron	2
Sulphat of soda	3
Sulphat of lime	1,5
	6,5

Of aerial fluids:

	Cubic inches.
Carbonic acid gas, or fixed air . .	15,75
Azotic gas	4,25
	20

Exper. XI. To a wine quart of this

water, just taken from the well, lime-water was added, which immediately caused a turbid appearance, and a fine cloudy precipitate gradually fell to the bottom; the lime-water was added, till no more precipitate was produced. This precipitate being collected by filtration, was found to weigh exactly six grains, which, if it had been procured from a gallon of the water, would have been 24 grains. From this if we subtract two grains, the quantity of carbonat of iron contained in a gallon of the water, we shall have 22 grains of carbonat of lime: but according to Bergman,* 100 grains of carbonat of lime contain 34 of carbonic acid, and consequently 22 grains of carbonat of lime will contain 7,48, or 7½ grains very nearly of carbonic acid. Now, supposing a cubic inch of carbonic acid gas to weigh half a grain, which is very near the truth; we shall have by these means 15 cubic inches of carbonic acid gas in a gallon of this water, (which is within a quarter of a cubic inch) the same quantity procured from the water, by the pneumatic vessel.†

* Physical and chymical essays, vol. I , p. 32.

† The invention of this method of ascertaining the

This experiment was made with a view of ascertaining the accuracy of the pneumatic machine, and this coincidence surprised me: I therefore repeated this experiment, with lime-water, as carefully as possible, and the weight of the precipitate was within less than half a grain of the last. Hence it appears that this vessel is not only by much the most convenient for experiments of this nature, but that it's accuracy may be relied on with great certainty.

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quantity of carbonic acid, by means of lime-water, has generally been attributed to Mr. Gioanetti; but, in a letter which I received from Dr. George Pearson, soon after the publication of the first edition of this treatise, he asserts his claim to the discovery, which, he says, was published in his treatise on the Buxton waters, before it was made known by Mr. Gioanetti.

SEC. III.

Of the Tewit-Spaw.

THIS water is very clear, and sparkles upon being poured out of one glass into another, rather more than the Old-Spaw water. Bubbles of air about the size of a walnut, are frequently seen to rise from the bottom of the spring, and break at the surface. These bubbles consist entirely of azotic gas.

The specific gravity of this water, was found to be to that of distilled water, as 1,00017 to 1,00000, the temperature of both being 60°.

The taste of this water is not very brisk, but evidently chalybeate.

Experiment I. Six drops of tincture of galls being mixed with a wine glass

full of the Tewit water, produced a beautiful purple color, inclining to black, and considerably more deep than that produced with the same quantity of the Old-Spaw water.

Exper. II. Prussiat of potash disengaged a great number of bubbles from the water, and produced a dark green color. Both these experiments were repeated with water which had been boiled, and water which had been exposed for 24hours to the open air, but no more effect was produced than if these precipitants had been mixed with distilled water.

The quantity of iron contained in this water, appears from the preceding experiments to be somewhat greater than that contained in the Old-Spaw, and is, like it, held in solution by a volatile substance.

Exper. III. Tincture of turnsole on being mixed with this water, had it's color changed, by it, to a red, somewhat deeper than by the Old-Spaw. After the mixture had stood 12 hours, the blue color returned.

Hence it appears that this water contains an acid, which escapes on exposure to the air.

Exper. IV. Sirrup of violets produced a color a little inclining to green.

Exper. V. Muriat of barytes produced no sensible effect, after standing near two hours.

Exper. VI. Acid of sugar did not produce any sensible effect at first, but, after standing two hours, a slight turbid appearance was discernable.

From exper. v. it does not appear that this water contains any sulphuric acid; though the contrary will afterwards be shown. The sixth experiment shows, that the quantity of calcarious earth contained in this water is very small.

Exper. VII. A quart of this water, from which the carbonat of iron had been separated, was evaporated till little more than two ounces remained; it began to deposite a fine flocculent matter; Muriat of barytes being mixed with part of it, instant-

ly produced a turbid appearance, and a white precipitate was formed. Acid of sugar produced the same effect. A solution of vegetable alkali in distilled water, produced a slight turbid appearance, and threw down a precipitate. Nitrat of silver produced a precipitate which was at first white, but gradually changed to a dark brown: this precipitate was not soluble in the acetic or nitrid acids. We might hence conclude, with sufficient certainty, that what remained in the water, after it's iron had been separated, was sulphat of lime or selenite; the presence of the sulphuric acid and calcarious earth, being pointed out by these different re-agents.

Exper. VIII. The quantity of gas contained in this water, was determined by means of the pneumatic vessel. A wine-gallon of this water was found to contain 21 cubic inches of permanently elastic fluids, of which 16 were carbonic acid gas, and 5 azotic gas.

Exper. IX. A wine gallon of this water was put into an earthen vessel, and left in an oven, heated to about 140° or 12 hours; it became turbid, and deposited a brown

powder, which, being collected by filtration and dried, weighed two grains and a half. This powder, which was of a much darker brown than that procured from the Old-Spaw water, being subjected to the same experiments, (sec. 2, exper. VIII.) was found to be entirely carbonat of iron. It dissolved perfectly in the sulphuric acid; the acid of sugar did not indicate the presence of any calcarious earth in the solution, and tincture of galls instantly produced a color as black as ink.

Exper. X. The water from which this powder had been procured by the last experiment, being evaporated by a very gentle heat to dryness, deposited gradually a quantity of fine flocculent matter, which being filtered and dried, weighed four grains. This powder had an insipid taste, and being dissolved in distilled water, was found to be sulphat of lime.

We have therefore obtained, from a wine-gallon of the Tewit-Well water, the following substances:

	Grains.
Of carbonat of iron	2½
Sulphat of lime	4
	6½

Aerial fluids:

	Cubic inches.
Carbonic acid gas	16
Azotic gas	5
	21

SECT. IV.

Of the Crescent-Water.

I SHALL first give the general characters and physical properties of the Crescent water, and then proceed to the experiments, which were made in the summer of 1790.

The Crescent water when first taken from the pump and poured from one glass into another, sparkles considerably, and emits numerous bubbles of air, which attach themselves to the inner surface of the glass.

It is not perfectly transparent, but more or less turbid at different times; in general it has a whitish cloudy appearance.

The taste is saline, and rather vapid, imparting a certain smoothness to the pa-

late;* it is much more pleasant than the sulphur water: a chalybeate taste is also very perceptible.

It has an evident sulphurous smell, or hepatic odour, though not near so strong as that emitted by the sulphur water.

By means of a very good hydrometer, the specific gravity of this water was found to be to that of distilled water, as 1002 to 1000, the temperature of both being 60 degrees.

On the 19th of August, 1790, I compared the temperature of the Crescent water with that of the atmosphere, and several other springs, and found the result to be as follows:

	Of Farenheit.
Temperature of the Crescent water - - - - -	52°
——— the pump, in the yard - - - -	55°
——— the Drinking sulphur well - -	54°
——— the well next the Drinking well	67°
——— the lowest sulphur well - - -	56°
——— St. Magnus's well - - - - - -	51°
——— the atmosphere - - - - - - -	60°

* This water seems much more strongly impregnated with fixed air, in winter than in summer: I have found the taste quite acidulous, and very brisk, several times this last winter.

Hence it appears, that the Crescent water is colder than any of the other mineral waters at Low-Harrogate, and nearly as cold as that spring commonly called, (though perhaps improperly) St. Mungo's, or St. Magnus's-Well, which is very pure water, and an excellent cold bath; though from what caprice I cannot tell, it has, of late, been very much neglected.

Experiment I. On mixing a few drops of *tincture of galls* with the Crescent water it soon assumes a fine purple tinge, which, by standing grows darker, inclining to a black or dusky green. If the water on which this experiment is made, is exposed to the air, it entirely loses it's dark color; a variegated pellicle seen on the surface, and in a few days, a brown precipitate falls to the bottom of the glass.

Exper. II. On mixing a few drops of the *prussian alkali* with a glass of the Crescent water, a beautiful dark green was instantly produced; and, when the mixture had stood about half an hour, a fine blue precipitate fell to the bottom.

Both these experiments were repeated

with water which had been exposed for 24 hours to the air, in a glass, and also with water which had been slightly boiled; but neither tincture of galls nor prussian alkali produced any change upon it in this state.

From these experiments, it is evident that the Crescent water is a chalybeate, or contains iron. Both the tincture of galls and prussian alkali are very delicate tests for discovering the presence of this metal, particularly the latter, which discovers the most minute portion of iron imaginable. From the experiments with the water which had been exposed to the air, and that which had been boiled, it appears that the iron is held in solution by a very volatile principle, and which is easily dissipated. This is also evident from the purple color, produced by the tincture of galls: for if the iron is held in solution by the vitriolic or marine acid, the color produced by tincture of galls is always a blue, inclining to black.

Exper. III. A piece of paper, on which characters were written with a pen, dipped in a solution of *saccharum saturni*,

being placed over a glass, nearly filled with the water, just drawn from the pump, the characters in about five minutes became visible, and of a brown color, but not near so dark as when such a paper is held over the sulphur-water.

From this experiment, it is evident that this water is impregnated with hepatic or sulphureous air, though not in the same quantity as the sulphur water.

Exper. IV. When paper tinged by saturated tincture of *turnsole*, was dipped into a glass of this water, taken fresh from the pump, it's color was evidently changed from purple to red; but no such change was produced when such a paper was dipped into water which had been exposed for six hours to the air, in an open glass.

From this experiment, we may conclude that this water is impregnated with an acid, since acids change the color of paper tinged by tincture of turnsole to a red. From the experiment with water which had been exposed to the air, it is evident that the acid with which it is impregnat-

ed, is of a volatile nature, and escapes upon exposure to the air.

Exp. V. When *salited terra ponderosa* is dropped into the water, white clouds are soon discovered: and after the mixture has stood some time, a small quantity of white sediment falls to the bottom of the glass.

This experiment shows, that the Crescent water contains vitriolic acid. For the salited terra ponderosa discovers the smallest portion of that acid, with whatever substance it is combined; because the vitriolic acid has a greater attraction for the terra ponderosa than for any other substance, except phlogiston; and separates it from all the other acids, forming with it a *spathum ponderosum*, which is scarcely at all soluble in water.

Exp. VI. A few drops of an aqueous solution of *acid of sugar*, being mixed with a glass of the Crescent water, the mixture became turbid, and a white precipitate fell to the bottom of the glass.

This experiment shows, that the Cre-

scent water contains lime, or calcarious earth; for the acid of sugar instantly discovers the most minute particle of lime, with whatever acid it is united. This acid attracts lime with such force, that it expels even the vitriolic acid itself, and all other acids hitherto known; and forms with it a salt very difficult of solution, which therefore falls to the bottom in the form of a white powder.*

Exper. VII. A little of the solution of silver, in the nitrous acid, being dropped into a glass of the Crescent water, just taken from the pump, the mixture immediately became turbid, and a white sediment fell to the bottom.

Exper. VIII. Lime-water being mixed with the Crescent water, renders it turbid, and a precipitate in a little time falls to the bottom.

Exper. IX. When the Crescent water was boiled, with an equal quantity of new milk, it did not curdle it.

* Bergman's essays, vol. I, p. 239; also essay on the acid of sugar.

Exper. X. The Crescent water will not dissolve soap, but curdles it.

I next endeavoured to ascertain the nature of the permanent vapours contained in this water. But as I had found, from repeated trials, all the methods for collecting these volatile principles, recommended by authors, very inconvenient, I was in hopes that I could improve upon them; and after several attempts, I think I have hit upon a method of obtaining and securing the volatile contents of waters, with ease, and sufficient accuracy. I took the hint from the perusal of a complex machine, described by Mr. Bergman, but which I found, from experience, will not answer the purpose. The first attempt I made of this kind, I have related in a treatise, which I published last year* but this was by no means so convenient as I could wish. I afterwards made use of a simple vessel hereafter described, which I found by much the most convenient of any which I have seen.

The vessel is made of tin, and is of one

* See experiments and observations on the Horley-Green spaw, p. 18.

entire piece; the bottom part is cylindrical, and perfectly closed both at the bottom and top, excepting where the tube, about two inches in length, is inserted. The cylindrical part holds exactly half a gallon, wine measure. To the top of this cylindrical part is soldered a shelving part, being the frustrum of an inverted cone; and the capacity of it is of no consequence.

When this vessel is used, the cylindrical part is accurately filled to the top of the tube, with the mineral water to be examined: the shelving part is likewise filled to the height of about four inches, with the same of common water. A phial filled with oil, alcohol, or even with common water heated to such a degree that it will not absorb the air, is inverted over the tube.

The vessel is then placed upon the fire, till it boils gently; all the air, or volatile matter contained in the half gallon of water, which fills the cylindrical part of the vessel, will be expelled by the heat, and rise up through the tube into the inverted phial, occupying the upper part of it, and displacing an equal quantity of the fluid, which will be forced into the

shelving part. When no more aeriform fluid rises, the place in the phial, occupied by the air, may be marked with ink, a diamond or a file. The phial is then to be filled with distilled water to the mark, and accurately weighed, and by calculation, the quantity of air, in cubic inches, will be very accurately determined; or, a gradulated phial may be used, which will show, at first sight, the quantity of air contained in the water.

If one phial will not hold all the aeriform fluid, it may be removed from the tube, before it be quite filled with air, corked under water, and another phial applied.

Exper. XI. This vessel being filled with the Crescent water, and phials applied, as above directed, I obtained 17,2 cubic inches, which in a gallon, would be 34,4 cubic inches of permanent vapour, which being introduced into an inverted vessel, filled with lime-water, was all, or very nearly all absorbed by agitation. The lime-water assumed a turbid milky appearance, and had evidently a sulphureous smell; whence I conclude, that the air contained

in the Crescent water, consists of fixed and hepatic air, common air being never found either in sulphureous or chalybeate waters.*

The next thing to be done, was to separate the fixed and hepatic airs from each other, which did not, at first sight, seem very easy, as both these airs are absorbed by water; I however attempted it, upon the following principle.

When a sufficient quantity of lime-water is mixed with water impregnated with fixed air, the air will be absorbed by the lime; but, when lime-water is mixed with water saturated with hepatic air only, no decomposition will take place. I therefore took a quart of lime-water, and added to it a quantity of quick lime in powder, which was much more than sufficient to absorb the quantity of air contained in an equal quantity of the Crescent water, provided it was all fixed air: this I put into the cylindrical part of the vessel, and added to it a quart of the Crescent water, which exactly filled it: I then stopped the

* Bergman's chymical essays, vol. I, p. 248, and 299.

tube with a cork; and, having filled the shelving part to the height of about four inches, the mixture was suffered to stand about half an hour; in which time, the fixed air must have been all absorbed from the water: I then applied an inverted phial, as above directed, and placed the apparatus on the fire; when the air had ceased to rise into the inverted phial, the place occupied by it was measured, and found to contain 3,4 cubic inches. This air did scarce produce any decomposition when passed through lime-water, but impregnated it strongly with an hepatic or sulphureous smell. Since therefore a quart of this water contains 3,4 cubic inches a gallon of it must contain 13,6 cubic inches of hepatic air, which subtracted from 34,4 cubic inches, the whole quantity of the air obtained by the first part of the experiment, leaves 20,8, for the quantity of fixed air. It appears then, that a wine-gallon of this water contains 20,8 cubic inches of aerial acid, or fixed air, and 13,6 cubic inches of hepatic or sulphureous air.

Exper. XII. I poured a wine-gallon of the Crescent water into a clean tin vessel, and placed it over a fire; air-bubbles began

to rise, the water grew turbid, and deposited a brownish sediment: it was suffered to boil for twenty minutes, before which time it had ceased to deposit any more sediment.

When the water was cold, I poured off the clear, till it came very near the bottom of the vessel; I then filtered the remainder, and having dried the filter, I found the weight of the powder left upon it to be 5⅛ grains.

Exper. XIII. That I might discover the nature of this powder, I exposed it for about a month to the rays of the sun, having frequently moistened it during that time: I then calcined it in a crucible, keeping it in a red heat for near an hour, and upon presenting a magnet to it, several particles were evidently attracted: from this I was convinced that it contained iron. In order to separate the iron from the other substances which might be mixed with it, which are generally calcarious earth and magnesia, I put the powder into a phial, poured upon it a quantity of distilled vinegar, and let it stand two days, having frequently agitated it in the mean

time. The distilled vinegar dissolves the magnesia and lime, but will not act upon iron, which has been dephlogisticated by the rays of the sun, or by calcination.* I then filtered the liquor; and, having dried the powder on the filter, I found the weight of it to be exactly two grains; the vinegar had consequently dissolved 3½ grains. This powder which remained on the filter, and which was not soluble in the distilled vinegar, was evidently iron: when calcined, it was attracted by the magnet; and upon dissolving it in diluted vitriolic acid, the prussian alkali precipitated it in the form of prussian blue.

Hence it is evident, that a gallon of the Crescent water contains two grains of iron, held in solution by fixed air.

Exp. XIV. The acetous solution was next evaporated to dryness, and yielded a filamentous substance, resembling moss. This substance being exposed to a moist air for above a week, was not diliquescent, but permanent, which was a proof of it's being acetated lime, for acetated magnesia

* Bergman's physical and chymical essays, vol. I., p. 160.

is diliquescent under the same circumstances.* To be more certain of this, it was dissolved in distilled water, a little of it was poured into a glass, and diluted vitriolic acid added to it, drop by drop. The mixture became in some measure turbid; and, in about an hour, I found a substance at the bottom in the form of fine flakes, which had an insipid taste, and every appearance of selenite. Another part of the solution was poured into another glass, and lime-water mixed with it; but, after it had stood more than an hour, no decomposition had taken place, which would have happened if any magnesia had been present; lime having a greater affinity for the vinegar than the magnesia has, and consequently would have separated that earth. To the remainder of this solution, a few drops of a solution of vegetable alkali were added: the mixture immediately became turbid, and deposited a copious sediment, which being collected by filtration, was put into a crucible, and kept in a red heat for more than an hour, and then dissolved in water. Some of the clear solution was poured into the bend

* Bergman's essays, vol. I., p. 161.

of a glass siphon, and upon making fixed air pass through it from my lungs, it immediately became turbid and white like milk, which convinced me it was calcarious earth; it was reduced to quick lime by calcination, in which state it was soluble in water, but was precipitated from it by fixed air.

From this it is evident, that a gallon of the Crescent water contains 3½ grains of calcarious earth, held in solution by the aerial acid.

Exper. XV. The gallon of water from which this precipitate (exp. 12.) had been procured, was evaporated very slowly in an earthen vessel, to dryness, and I found at the bottom of the vessel a quantity of whitish salt, the weight of which was 8 dwts. 1 gr.

Exper. XVI. In order to see what acids this salt contained, I evaporated some more of the water, and obtained a proportional quantity of salt. Upon part of this salt, I poured some concentrated vitriolic acid; a grey smoke was instantly produced, with a peculiar smell, which I

knew to be that of the marine acid. I held a paper moistened with water over the salt, and the vapour instantly surrounded it, which was another proof of it's being the vapour of the marine acid:* the paper soon acquired an acid taste.

From this experiment it appears, that this salt contains the marine acid in it's composition.

Exper. XVII. A little of this salt was dissolved in water, and a few drops of salited terra ponderosa being mixed with it, the mixture soon became turbid, and a small quantity of a white precipitate fell to the bottom of the vessel.

From this experiment it is evident, that this salt contains some vitriolic acid, in it's composition.

To determine accurately the nature and quantity of each salt which this water might contain, I made the following experiments, as directed by M. Bergman, in

* Bergman's essays, vol. I. p. 167.

his physical and chymical essays,* and M. Fourcroy, in his elements of chymistry.†

Exper. XVIII. (A) The salt which was collected from a gallon of the water, and which, as was observed before, weighed eight pennyweights and one grain, was put into a phial, and rectified spirits poured upon it, to the height of about two inches; the phial was then well stopped and shaken, and after standing 20 hours it was filtered.

(B) To the residuum, I then added eight times it's weight of cold distilled water; the mixture was shaken, and after standing about 12 hours, it was filtered; but nothing, or next to nothing, was left on the filter.

I next proceeded to examine the solution obtained by the rectified spirit, which was of a brownish color, and had a very bitter taste. As this solution generally consists of lime or magnesia, salited or nitrated,‡ to discover whether these salts

* Vol. I., p 159. † Vol. II., p. 208.

‡ Bergman's essays, vol. I., p 164.

were present, I made the following experiment.

Exper. XIX. I took part of the salt obtained from the water in exper. 16, and poured rectified spirit upon it, in the same manner as upon the salt procured from a gallon of the water, (exper. 18, A). Part of this spirituous solution was evaporated to dryness, and upon pouring upon it some concentrated vitriolic acid, and holding a wet paper over it, it was evident from the peculiar smell and grey smoke, which attached itself to the paper, that this salt contained the marine acid in it's composition. Nitrated silver, upon being mixed with a solution of this salt in water, confirmed this, by the turbid appearance which it occasioned, and the precipitation which followed.

Into part of the remainder of this solution, I dropped some salited terra ponderosa; but no change was produced which indicated the presence of the vitriolic acid.

To determine the quantity of this salt, I evaporated the first spirituous solution (exper. 18. A.) to dryness; and found 1 dwt.

21 gr. of a brownish salt, which had a very pungent, bitter taste, and which, on being exposed to the air a very little time, became deliquescent.

The next thing to be done, was to discover the base of this salt, for which purpose I made the following experiments:

Exp. XX. A quantity of this salt was dissolved in water, and an equal quantity of lime-water was mixed with it: a decomposition soon took place, and a precipitate in fine flakes like snow, fell to the bottom of the vessel. A little diluted vitriolic acid was mixed with tincture of turnsole, and this precipitate was added by degrees, agitating the mixture frequently, till by the color, I judged that the vitriolic acid was saturated with the earth. The solution was very transparent; it was evaporated almost to dryness, and on being suffered to stand two days, a few small crystals were observed at the bottom of the vessel, which from their figure and taste were certainly vitriolated magnesia or Epsom salt.

Hence it appears, from the preceding

experiments, that the salt dissolved by the rectified spirit, was *salited magnesia*, and that a wine-gallon of the Crescent water, contains 1 dwt. 21 grs. of this salt.

Exper. XXI. The solution made by cold water (exp. 18. B.) was next examined; it was evaporated to dryness, and was found to weigh 6 dwts. 1 gr., which was three grains short of what it ought to have weighed, since the whole quantity of salt procured from a gallon of the water, weighed 1 dwt. 1 gr. (exper. 15.) and the quantity dissolved by the alcohol, being subtracted from it, leaves 6 dwts. 4 grs. Whether these three grains were lost in performing the experiments, or whether it might depend upon the salt having less of the water of crystalization, I am at a loss to determine. This salt was re-dissolved in water, and evaporated by a very gentle heat, till a drop of it being taken out of the vessel, and let fall upon cold glass, showed evident signs of crystalization; it was then placed in an oven, near a fire, for 48 hours, and in that time was converted into beautiful crystals, which seemed all of marine salt; but this salt having been exposed to a damp air, for some

days, became in some measure moist: this circumstance, together with the experiment with the salited terra ponderosa, (exper. 17.) showed that a vitriolic salt was mixed with it. I therefore dissolved the salt again in water, and added to it a solution of the *fossil* alkali, that the basis of the marine salt might not be precipitated; the mixture, after standing some time, showed evident marks of a decomposition; and, after it had stood six hours, a very small quantity of precipitate was found at the bottom of the vessel. This being carefully collected on a filter, was found to weigh 1½ grains. On pouring diluted marine acid on this earth it was dissolved, and precipitated again by lime-water, which was a proof of it's being magnesia; consequently the salt mixed with the marine salt, was vitriolated magnesia, or Epsom salt.

To determine the quantity of Epsom salt, from which this grain and a half of magnesia was precipitated, Mr. Kirwan informs us, that 100 grains of crystalized Epsom salt contain 23,75 of acid, 19 of earth, and 57,25 of water: hence the quantity of crystalized Epsom salt, from

which this magnesia was produced, must have been very nearly 8 grains. This subtracted from 6 dwt. 1 gr. leaves 5 dwt. 17 gr., for the quantity of muriatic or sea salt.

For the preceding experiments, a wine gallon of the Crescent water appears to contain

	dwt.	gr.
Of aerated iron	0 :	2
aerated lime	0 :	8⅛
salited magnesia	1 :	21
muriatic or sea salt	5 :	17
vitriolated magnesia, or Epsom salt	0 :	8

Of aerial fluids:

Aerial acid, or fixed air, 20,8 cubic inches.
Hepatic, or sulphureous air, 13,6 cubic inches.

Exclusive of a small quantity of aerial acid, retained by the iron and lime in the heat of boiling water.

It may, at first sight, appear surprising, that this water should contain magnesia united with the vitriolic and marine acids; and, at the same time, calcarious earth, combined with fixed air; for we might, perhaps, expect that the calcarious earth, which has a greater affinity for those acids than magnesia has, would separate that

earth, and combine with them, and leave the magnesia at liberty to combine with the fixed air. But, such examples frequently occur in chymistry, and can only be explained by what the chymists call double elective attraction, whereby it happens that substances are often combined differently from the order of simple affinities; because the sums of the attractive forces which hold them in combination, are greater than the sums of the forces which endeavour to separate them.

To illustrate this, let us suppose that A is a stronger acid, and B a weaker, also that C is an earth which has a greater attraction for those acids than D has. Suppose the attraction between A and C=x, and the attraction between A and D which is less,=$x-1$; suppose that the attraction between B and C, which is likewise less than the attraction between A and C, be also=$x-1$, but the attraction between B and D, being the least of all, we may suppose=$x-3$. Suppose next that A is combined with D, and C with B, yet there will be no separation, though C has a greater attraction for A than it has for B, for the forces which kept the compounds together,

will be equal to the sums of the attractions of A for D, and C for B, $=2x-2$, but the forces which tend to separate them, will be $2x-3$, which being less than the forces by which they are kept together, will produce no effect.

I have now given a faithful account of my experiments on the waters most generally used at Harrogate, and I hope a more accurate analysis of them, than has yet been presented to the public. There is a great variety of waters at Harrogate, of which I have not yet been able to make an accurate analysis. Among the sulphur waters in the bog above the village of Low-Harrogate, there are some which are strongly impregnated with hepatic air, and which contain a small quantity of saline matter, these I have found very useful external applications in some cases, where those which contained more salt, occasioned great pain. In one of the sulphur wells situated in a bog, I have discovered alum, and I suspect salited clay. In a chalybeate water near the road, and not far from the Crescent garden, the iron is dissolved by the muriatic acid.

Sufficient attention has not been paid to these numerous waters, and many of them, though perhaps capable of very useful application, have not yet been used. We cannot reflect without astonishment, on the different mineral strata with which this place has been so liberally endowed by nature; neither can we sufficiently admire the wisdom of Providence, which, in the distribution of it's bounties, has enabled the inhabitants of the most barren and unfavorable spots of ground, to draw a liberal supply of the necessaries of life from other places, and to enjoy even it's luxuries, in at least an equal degree with those of richer countries.

The contents of a wine-gallon of each of the waters examined in this treatise, may be seen at one view, in the following table,

A TABLE,

Exhibiting the contents, in a wine-gallon, of each of the Harrogate waters.

NAMES *of the* WATERS	Specific gravity.	Cubic inches.			Grains.								
		Carbonic acid gas	Azotic gas	Hepatic or sulphurated hydrogen gas.	Muriat of soda.	Muriat of lime.	Muriat of magnesia	Carbonat of ~~iron~~ Lime	Carbonat of magnesia	Carbonat of ~~lime~~ Iron	Sulphat of magnesia	Sulphat of soda.	Sulphat of lime
Sulphur Water.	1,0064	8	7	19	615,5	13	91	18,5	5,5		10,5		
Crescent Water.	1,002	20,8		13,6	137		45	3,1		2	8		
Tewit Well.	1,00017	16	5							2,5			4
Old Spaw.	1,00014	15,75	4,25							2		3	1,5
Saint George's Spaw.	1,00012	13,5	3,5							2			4,5

SECT. V.

Observations on the different permanently elastic fluids, with which these waters are impregnated.

THOUGH a considerable quantity of azotic gas may be procured from the mineral waters at Harrogate, yet this substance has escaped the attention of other chymists who have attempted to analyze those waters, which was most probably owing to the imperfect knowledge we have had of the properties of this air, for it is only lately that we have obtained any notions concerning it. Dr. Priestley was the first chymist who made any experiments of consequence on this substance, from which he concluded that it was a compound of pure air and phlogiston. It has, indeed, been long known, that common air which has for a certain time supported combustion or respiration, is no longer proper for these purposes; and this fact might lead this

ingenious philosopher to believe, that the pure air contained in the atmosphere was phlogisticated by these processes; but, it has been shown by M. Lavoisier, and other french chymists, that azotic gas is either a simple substance sui generis, or one whose component parts have not yet been discovered; that when mechanically mixed with a certain portion of oxygen gas, or pure vital air, it forms atmospheric air, but when chymically combined with a larger portion, it forms nitrous acid, and when united with a certain proportion of hydrogen, or the base of inflammable air, it forms volatile alkali.

As we cannot combine this substance with water by agitation, we are at a loss to know in what manner nature forms this union. I have attempted the following explanation, which to me appears satisfactory.

We know many substances, which, when simple, cannot be united with water, yet when combined with oxygen or pure vital air, readily united with it: for instance, sulphur is little disposed to unite with water, and perhaps cannot be dissolved in it with-

out the aid of some other medium; yet, when saturated with oxygen, so as to form sulphuric acid, it attracts water, and combines with it very eagerly. We find, likewise, that though azotic gas do not combine with water, yet when azote is mixed with oxygen so as to form atmospheric air, water readily absorbs this compound.

Now, supposing the water to absorb atmospheric air, (which we know it will) how does it happen that this air is not procured from it instead of azotic gas?

To explain this, let us first consider the chalybeate water. We know that iron is little disposed to unite with fixed air, or any other acid, unless that metal be oxygenated;* but, that it attracts oxygen very eagerly when presented to it; this is instanced by the calcination of iron, when moistened and exposed to the atmosphere. Now, it must follow, that if water contain fixed and atmospheric air, and runs over iron, that metal will attract the oxygen of the atmospheric air, and thus become more soluble by the fixed air, while the azotic

* See Keer's translation of Lavoisier's elements. p. 200,

gas will be left loosely attached to the particles of the water, and ready to break out in the form of bubbles.

This is the reason why we seldom find oxygen or atmospheric air in chalybeate waters, which fact was observed by the celebrated Bergman,* though the presence of azotic gas, which I think is very generally to be found in chalybeate waters, had escaped him, the nature of that elastic fluid had not been sufficiently known in his time.

Before I attempt to explain the reason why we find azotic gas in the sulphurated waters, I shall premise a few observations on hepatic air, or sulphurated hydrogen gas.

Among several ingenious chymists who have attended to the nature of permanently elastic fluids, M. Gengembre was the first who considered hepatic gas as a solution of sulphur in inflammable air. Having introduced a quantity of sulphur under a glass jar, filled with inflammable air,

* Physical and chymical essays, vol. I., p. 299.

and inverted over mercury, this philosopher effected the solution of the sulphur by means of a burning glass; and, upon examining the air in the jar, he found that it possessed all the properties of hepatic gas; it was soluble in water, and communicated to it the peculiar smell which hepatic air is known to communicate to water. This gas is procured in considerable quantity from hepar sulphuris, as well as pyrites, by the affusion of the different mineral acids. Professor Bergman was of opinion, that this gas was entirely contained in the hepar; but, M. Gengembre's experiments, as well as those related by M. Fourcroy, in an ingenious memoir, published in the *histoire de l'academy royale des science*, for 1786, show that liver of sulphur, prepared by fusion, has no fœtid odour while dry; that it acquires this in proportion as it imbibes moisture; that the production of this gas is owing to the decomposition of water; and that the acid employed in obtaining it from dry hepar, is only effectual in proportion to the water which it contains. As neither sulphur nor the alkali can separately decompose water, this effect is shown my M. Fourcroy, to be owing to the powerful attraction with which the alkali

tends to unite with the sulphur, when converted into sulphuric acid. In order to undergo this change, the sulphur must be combined with oxygen; and, when it is disposed by the alkali to this combination, it deprives the water of one of it's component parts, the oxygen; and, it's inflammable gas being thus let loose, dissolves and carries with it a portion of the sulphur. In proof of this, M. Fourcroy observes, that sulphuric acid is always found in hepar, from which hepatic gas has been produced. Thus, when hepar is moistened with water, and a considerable quantity of this gas is obtained from it by distillation, the residuum is found to contain a vitriolic salt; and, if the liver of sulphur, instead of being only moistened, be dissolved in water, a large quantity of hepatic gas will be obtained; and the residuum will be a vitriolic salt, without any mixture of sulphur, because, in this case, the water converts the greatest part of the sulphur into sulphuric acid, which combines with the alkaline basis of the hepar, while the remainder of the sulphur is dissolved by the inflammable air of the water, and forms hepatic air, more properly, according to the new nomenclature, called *sulphurated hydrogen gas*.

One of the properties of this gas, according to M. Chaptal,* is to unite with the oxygen of atmospheric air, and form water, depositing the sulphur which it held in solution. Now, if we suppose the water to be originally impregnated with atmospheric air, when it meets with the hepatic air, the last will unite with the oxygen, and form the water, while azote will be left loosely attached to the particles of the water, in the same manner as in the chalybeate springs: but, there being a greater quantity of hepatic gas than will saturate the oxygen of the atmospheric air, dissolved by the water, the remainder retains it's peculiar properties, and gives the water it's sulphureous smell.

The sulphur, which is found deposited in the channels through which the water runs, is deposited by the inflammable air, on it's union with the oxygen. The surface of the water of some of the wells which are much exposed to the air, as well as that which is collected in large open vessels for baths, is covered with a pellicle of sulphur, which is deposited by

* Elemens de Chimie, tome I, p. 100.

the hepatic air, on it's union with the oxygen of the atmospheric air in contact with the surface.

I shall next make a few observations concerning the origin of the sulphurated hydrogen gas, with which the waters at Harrogate are impregnated; and, to which they perhaps owe, in a great measure, their property of curing various cutaneous diseases.

This gas often derives it's origin from the decomposition of pyrites in the bowels of the earth,* where water being decomposed, it's oxygen forms sulphuric acid with part of the sulphur, while it's hydrogen dissolving another portion of the sulphur, forms hepatic air, and escapes along with certain waters, communicating to them peculiar properties. But, though there is pyrites in the bog above the village, from which the sulphur waters undoubtedly spring, and where they are impregnated with hepatic air; yet, should the impregnation arise from this source, we might perhaps expect to meet with a considerable

* See Elemens de Chimie de Chaptal, tome I, p. 100.

quantity of vitriolic salt in these waters, very little of which is however found in any of them; and, I think it more probable, that the sulphurated hydrogen gas, with which these waters are impregnated, may derive it's origin from another source.

The four sulphur springs, at the village, evidently take their rise from the bog, which is three or 400 yards above them; from thence the water seems to be filtered under ground between strata of shale, and springs up perfectly transparent, forming the four sulphur wells now generally resorted to. This bog has been formed by the rotting of wood; and the earth of the rotten wood, which is every where distinguishable on digging, is, in many places, four or five feet in thickness, having a stratum of clay and gravel every where under it. Now, we know, that one of the greatest sources of the formation of sulphur is the decomposition of vegetables M. Chaptal, speaking of the origin of this substance, says, "*Ilse presente presque partout ou il y a decomposition vegetale;** and it is likewise well known that hydrogen,

* Elemens de Chimie, tome I, p. 80.

which forms a considerable part of vegetable bodies, is continually escaping from bogs and ponds, during the decomposition of vegetables; this hydrogen gas dissolving a portion of the sulphur, will be converted into hepatic air, and impregnate the water it meets with, giving it peculiar properties.

Whether nature really use either of these methods for impregnating those waters with hepatic air, I cannot presume to say. The inflammable air may likewise, perhaps, originate in another manner, besides escaping naturally during the decomposition of vegetable substances, of which it forms a part.

It is now well known, that the greatest part of the vegetable fibre consists of charcoal. The carbonic acid floating in the atmosphere, or dissolved in water, is absorbed by plants, and being decomposed by the vegetable powers, it's base, the charcoal, appears to form the vegetable fibre, while the oxygen is exhaled from the plant:* it is by no means unlikely, that on

* Elemens de Chimie de Chaptal, tome 3, p. 30.

the dissolution of the vegetable, nature may again, from this base, form carbonic acid, which may be done by the decomposition of water in contact with the putrified vegetable; the oxygen of the water will unite with the charcoal, which composed the vegetable fibre to form carbonic acid, while the hydrogen dissolving a portion of sulphur, which is found in such plenty here, will form hepatic air.

That hepatic air is produced by the putrefaction of wood, is the opinion of the learned Dr. Watson. In a paper inserted in the Philosophical Transactions, he says "I have been told, that, on breaking into an old coal work, in which a considerable quantity of wood had been left rotting for a long time, there issued out a great quantity of water, smelling like Harrogate water, and leaving, as that water does, a white scum on the earth over which it passed. On opening a well of common water, in which there was found a log of rotten wood, an observant physician assured me, that he had perceived a strong and distinct smell of Harrogate water. Dr. Darwin, in his ingenious account of an artificial spring of water, published in the

first part of LXXVth volume of the Philosophical Transactions, mentions his having perceived a slight sulphureous taste and smell in the water of a well which had been sunk in a black, loose, moist earth, which appeared to have been lately a morass, but which is now covered with houses built upon piles. In the bog or morass, above-mentioned, at Harrogate, there is great plenty of sulphureous water, which seems to spring from the earth of the rotten wood of which that bog consists."

If, by these observations, I have not been able to throw much light on the method which nature uses for impregnating these waters with hepatic air: I hope they may not be altogether useless, but may afford a hint which may be farther pursued by some ingenious person, who, by diligent observation and attention, may be let into the secret, and detect nature in the act.

PART III.

The medicinal Properties

OF THE

Harrogate Waters.

By chymic art, your healing qualities
I too may boast to know; and, whence deriv'd,
From earths, or salts, or mineral particles
Combin'd, suspended by attraction's laws,
Or, held in union by aerial chains,
And crown'd with sprightly gas!

Infancy, book 4.

BEFORE I enter upon the consideration of the medicinal properties of these waters, it may not be improper to make a few observations on the air at Harrogate, that principle being the main spring in the animal machine, the source of heat and activity; without which, our blood would

soon become a black stagnant mass, and life would soon stop. It is now known that only a part of atmospheric air is necessary for respiration. The atmosphere of our planet consists, in general, of about three-fourths of an air, which, of itself, is perfectly unfit for respiration, viz. the azotic gas, and one-fourth of pure or eminently respirable air, in which an animal immersed will live much longer than in common air: besides these two fluids, the atmosphere contains a small portion of various gases, and substances capable of being dissolved in them. These proportions, though perhaps sufficiently exact, when the general state of the whole atmosphere is considered, are very different in different places, and in the same place at different times. Combustion, putrefaction, and the breathing of animals, are processes which are continually diminishing the quantity of oxygen or pure vital air in the atmosphere; and consequently, if the wise author of nature had not provided for it's continual re-production, by the decomposition of water by vegetables, and perhaps other means, it would probably soon become too impure to support life. But vegetables absorb

water, and decompose it, and taking the inflammable air or hydrogen gas for their nourishment, breathe out the oxygen in a very pure state,* which is received into the lungs of animals, gives them their heat, and communicates a red color to their blood.

From what has been said, it is evident, that in large and populous cities, where combustion and respiration are continually performed on a large scale, the air must be much less pure than in the country, where there are few of these causes to contaminate the atmosphere, and where vegetation is continually tending to render it more pure; and, were it not for the winds which agitate this element, and continually occasion it's change of place, the air of large

* It has been an universal observation, that those countries abounding with large forests, are subject to violent degrees of cold; but that, as the ground becomes cleared of wood, and the bogs drained, the temperature of the climate becomes more mild. Among other causes, may not the decomposition of water, by vegetables, contribute greatly to the production of this cold? The conversion of so large a quantity of oxygen into the state of gas, by extensive forests, fed by numerous pools of water, must, occasion the absorption of a great quantity of heat, which becomes latent in the oxygen gas, and preserves it in it's elastic state.

towns would probably become soon unfit for respiration. Hence proceeds, in a great measure, the rosy bloom, found in the rural cottage, which we in vain look for in the stately palace, or the splendid drawing-room. Hence the propriety of the following advice of the æsculapian bard:—

Ye who, amid the fev'rish world, would wear
A body free of pain, of cares a mind;
Fly the rank city, shun it's turbid air;
Breathe not the chaos of eternal smoke
And volatile corruption, from the dead,
The dying, sick'ning, and the living world
Exhal'd, to sully heaven's transparent dome
With dim mortality.
While yet you breathe, away, the rural wilds
Invite; the mountains call you, and the vales;
The woods, the streams, and each ambrosial breeze
That fans the ever-undulating sky.

Armstrong, on health, book I.

No place in the kingdom can boast of a better or purer air than Harrogate; almost every person on coming here, experiences it's lively, bracing, and exhilarating power. Situated at nearly an equal distance between the eastern and western shores, and at a great height above the level of the sea, it experiences the winds from which ever part they blow; the air never stagnates,

but circulates freely, not interrupted by wood, or rendered humid by stagnant water. It's high situation likewise renders it's air much more pure; the atmosphere being found to contain a larger portion of oxygen upon the tops of mountains, than in the valleys.*

The number and variety of mineral waters are such, and the air so salubrious, that if proper directions be followed, there are, I think, few chronic diseases which are not likely to be relieved by a visit to this place.

Among the advantages, we must not forget the sociability of the company, and the number of pleasing and delightful scenes, with which this country abounds;† in the lively conversation of the former, the valetudinarian forgets his weakness; and, in the contemplation of the latter,

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* See Chaptal's Elemens de Chimie, also Annales de Chimie, tome 4, p. 88, where M. Fourcroy observes "Parmi les differentes classes des animaux, les oiseaux vivans dans un *air plus pur*, en recevant une plus grande quantite dans les organes plus etendus."

† With regard to the public amusements, natural curiosities, agreeable rides, and pleasing prospects, in the neighbourhood of Harrogate, see HARGROVE's *History of Knaresbrough and Harrogate.*

the gloomy hypochondriac no longer remembers the anxious cares which have distracted his mind, and troubled his repose.

I next proceed to make a few observations on the medicinal virtues of the different waters, and shall begin with the chalybeates.

Iron is the only metal which seems naturally friendly to the animal body; it is the only one which contains nothing hurtful, and whose effects need not to be dreaded; it bears such an analogy to the organic bodies, that it seems to make a part of them, and frequently, if not constantly derives it's origin from the animal and vegetable powers; for, as M. Fourcroy observes, plants raised in pure water contain it, and it may be extracted from their ashes.*

This opinion concerning the origin of iron, is not a little strengthened by some

* Elèmens d'Histoire Naturelle et de Chimie, tome 4. Morse, in his American Geography, in the account of New Jersey, p. 28, has the following curious note. "Some persons will be surprised at my saying, that *ore grows*, but that it does in fact grow, is well known to many curious naturalists, who have carefully observed it."

curious facts which were lately mentioned to me by the Count de la Tour du Pin, an ingenious chymist and philosopher. He observes that the analysis of the egg, (till by the effect of incubation, life becomes developed) affords not the least vestige of that metal; but as soon as the animal exists, although it has been perfectly shut up, and as had no external cummunication, the analysis discovers a particle of iron, which is attracted by the magnet.*

The effects of iron, upon the animal œconomy, are sufficiently numerous. It stimulates the fibres of the stomach, and other abdominal viscera, and agments the tone of all the muscular fibres, strengthens the nerves, and gives the weakened

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* I shall here insert an extract of a letter, which I received from this ingenious philosopher, on this subject, "Ce que je vous ai dit de l'œuf, ètoit relatif à la formation du fer, qui paroit resulter ègalement de la vie animale et de la vègètale. L'analise de l'œuf, jusqu'à ce que par l'effect de l'incubation la vie y soit developpèe, ne donne pas vestige de fer; au contraire, des que l'animal existe, quoique renfermè et n'ayant point eu de communication extèrieure, l'analise laisse apercevoir un atome de fer, devenu attirable par l'effet de l'operation. Quand aux vègètaux, examinez, lorsque vous en aurez l'occasion, les cendres rèsultant de la combustion des Tourbes, et vous les trouverez, sans exception, attirables au bareau."

system a remarkable energy and vigour. It increases the strength of the pulse, and the pale emaciated countenance, from it's use, assumes a healthy florid color. It easily passes into the circulation, and combines with the blood, to which it gives density, consistence, and color. Like astringents, it braces the fibres, and increases their tone; and is preferable to other remedies of this class, on account of the greater certainty and durability of it's effects; on these accounts, it is proper, in all cases, where the fibres of the viscera, of the muscles, or of the nerves, (if this last expression be allowed) are relaxed, and have their action weakened; and, in all cases where the fluids, and particularly the blood, have not proper consistence, but are too watery. Most of the good effects above-mentioned, must have been observed by those who have had occasion to employ this remedy, in diseases of debility: The great Boerhaave observes, that no remedies, either animal or vegetable, no diet, no regimen, can produce the effects which are in these cases accomplished by iron. Indeed, the effects which we see every day produced by it, cannot be explained merely on the stimulant of tonic

power, which it is thought to possess in common with a number of remedies of that class. It seems to act a much greater part in the animal economy.

According to M. Chaptal, the red particles of the blood seem to consist entirely of iron, and there does not exist a particle of this metal in the coagulable lymph, which has been well washed and freed from the red particles;* but, it is well known that the blood acquires it's red color from it's exposure to the air in the lungs, from which nothing but oxygen is absorbed; it seems probable, therefore, that the red particles of the blood consist of particles of iron, calcined by oxygen or pure vital air, and reduced to the state of red oxyd of iron.

Hence it appears, that chalybeates will not only increase the quantity of red particles in the blood, on which the stimulant and tonic powers of that fluid must, probably in a great measure, depend, but will enable it to decompose a larger quantity of oxygen, which is received by the lungs in respiration, and thus occasion a greater evo-

* Elemens de Chimie de Chaptal, tome III, p. 291.

lution of heat, and will produce the same effect upon the system, as if a much purer atmosphere had been breathed for some time. It is perhaps probable, that even a change to a purer air will not, in some cases, produce the desired effect, without the administration of chalybeates at the same time.

In support of this theory, may be adduced the beautiful experiments of M. Menghini, published in the memoirs of the institutes of Boulogne, which show that the blood of persons who have made use of iron for some time, is much more colored and florid than it is naturally.

With regard to the various preparations of iron, those seem best calculated to answer the purpose which are most certainly conveyed into the blood, and most easily converted into the state of an oxyd. Of these, iron dissolved by fixed air seems preferable, for though the salts formed by the union of that metal with the different mineral acids, may pass into the blood most easily, and in the greatest quantity, yet they are decomposed with more difficulty than the carbonat of iron, and conse-

quently the iron is not so easily oxygenated; and, with respect to quantity, experience shows us, that small doses of iron produce better effects than large ones; concerning this fact, I am happy to corroborate my own experience, by an appeal to the observation of Dr. Cullen, who, in his lectures on the Meteria Medica, observes, "that in all cases of laxity and debility, and in obstructions and slowness proceeding from these causes, iron is employed, though other simple astringents might also answer the effect. Here we ought to beware of too sudden an astriction, which might be attended with bad consequences; and, therefore in exhibiting it in these cases, we should give it in small doses, and trust to length of time for a cure; and, by this means we shall avoid those inconveniences of which physicians often complain, in their preparations of iron. Mineral waters often produce cures, which we in vain attempt to perform by the combinations in our shops, even although these waters contain nothing but iron. This is manifestly owing to the weakness of the dose; in proof of which we find, that the strongly impregnated waters seldom an-

swer so well as those weak ones we commonly reject."

The chalybeate waters at Harrogate, seem well calculated to answer most of the ends for which chalybeates are in general given; and, though the quantity of iron which they contain is but small, yet it is equal to the quantity contained in some of the celebrated german waters; and experience shows that it produces the happiest effects. The mineral spirit or fixed air, by which this metal is held in solution, should by no means pass unnoticed, as it is an agent possessing no small power over the human frame, and if properly employed, becomes one of the most useful remedies. Pure water, impregnated with this elastic fluid, acquires a briskness, and poignancy; sparkles when poured out of one glass into another, and when taken into the stomach, wonderfully exhilarates the spirits, even sometimes to a degree of intoxication. To this principle, mineral waters owe their activity; it is this fluid which holds some of their most powerful ingredients in solution, and enables them to pervade the remotest recesses of the human frame, and subdue

some of the most obstinate diseases. The chalybeate waters at Harrogate, it is true, do not contain so much of this elastic fluid as some other mineral waters, yet they seem to contain it in sufficient quantity to produce all the good effects expected from aerated chalybeate waters, without occasioning some of the bad ones.

Whether the azotic gas contained in these waters possess any peculiar medicinal powers, I cannot say; for I know of no experiments that have been made, which would warrant us in concluding either that it does, or does not. By reasoning alone we might be led to think, (and the industry of philosophers may perhaps shortly prove) that this elastic fluid, which is more abundant in nature than any other, and which has been lately shown to form a principal constituent part of nitrous acid and volatile alkali, possesses no ignoble place in the animal economy. From the experiments of Dr. Priestley,* it appears that a quantity of azote or phlogisticated air is subtracted from the atmosphere, and taken into the blood by

* See Journal de physique, tome 39, Novembre, 1791.

the action of respiration; and we know that this substance exists in great plenty in the animal body, forming a great part of the volatile alkali, which is contained in all animals; it is by no means improbable that this fluid, taken into the body along with the water, may be applied to this purpose.

Chalybeate waters are useful in all diseases depending upon debility, where the solids are relaxed and the system weakened; in the numerous class of nervous disorders, these remedies, properly administered, produce the happiest effects. There are perhaps no diseases which appear under a greater variety of forms than those called nervous, as there is scarcely a complaint which they do not resemble. This variety in appearance, has caused them to be distinguished by different appellations: In women, the greater part of them have been called hysteric, while the same diseases in men, have been called hypochondriac, melancholic, low-spiritedness, &c. Large cities are in general the habitations of nervous disorders; infants there suck them in with their milk, or if they have been fortunate enough to be educated in

the country, when they repair to the city, the various vices and irregularities to which they are exposed, as well as sedentary employments, and the various emotions of the mind to which they are subject, render these haunts of men fertile sources of these diseases, which the laborious husband-man, in his rustic cottage, has no knowledge of. He may well be reconciled to his poverty and laborious life, when he beholds so many illustrious victims daily suffering worse than death, upon the down of indolence. The particular symptoms which accompany these diseases, are so well described by Whytt, Tissot, and other eminent writers, that I shall content myself with mentioning a few of the most obvious. I hope my readers will pardon me, if I pay more particular attention to this subject than it may seem, to some of them, to deserve; those who have been the victims of this class of diseases, take a pleasure in relating their ills; and, it is always a consolation to fellow-sufferers to heart hem.

The state of a person's mind laboring under these diseases, is distinguished by many, or perhaps all the following cir-

cumstances:—a languor, listlessness, and want of resolution, with respect to all undertakings; a disposition to seriousness and sadness, and an apprehension of the worst with regard to future events, and consequently upon the slightest grounds, an apprehension of great evil. Such persons are particularly attentive to the state of their own health, and to every small change of feeling in their bodies; and from any unusual sensation, perhaps of the slightest kind, they apprehend great danger, and even death itself; and, with regard to all these feelings and apprehensions, there is commonly the most obstinate belief and persuasion.* Delicate constitutions, endued with exquisite sensibility are chiefly the victims of nervous disorders; hence we frequently view, with infinite concern, the sex formed to soften and polish our manners, in whose company we forget our natural rudeness, and who communicate to us the social affections, a prey to the bitterest anguish, and the most brooding melancholy. Every temperament, and every constitution, is liable to be afflicted with diseases peculiar

* Cullen's First Lines.

to itself. Narrow and confined minds are seldom afflicted with these disorders; shut up in a small circle of ideas, they are only occupied with the wants of the moment; but melancholy loves to vent her fury on superior intellects, born to enlighten their kind, or to preside over the fate of empires.* Nature has bestowed her gifts with greater equality than is generally imagined; to some she distributes enlightened understandings, and calls them from obscurity to the first dignities; but she makes them pay dearly for her kindness, by devouring inquietude and painful sensibility; while she permits the soul on which she has bestowed less pains, to enjoy calmly the various vicissitudes of life.

If it be difficult entirely to eradicate these complaints, it is certainly possible to point out proper methods for preventing them, and to fix a boundary to their ravages. They almost all depend on debility, and are induced by every cause that can relax or weaken the habit, such as intemperance, a sedentary life, and too

* See Avis aux buveurs d'eaux minèrales affliges de maux de nerfs.

close application to study or business; the use of coffee, tea, tobacco, and spirituous liquors; but perhaps the most common cause, and the effects of which are the most difficult to remove, is to be looked for in the mind.

The passions and emotions of the soul, when exercised with moderation, and kept within proper bounds, are the sources of life and activity. Without these precious affections, we should be reduced to a kind of vegetation, equally removed from pleasure and from pain. For want of these elastic springs, the animal spirits would lose their regularity and play; life would become a lethargic sleep, and we should fall into indifference and languor.

If then the passions be so necessary to the support of the health of the body, when in a proper degree; can we expect that when they are inordinate and excessive, we shall escape with impunity? Tumultuous passions are like torrents which overflow their bounds, and overturn every thing before them; and, mournful experience convinces us, that disorders communicated to the mind, likewise affect the

body; we ought, therefore, to be particularly on our guard against the passions:

"'Tis the great art of life, to manage well
"The restless mind."

It is particularly in their infancy, if we may so call it, that we ought to be upon our guard against their seduction; they are then soothing and insidious; but, if we suffer them to gain strength, and establish their empire, reason obscured and overcome, rests in a shameful dependance on the senses; her light becomes too faint to be seen, and her voice too feeble to be heard; and the soul hurried on by an impulse to which no obstacle has been presented, communicates to the body its languor and debility. Next to the regulation of the passions, exercise in the open air and agreeable amusement promise the most relief. At Harrogate, the keenness and purity of the air, the agreeable mixture of company, and the number of pleasant rides in the neighbourhood, are admirably adapted to the cure of these diseases; when we add to these the bracing powers of the chalybeate waters, I think there are but few hypochondriacs who will not

receive benefit from the place, if proper directions have been followed for a suitable time. The minds of persons laboring under these diseases, ought always to be kept in a state of tranquillity, or agreeably amused; such persons should never remain alone, and brood over their ills; but should take as much exercise in the open air as they can conveniently, not alone, but in the company of a cheerful companion, whose conversation can sooth their griefs, and make them forget their melancholy. Exercise ought always at first to be very gentle, and increased as the patient can bear it, and he ought as much as possible, to avoid exposing himself to the hot rays of the sun. Such patients may, with advantage, "mix in the sprightly dance," taking particular care however to avoid fatigue; they should live temperately, but not too abstemiously, indulging themselves with a glass of generous wine; but guarding against the least excess, as against the most fatal poison. Such patients, for their cure, should depend chiefly on the use of the chalybeate waters; in order to prevent costiveness, a little of the sulphur water may now and then be taken. In some nervous

cases, I have seen the Crescent water produce very good effects. It will scarcely be necessary to observe, that the warm bath (so eminently useful in cutaneous complaints) would, in most nervous disorders, prove prejudicial; on the contrary, the cold bath, when properly used, by it's bracing powers, promises the best effects. There are some hypochondriac cases, however, accompanied with costiveness, and where the melancholic temperament is strongly marked, in which the warm bath may be used with advantage.

I shall conclude my observations on nervous complaints, with a few extracts from Dr. Cullen, who, in his First Lines on the practice of physic, has treated these diseases with his usual sagacity.

"The management of the mind, in hypochondriacs, is often nice and difficult. The firm persuasion that generally prevails in such patients, does not allow their feelings to be treated as imaginary, nor their apprehensions of danger to be considered as groundless, though the physician may be persuaded that it is the case in both respects. Such patients, therefore, are

not to be treated either by raillery or reasoning.

"As it is the nature of man to indulge every present emotion, so the hypochondriac cherishes his fears, and, attentive to every feeling, finds in trifles, light as air, a strong confirmation of his apprehensions. His cure, therefore, depends especially upon the interruption of his attention, or upon it's being diverted to other objects than his own feelings.

"Whatever aversion to application of any kind may appear in hypochondriacs, there is nothing more pernicious to them than absolute idleness, or a vacancy from all earnest pursuits. It is owing to wealth admitting of indolence, and leading to the pursuits of transitory and unsatisfying amusements, or to that of exhausting pleasures only, that the present times exhibit to us so many instances of hypochondriacism.

"The occupations of business, suitable to their circumstances and situation in life, if neither attended with emotion, anxiety, nor fatigue, are always to be admitted and persisted in by hypochondriacs. But, oc-

cupations upon which a man's fortune depends, and which are always, therefore, objects of anxiety to melancholic men; and, more particularly where such occupations are exposed to accidental interruptions, disappointments, and failures; it is from these that the hypochondriac is certainly to be withdrawn."

I have observed before, that in all cases of relaxed solids, the chalybeate waters may be used with advantage. The symptoms indicating a relaxation of the solids, are such as must evidently result from an impaired and debilitated state and action of the several organs and functions of the body. From a weakened state of the stomach and first passages, proceed loss of appetite, indigestion, flatulencies, heart-burn, and acid eructations. From a debilitated action of the circulating powers of the heart, and vascular system, arise a languid circulation, an increased secretion, and impeded absorption; whence proceed palpitations of the heart, shortness of breath, a general indolence and weariness, obstructions, fluor albus, hemorrhagies, a bloated countenance, and dropsical swellings.*

* See Smith's Formulæ.

When ever a number of these symptoms occur, so as to indicate a relaxed state of the system, recourse may be had to the chalybeate waters.

It may perhaps be proper here to make a few observations on some complaints, which, for several years, have been the subjects of my attention: I mean female complaints, which, though no doubt frequently depend upon relaxation, have not always been ranked under this class, viz. cases where the natural discharge has been obstructed, or immoderately increased. In the former instance, when the patient is affected with sluggishness, lassitude, and debility, and with various symptoms of indigestion; where the face loses it's fine florid color, and becomes pale and flaccid; where the breathing is much hurried by quick motion; where the heart is liable to palpitation, and the patient is subject to fainting: when these symptoms are attended with head-ach and pain in the back, there can be little doubt that the suppression depends upon a general laxity or weakness of the constitution; and in such cases, I should seldom hesitate in advising the chalybeate waters, which often

produce wonderful effects by their strengthening power, which restore the tone and vigour of the languid vessels, and enable them to overcome the obstruction.

With regard to the opposite disease, the immoderate flow of the menses, I think that this generally, if not always depends upon relaxation. I know there have not been wanting men of great name and high respectability, who have maintained that this disease arises generally from too great action of the system, depending upon an inflammatory disposition. If such a state should accompany the disease, chalybeates would be hurtful, as having a tendency to increase that state; a profuse discharge, however, depending upon this inflammatory state, cannot continue long; for, by weakening the system, it must either cure itself or induce a contrary state. But, when we consider the constitution of the patients generally subject to such profuse discharges, and the symptoms attending their debilitated systems, and pale and sickly habits, we can have but little doubt that the disease in by far the greater number of instances, depends upon relaxation;

and that chalybeates may not only be used with safety, but by improving the state of the blood, will be found the best remedies. There is another disease analogous to the last-mentioned, viz. the fluor albus, which generally happens to those who are subject to an immoderate flow. The various circumstances accompanying this disease, can leave little doubt that it depends on a laxity of the uterine vessels, and an impoverished state of the blood. The same mode of cure must therefore be attempted, and in this case chalybeates may, perhaps, be used with less fear and a greater prospect of success.

In many instances sterility has been removed by the use of the chalybeate waters, at Harrogate, and when it depends upon a laxity or debility of the uterine vessels, which is often the case, no other remedy seems more likely to be successful.

The chalybeate waters have frequently afforded great relief in the stone and gravel; the pains are in general much alleviated after drinking the water for a few days, and it not unfrequently happens that the

patient passes several small pieces of calculi during it's use.

In the *atonic* gout, where the system has been weakened by frequent and severe attacks of that disorder, chalybeate waters are extremely useful. The symptoms are severe pain in the stomach, and other affections of that organ, such as loss of appetite, indigestion, and it's various concomitants, viz. sickness, nausea, vomiting, flatulency, and acid eructations. These symptoms are frequently accompanied with pains and cramps in several parts of the trunk, and upper extremities of the body, which are frequently relieved by the discharge of wind from the stomach. Though in this state of the system, chalybeates are very useful, yet it is doubtful whether they should be employed during a regular fit of the gout. Where there is evidently a plethoric or inflammatory state of the system present, they are certainly improper, since they would increase that state.

In bilious complaints, and in *some stages* of consumption, chalybeates may be employed with advantage; but the Crescent

water seems more peculiarly suited to such complaints than the simple chalybeate waters, on account of the salt it contains, which will in some measure counteract the stimulant operation of the iron; and, perhaps this compound may possess medicinal properties different from what the ingredients do in their separate state, as is the case in other instances. I have seen consumptive complaints much relieved, and some cured, by the use of the Crescent water. It may however be questioned, how far these waters may be used with safety in incipient *tubercles* of the lungs; which if neglected in the beginning, frequently terminate in consumption. This is a question to which I confess I cannot give a decisive answer, from my own observation; but the bad success which has hitherto attended the several remedies administered in such cases, admonishes us to adopt other modes of treatment. I shall here present the reader with the sentiments of Dr. A. Fothergill on this subject: "A mineral water," says he, "which possesses the power of pervading the lymphatic system, and of disburthening the lymphatic glands, in remote parts of the body, by promoting an increased secre-

tion from the intestinal glands, and that without heating or weakening the frame, seems of all others the most likely to answer the intention; the small portion of iron contained in the water, need not be dreaded on account of it's supposed heating quality, which is effectually obviated by a portion of cooling salts sufficiently diluted." The Crescent water possesses these properties in an eminent degree.

But though, in cases where the solids are relaxed, and the system weakened, chalybeates may be employed with the greatest advantage; yet, we should carefully guard against their use in cases directly opposite; where a plethoric or vigorous state of the system prevails, where the vessels are full of blood, and where there is a tendency to any inflammatory disease; because chalybeates would increase that state, and consequently bring on diseases which depended upon it, if such were not already present. But, though in these cases chalybeates be improper, Harrogate affords a safe and easy remedy in the sulphur water, which, by

it's cooling and purgative qualities, will effectually take off the plethoric state.

I shall next make a few observations on the diseases in which the sulphur water is useful.

The salts with which this water is impregnated, render it a mild purgative; it passes off very quickly and easily, seldom occasioning the least pain in the bowels; hence it may be used either as a powerful evacuant, or a gentle laxative. It's impregnation with hepatic air, renders it one of the most powerful remedies in several diseases of the skin; it's mode of action in these diseases has not been accounted for in a satisfactory manner, but experience confirms it's use. The saline substances which it contains may contribute to the cure of cutaneous diseases, both by promoting perspiration when the water is taken internally, and by stimulating the cutaneous vessels, when it is used externally; but, I am inclined to think, that the hepatic air acts a principal part in the cure of these complaints, for I have known common water impregnated with hepatic air, produce powerful effects in some her-

petic cases, in which the sulphur water at Harrogate had been formerly used with success, but to which the patients could not then conveniently have recourse.

The sulphur water speedily and easily carries off the effects of intemperance, as is experienced every year. Those who have spent the winter in festivity, come to Harrogate with a constitution loaded with impurities, and heated by repeated debauches; but, the use of the sulphur water for some time, as a purgative, or gentle laxative, not only cleanses the first passages, but purifies the blood, opens the pores of the skin, and promotes perspiration; and such patients, though they come heavy and loaded, their appetites gone, and their nerves unstrung, generally return alert, their spirits lively, and appetites good.

The sulphur water may be used with advantage, by persons pre-disposed to apoplexy; and, if properly administered, it will be found one of the best preventives of that dreadful disease; it is only as a preventive that this water can be used;

for, when the disease is present, very different methods must be tried.

The external signs of pre-disposition to apoplexy, are a large head, short neck, corpulency, a full habit, and generally a red turgid countenance. When a person of this form and habit, has led a life of indolence and inactivity, has indulged himself in a full diet, and frequent intoxications, and is advanced in years, he still becomes more subject to attacks of this disease,* and more especially if he be of a costive habit.

When apoplexy does not prove suddenly fatal, it is sometimes preceded by a swimming in the head, giddiness, headache, numbness in the arms or legs, drowsiness, false or confused vision, ringing of the ears, a more than usual fulness in the face and neck, incoherent speech, and frequent attacks of incubus. A hæmorrhage from the nose, particularly in the decline of life, and where a person has not been accustomed to it before, is often a certain prelude to the disease.†

* Cullen's First Lines, vol. 3. p. 128.

† Cullen's First Lines, vol. 3, p. 129; and Walker's Essay on the Harrogate waters, p. 117.

From the several symptoms preceding an apoplectic fit, it would appear that, in many cases, a fulness of blood, and an over distension of the blood vessels, of the head in particular, are to be reckoned among the causes which produce it. It is therefore probable, that a steady perseverance in a course of low diet, consisting chiefly of milk and mild farinaceous vegetables, begun early in life, and an attention to the use of constant exercise, might prevent this dangerous disease, even in those who were, from their form and habit, predisposed to it. But, in persons who are advanced in life before they think of taking precautions, and are at the same time of a corpulent habit, which generally supposes their having been accustomed to full living, it might not be safe to put them upon a low diet, and it may be enough that their diet be rendered more moderate than usual, especially with respect to animal food, and that at supper, such food should be abstained from altogether.*

Evacuations, by stool, certainly contribute to relieve the plethoric state of the

* Cullen's First Lines, vol. 3, p. 156.

vessels of the head; and, upon an appearance of any unusual turgescence in these, purging will be very properly employed; and consequently, the sulphur water may be used with advantage; but, when no such turgescence appears, the frequent repetition of purging might weaken the body too much; and, for preventing apoplexy, it will for the most part be enough to drink the water in such a manner as to keep the body regular and rather open. This caution is the more necessary as instances are not wanting of persons predisposed to apoplexy, having a fit brought on by the too free use of the sulphur water.

Patients of this class ought to be cautious with respect to the warm bath. The rarefication it occasions, has been known to excite, in the full and plethoric, a fit of apoplexy, immediately after coming out of the bath.* Cold bathing, by tending to propel the blood into the internal parts, and particularly into the head, cannot be used without risk of danger by persons pre-disposed to apoplexy.

* Dr. Walker's Essay, p. 118.

By much the greater number of patients who resort to Harrogate, are those afflicted with eruptions on the skin; and, the relief experienced in the most obstinate cases of this kind, from the use of the sulphur water, is astonishing. This water was, for a long time, thought too offensive or too dangerous to be taken internally; and therefore was at first only used as a bath, or wash, in diseases of the skin, many of which it annually cured, by this mode of application only; but when, in time, it came to be used internally also, it's efficacy in removing those diseases, became still more striking and obvious.

Notwithstanding the common appearance of these diseases, few have been so little understood by medical practitioners; and, perhaps, no author has yet described them with accuracy. By persons unacquainted with the science of medicine, herpetic complaints have been almost universally confounded with the scorbutic kind; and, it is astonishing that some practitioners should be so ignorant of the distinction;* no two diseases being more

* "The term *Scurvy*," says the learned Mackbride, "is

opposite. Herpes generally attacks the young and plethoric, who, in other respects, enjoy high health; and is, in it's nature, always inflammatory; the scurvy, on the contrary, shows every indication of a putrid state; and when it is not brought on by putrescent diet or long abstinence from fresh vegetables, it is mostly confined to the weak and debilitated valetudinarian, who has passed the meridian of his life, in habits of rigid abstemiousness.* In herpetic complaints, there is generally a super-abundance of oxygen in the blood; scorbutic complaints have been shown, by Dr. Trotter, Dr. Beddoes, &c. to depend upon a deficiency of that principle. And besides, the real scorbutic ulcer exhibits appearances perfectly different from the disorders now under consideration; in so much, that, as Mr. Bell observes, there is

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often indiscriminately applied, even by medical people, to almost all the different kinds of cutaneous foulness; and this vague way of speaking, is owing to some writers of the last century, who comprehended such a variety of symptoms under this denomination, that there are few chronic diseases but may, according to this scheme, be called a scurvy." Introduction to the theory and practice of physic, p. 615.

* Walker's Essays, p. 133.

scarcely a possibility of mistaking the one for the other; and the remedies of the two diseases are just as opposite as their several symptoms and appearances are different.*

The best and most accurate description of herpetic complaints, is, in my opinion, that given by Mr. Bell, in his treatise on ulcers; he considers herpes as a variety of his species of ulcer, which he calls cutaneous; and observes, that all the appearances of this species of cutaneous ulcer, may be included in the following, viz. 1. The *herpes* ferinosus, or dry scaly ulcer, which includes what has been called by some, the dry tettar. 2. *Herpes* pustulosus, which includes the crusta lactea, and tinea capitis, or scald head. 3. *Herpes* miliaris; of this variety is the ulcerous eruption, called the ring-worm. 4. *Herpes* exedens; this includes the ulcers, called depascent and phagedenic.

The herpes farinosus is the most simple kind, as well as the most common; it appears on any part of the body, but most

* Bell's Treatise on ulcers, p. 354.

usually on the face, neck, arms, or wrists; those parts being most particularly exposed to the extremes of heat and cold. It appears in small red pimples, which are attended with a troublesome itching, and when scratched, often discharge a thin watery serum, resembling the true itch; these pimples soon fall off in the form of a white powder, resembling fine bran; they leave the skin perfectly sound, but are apt to return in the form of a red efflorescence, fall off, and be renewed as before.

These diseases of the skin have been thought, perhaps too frequently, to depend upon an acrimony in the blood, which, by an effort of nature, is thrown out on the surface of the body; but, there are no direct proofs of such acrimony in herpetic cases, and there is reason to believe, that they are less connected with a diseased state of the constitution, than has generally been imagined. Indeed, the greatest part of those, subject to them, enjoy good health, and are perfectly free from any constitutional disease. They are confined to the skin, and depend, in a great measure, on changes in the state of

the atmosphere, such as sudden alterations of heat and cold, and perhaps sometimes on sudden alterations in the weight of the air. The human skin is exceedingly porous; and these pores consist both of the extremities of exhalent vessels, which convey useless and excrementitious juices out of the body, particularly the perspirable matter, which, in a sound state, is continually poured out in large quantity, and likewise inhalent or obsorbent vessels, which imbibe, and carry into the body, any fluid with which it is surrounded. Over the true skin, in which both these kind of vessels terminate, is spread a fine thin membrane, called the cuticle, or scarf skin, being that which is separated on the application of a blister. The pores of this membrane are extremely numerous, as is evident on viewing a portion of it, by the assistance of a good microscope, particularly a solar one; and, these pores far exceed in number the extremities of the exhalent vessels, which open immediately under this membrane; from hence it is evident, as Dr. Walker observes, that perspiration and sweat are poured out, not on the surface of the cuticle, but under it, and from thence ouze out as through a sieve.

In cold weather, there is reason to suppose that perspiration is not only diminished, but that the quantity of saline matter which ought to pass off by the skin is not evacuated in due proportion, and may therefore accumulate under the cuticle, where it may prove so stimulant and acrid, as to cause an itching, redness, and perhaps some degree of inflammation. Perspirable matter being thus detained under the cuticle, will account for the small portions of the latter, which are often forced off from the true skin in the form of scales, in many eruptive cases.*

By this mode of reasoning, we cannot account for the influence of sudden changes of weather, upon diseases of this kind; they commonly appear upon the part of the face which is exposed to the air, and more seldom upon that part of the forehead, covered with the hat, which may be easily accounted for. It too often happens, in this country, that men rise from the table after having drank a considerable quantity of wine: the vessels are then in a high state of excitement, and perspiration is

* Walker's Essay on Harrogate waters, p. 135.

going on very plentifully; notwithstanding which, they go out into the cold air, which suddenly produces a contraction of the cuticle in those parts exposed to it, while the exhalent vessels are still pouring out the perspirable matter in a large quantity; this must (and frequently does suddenly) occasion an herpetic eruption on those parts of the body which are exposed to the air.* Thus we see the reason why those, whose constitutions are the most robust, and who have indulged freely in the pleasures of the bottle or the luxuries of the table, are subject to these kind of eruptions, while it more rarely attacks the fair sex, and such of our own as live temperately. Though this theory may perhaps account for the general appearance of these complaints, yet it must be confessed that it is liable to exceptions, for we often see those who have lived the most temperately, and even abstemiously, subject to these eruptions. The disposition to them seems to be hereditary, for I know several numerous

* Is it not probable that the cutaneous vessels, particularly those parts exposed to the air, when thus highly excited, absorb *oxygen* from the atmosphere, which causes an inflammation, florid appearance, and cutaneous eruption?

families, who are all, without exception, afflicted with complaints of this nature.

In some instances of this disease, the legs are covered with an infinite number of small red pimples, so close together, that they seem to form one even inflamed surface; but, when nicely examined, are found evidently to consist of small distinct pustules: they give a rose color to the limb; the cuticle falls off in the form of a fine white powder, but in a few days it becomes again visible, in the form of a fine transparent shining membrane, which soon falls off as before. I have seen instances where both legs have been entirely covered by them, and sometimes several other parts of the body.

The *herpes* pustulosus occurs most frequently to children, and generally attacks the face, and behind the ears, but seldom any part except the head. It appears in the form of pustules, which are originally separate and distinct, but afterwards run together in clusters; at first they seem to contain nothing but a thin watery serum, which afterwards turns yellow, and exuding the whole surface of the part affected,

at last dries into a thick crust or scab; when this falls off, the skin below frequently appears entire, with only a slight degree of redness on it's surface; but, on some occasions, when the matter has probably been more acrid, upon the scabs falling off, the skin is found greatly excoriated.

The *herpes* miliaris generally appears in clusters, though sometimes in distinct circles of very minute pimples. These are at first perfectly separate, and contain only a clear lymph, which, in the course of the disease, is excreted upon the surface, and there forms into small distinct scales; these at last fall off, and leave a considerable degree of inflammation below; in consequence of which, fresh matter still continues to exude, which likewise forms into cakes, and falls off. The itching in this sort of ulcers is always very troublesome, and the matter discharged from the pimples, is so tough and viscid, that every thing applied to the part adheres so, as to occasion much trouble and uneasiness to the patient, on it's being removed. The whole body is subject to this species of herpes, but it most

frequently appears on the loins, breast, scrotum, and groins.

The *herpes* exedens, discovers itself on any part of the body, but mostly about the loins, where it sometimes spreads to such a degree, as to extend quite round the waist. At first it usually appears in the form of several small ulcerations, collected into larger spots of different sizes, and of various figures, with always some degree of inflammation. These ulcerations discharge large quantities of a thin, sharp, serous matter, which sometimes forms into small crusts, that in a short time fall off; but, most frequently the discharge is so thin and acrid, as to spread among the neighbouring parts, and there produce the same kind of sores. Though these excoriations or ulcers do not in general proceed farther than the true skin, yet sometimes the discharge is so very penetrating and corrosive, as to destroy the skin and cellular membrane, and on some occasions, the muscles themselves.*

Besides these cutaneous diseases, which are more properly called herpetic, others

* Bell's Treatise on ulcers.

are met with at Harrogate, and are often cured by a proper use of the sulphur water, after many other remedies have been tried in vain. I mean *lepra* and *elephantiasis*.

Leprosy is distinguished by an uncommon roughness of the skin, upon which white surfuraceous eschars appear, which are sometimes humid and itchy, at other times dry and scaly. The disease first makes it's appearance on the surface of the skin, in the form of small red spots, which are generally of a roundish figure, rising a little above the level of the skin, yet they are not pointed, but flat at the top. The cuticle which covers them, becomes thinner by degrees, and at last separates in a thin transparent scale. A fresh cuticle is soon generated, which likewise falls off, and is succeeded by another as before. The eruption sometimes spreads over the whole body, but is generally more confined.* The part affected is frequently covered with scales, lying over each other like the scales of a fish, or the tiles of a house.

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* Walker's Essay on the Harrogate waters, p. 153.

The first symptoms of *elephantiasis* which appears, is a swelling of the calf of one or both legs, which soon grows considerable, and the part becomes almost insensible to the touch; the finger leaves no impression upon it, as it does on œdematous swellings; the cuticle which covers the tumour becomes scaly, and schirrhous tubercles about the size of nuts are formed upon it, but there does not appear to be any particular discoloration.* By degrees the leg is more and more tumefied, and the veins are formed into large varices which are very apparent from the knee, downward to the toes. After this, the whole skin grows rugged and unequal, a scaly substance soon forms itself on it, with fissures here and there. These scales do not fall off, but are daily protruded forward, until the leg be greatly enlarged. Notwithstanding the monstrous size of the diseased leg, the appetite remains good, and in all other respects the patient is healthy; it more rarely happens that both legs are affected. This disease is by no means so common in this country as in warmer climates; Dr. Towne observes,

* Walker's Essay on the Harrogate waters, p. 153.

that negroes are more subject to it, than the white people. Instances of it are not, however, very uncommon in England.

In the cure of these various diseases of the skin, it has been generally believed to be unsafe, and even dangerous to proceed in any other way, than by correcting the original disorder of the fluids, which was supposed to produce them. It may indeed occasionally happen that some disorder of the general habit accompanies these complaints of the skin, and then regard must be paid to it; but, in the greatest number of instances, they are more certainly and speedily removed by the use of local remedies. In confirmation of this opinion, I shall insert some arguments advanced by Mr. Bell: antimonials, he observes, produce the most beneficial effects in these complaints, but the principal advantages attending them, seem to depend entirely on their producing a determination to the skin, and keeping up a free discharge of the matter of perspiration; which frequently, for want of cleanliness, and sometimes from other causes, being long retained on the surface of the body, and there turning acrid, may often, it is possible, give rise to many of our

cutaneous affections. And, accordingly we find that all such remedies prove more or less effectual, according as they are more or less powerful in keeping up a free perspiration.

By those who maintain that an acrimony of the fluids is the most common cause of these disorders, it is supposed that the beneficial effects of antimonials, and other diaphoretic medicines, depend entirely on their evacuating, or carrying off the morbid matter, with which the fluids in those disorders, are imagined to abound.

Many arguments, however occur, against the probability of this opinion, and in particular the difficulty, or rather impossibility of showing how these morbid matters, supposing that they really existed, should be more readily evacuated by sudorifics, than the other parts of the blood, with which they must, in the course of the circulation, be intimately mixed. But what puts it beyond a doubt that all such medicines act entirely in consequence of preserving a free perspiration, and not by evacuating any fluids particularly morbid, is that the very same advantages in all such

complaints are frequently to be obtained, merely by the use of repeated warm bathing, with a due attention in other respects to cleanliness.

From this view of the theory of such complaints, many circumstances with respect to them may be much more clearly accounted for, than on any other supposition. Of these, however, we cannot enter into a full consideration; and shall only observe, that by it may be explained the reason why such complaints appear very frequently in a partial way only, which they often do, by breaking out in a single spot, without affecting any other part of the surface. This we cannot suppose would frequently happen, if these disorders always proceeded from a general affection of the system; but it may very readily occur from a local stoppage of perspiration, occasioned by the application of such causes to particular parts, as we know to be generally followed with that effect.*

In the treatment of these disorders, the first and principal circumstance to be

* Bell's Treatise on ulcers.

attended to, is, that not only the parts affected, but the whole surface of the body be kept as clean and perspirable as possible. To this end, the frequent use of warm bathing and gentle frictions are singularly serviceable. Nothing could have been better contrived to answer the end in these cases, than the sulphur water at Harrogate; to the advantages common to warm baths, are joined it's saline impregnation, and the hepatic gas which it contains; the first enables it to stimulate and deterge the vessels and pores of the skin, while the latter seems to act as a specific in these diseases. What would tend greatly to prove, that the power this water possesses over cutaneous diseases, depends, in a great measure, on the herpetic air, is that all the other advantages might be expected from warm sea-water, which however is never found, by any means, so efficacious as the sulphur water at Harrogate. May not the action of the sulphurated hydrogen gas, in the greater number of herpetic complaints, be rationally explained on the following principles? Most of these complaints depend upon an inflammatory state of the system, and there are in general evident marks of a superabundance of oxygen, such as the

heat and florid color of the parts affected, and the florid color even of the venus blood, when drawn in most of these cases. The sulphurated hydrogen will most powerfully diminish this oxygen, by uniting with it, and forming water.

In these diseases, I would advise the patient frequently to use the warm bath, and if there be no circumstance which particularly prohibits it, he may go into the bath every second evening,* taking care to observe the general directions hereafter given, concerning warm bathing. In all diseases of the skin, the patient should either bath the whole body, or the parts more particularly affected, in the sulphur water; and those who are afflicted with the *herpes farinosus*, or dry scaly eruption, should be well rubbed immediately before they go into the bath, with a flesh-brush;

* I have had several patients who have persisted in the internal use of the sulphur water daily, for two or three months, and who have remained in the warm bath from one to two hours every day, for the same length of time, without debilitating the body, or in any way injuring the constitution; but, on the contrary, thereby acquiring both health and strength. The use of the warm bath two or three times a week, has assuredly, a very renovating effect upon old and emaciated people; and I am confidently of opinion that it's use has no inconsiderable tendency to retard the advances of those infirmites naturally incident to old age.

or, if that should occasion too much pain, with a piece of flannel; the flesh-brush may be likewise used while the patient is in the bath; this not only opens the pores of the skin, but takes off also the scurf, which is usually upon it; by which, the water not only enters more easily into the blood, but is likewise more immediately applied to the little ulcers upon the skin, and heals them up sooner. After the patient comes out of the bath, he should endeavour to support a gentle perspiration, by means of warm diluent drink, such as negus or gruel.

With respect to the internal use of the sulphur water in such complaints, as the principal indication is to open the obstructed pores of the skin, it may often answer better, when taken as a gentle laxative, than a powerful purgative. But, as most herpetic complaints are attended with, and perhaps originated from a plethoric or inflammatory state of the system, gentle purging will take off that disposition. At any rate, the body ought to be kept open. The plan which is generally found to answer best in such cases, is to take the water on the mornings when the bath has not been used the night before, in such a

manner as to procure one or two stools, but no more. Half a glass full of the water may be taken about half an hour before bed-time every evening, when the bath is not used, with a few drops of antimonial wine in it. This generally promotes a free and gentle perspiration during the night. When the sulphur water is thus taken at night, a very light and early supper should be taken.

The morning after using the bath, it will, in general, be best not to drink the water before breakfast, as on other mornings, but to take a small glass between breakfast and dinner.

These methods persevered in for a sufficient length of time, generally cure, or at least greatly alleviate those diseases of the skin; but, sometimes cases occur, which are so obstinate as to require the exhibition of other remedies, both internal and external, which the nature of the case, and the judgment of the physician, will readily suggest to him.

I have been more particular in my observations on cutaneous complaints, than

on any other diseases in which these waters are found useful; and that for two reasons: 1st. Because they are the most numerous in the cases we meet with at Harrogate; and 2d. Practitioners not having formed a proper notion of the nature of these complaints, there is reason to believe that patients have frequently been improperly treated, and their stomachs loaded with alteratives as they are called, which in these cases are seldom useful, and frequently prejudicial.

The sulphur water has been much used in cases of worms; and, as Dr. Alexander justly observes, "it is one of the most sovereign remedies yet discovered." The worms, which infest the human body, are of three kinds: 1st. The *lumbricus* or round worm, which is about a span long, round and smooth, very much resembling the common earth-worm; this worm is found, for the most part, in the upper small intestines, but sometimes it is lodged in the stomach, and in any part of the intestines, even to the rectum: 2d. The *ascarides*, being very small white worms, which have their seat usually in the rectum: 3d. The *tœnia*, or tape-worm, which is from two

to forty feet or more in length, and generally possesses the whole tract of the intestines, but especially the *ileum*; it is full of joints, and very much resembles a piece of tape in it's appearance, whence it obtains it's name.

The symptoms generally assigned by writers, as indicating the presence of worms, are an itching of the nose, acid eructations, a depraved or voracious appetite, a pale countenance, a hard and swelled abdomen, a swelling of the upper lip, grinding of the teeth, and frequent starting, during sleep, with frightful dreams, such as of dogs tearing the patient's bowels. It must be owned, however, that the symptoms are often fallacious, and that the only certain sign, is that of passing the worms along with the fæces.

The round and tape-worms are frequently evacuated by the water taken as a brisk purgative; but the ascarides, which generally lie low in the rectum, may be most effectually destroyed by the water injected into the intestines. For this purpose, about a pint of it should be made milk-warm, and thrown into the bowels by way

of glyster; this should be done in bed, where the horizontal position of the body will favor the ascent of the injection. This method may be repeated every day, or every second day; by which means, these worms will be sooner and more effectually destroyed, than by drinking the water only. As these complaints are frequently attended with weakness; and, as it is generally allowed, that a debilitated constitution is more favorable to the generation of worms, it will not be amiss to drink the chalybeate waters at proper intervals.

In cases of *hemorrhois* or piles, the sulphur water has frequently been exhibited with great advantage. One of the principal symptoms in this disease, and which alone is frequently the cause of it, is costiveness; and, as nothing is of more consequence in this complaint, than to have an easy gentle stool, once or twice a day, so nothing answers this purpose better than the sulphur water, which is extremely mild in it's operation, is very seldom attended with any griping, and stimulates the rectum perhaps less than any other purgative. By continuing the use of this water for a week or two, the piles are commonly very

much relieved, if not entirely eradicated; but it will, in general, accelerate the cure, if the patient goes into the warm bath once or twice a week, which softens or relaxes the parts affected, and gives present relief from, as well as future security against pain. Instances are not wanting where the piles have been cured by the sulphur water, after every medicine generally exhibited in such cases, had been used to no purpose.*

It is justly observed by Dr. Alexander, that there is scarcely any disease which requires more temperate living than the piles, the least immoderation, either in eating or drinking, will infallibly render them worse, and retard the cure.

Cases of obstinate and habitual costiveness, have been much relieved by the sulphur water. Such cases frequently afflict persons of a sedentary life, and often arise from too anxious application to study or business, which prevents their attending to the calls of nature; in consequence of which, the rectum becomes, in time, in-

* See Alexander on the Harrogate waters, p. 83.

sensible to the stimulus of the fæces. Such persons will find the sulphur water a safe and mild purgative,* well suited to their complaints: the warm bath may be used with advantage in such cases, and injections of the warm sulphur water are frequently of service; but, what will contribute most to the cure and prevention of such complaints, is to endeavour to acquire a habit of going to stool at a certain hour, which will soon become easy; and, nature being accustomed to that regular discharge, will bring on an inclination at the usual time, which will return with the same regularity, and for the same reason, as the appetite for food.

In the *chronic rheumatism* the sulphur water is often made use of as a warm bath, and with great advantage; in the *acute rheumatism* it's use is doubtful, and perhaps improper, that species of the disease being attended with fever and inflammation. The chronic rheumatism is frequently the consequence of the acute,

* The use of the sulphur water is not (like many other purgatives) followed by a costive state of the bowels, but produces an increased action of the intestinal canal for some time after.

and is distinguished by the following symptoms; pain and stiffness of certain joints, which feel uneasy upon motion, or on changes of the weather; generally, however, unaccompanied with any remarkable swelling or fever: these pains very often shoot along the course of the muscles from one joint to another, and are generally much increased by the action of the muscles belonging to the joints affected. Patients laboring under this disease, should go into the warm bath every second night, and afterwards endeavour to encourage a gentle perspiration. Much advantage is not to be expected from drinking the water, in this disease; though it may be taken in such a manner as to prevent costiveness.

The Harrogate waters have been used in *scrofulous* complaints, and I have no doubt that many have received benefit from them. Plentiful dilution by some saline water, has at all times been recommended as one of the most useful remedies. Sea water has been particularly celebrated in this disease, on account of the saline matter which it contains; but, whatever encomiums it may merit, (and

it certainly is one of the most useful remedies in this disease) all the good effects to be expected from it, may be obtained from the saline waters at Harrogate. If the sulphur water be used, it should be drank in small quantities, several times a day, but not so as to purge. For, since scrofulous complaints are generally accompanied with a debilitated state of the system, purging will on this account be improper; besides, it prevents the water from entering into the blood. Of all the waters at this place, the Crescent seems the best suited to scrofulous complaints, since the portion of salt which it contains, is just sufficient to make it active as a gentle stimulous upon the excretories, without causing it to operate by the intestines, whereby it will be taken into the blood, enter the minutest vessels in the body, and promote all the secretions; while the iron which it contains, will tend to remove the debility, which, if not originally the cause of the disease, always retards it's cure. With the same intention, the cold bath may be used two or three times a week: all the good effects in this disease, may be expected from the very cold

bath at Low-Harrogate, that are obtained at Ilkley.

Whether the sulphur water might be prescribed with advantage in the *colica pictonum*, or colic, proceeding from lead, a disease to which painters, miners, and others who deal much in that article, are subject, we have had few opportunities of ascertaining.* Our grand indication in this complaint, must be to remove or correct the exciting cause; any other indication can only be secondary and subordinate: for it is most probable that all the symptoms will disappear when we have fulfilled this indication.

The effect produced by sulphur, or hepatic air upon lead, is remarkable. Whether it possesses any correcting power, and whether lead mineralized by sulphur, would lose much of it's activity, as is the case with some other mineral substances, has not I believe been ascertained by experiment, but does not seem unlikely. The salt contained in the sulphur water, would serve as an evacuant, and this

* Since the first edition of this treatise was published, I have seen a case of *colica pictonum*, which was cured by the use of the sulphur water.

water, by fulfilling both our indications, may be peculiarly suited to this complaint. It certainly deserves a trial.

In speaking of the medicinal virtues of the chalybeate waters, I mentioned some cases of consumption, in which they are useful; we must however expect the florid consumption, on which Dr. Beddoes has lately thrown considerable light. From his observation it is highly probable, that in this disease the blood is superoxygenated.* In such cases chalybeates would be hurtful, because they would increase the number of red particles in the blood, and enable it to take in more oxygen, and thus increase the disease; but some of the sulphur waters, particularly those which contain but little salt, might perhaps be used with safety and advantage, both internally and externally; for, it is probable, that the sulphurated hydrogen gas would powerfully diminish the superabundant oxygen, by uniting with it, and forming water. I have not yet seen a case of florid consumption in which

* Vide Dr. Beddoes's Observations on the nature and cure of calculus, sea-scurvy, consumption, &c. Also, his Letter to Dr. Darwin.

these waters have been tried, but should think them much preferable to those of Bristol, in these cases. In confirmation of this theory, I beg leave to add the following fact:—After walking a great deal for several days in frosty weather, when the barometer was high, I was seized with a difficulty of breathing, great tightness in my breast, a short dry cough, countenance very much flushed and florid, with every symptom which attacked Dr. Beddoes, after inhaling oxygen gas, which convinced me that the system was superoxygenated; the exercise of walking obliged me to make more frequent respirations, while I took in at each inspiration a greater than usual quantity of oxygen, on account of the dense state of the air. These symptoms were instantly relieved and soon cured, by inhaling sulphurated hydrogen gas, procured from *hepar sulphuris*.

PART IV.

DIRECTIONS

For the Use of the

Harrogate Waters.

SECT. I.

Chalybeate Waters.

PATIENTS, whose cases are suited to the chalybeate waters, should in general, before they begin with them, drink the sulphur water for a day or two, in such a manner as to procure about two stools a day; let them then begin with the Tewit-Well or Old-Spaw, drinking about half a pint three or four times a day, at a time when their stomach is pretty empty. The best times are early in the morning, about two hours before dinner, and in the afternoon. If this quantity be found to agree

very well with the patient, he may drink two half-pint glasses three or four times a day; riding or walking about ten minutes or a quarter of an hour between the two glasses. If the water agree, it will occasion an agreeable sensation about the stomach, and a pleasant warmth over the whole body, frequently accompanied by an exhilaration of spirits; it sometimes acts powerfully as a diuretic, particularly if the atmosphere be cold, and the body lightly clothed; on the contrary, if the temperature of the air should be moderately warm, it occasions a gentle perspiration.

If it should occasion giddiness, or a sense of heaviness in the head, or particularly if it occasions a sense of fulness about the nose, similar to an incipient catarrh, with a slight soreness of the throat, (which it sometimes does, when it's tonic power has been exerted too violently) it will be proper either to lesson the quantity, or to omit the use of it for a day or two, and take a dose of Glauber's salt, *soda phosphorata*, or a little sulphur water, which will soon carry of these effects; the water may then be had recourse to, but in less quantity. Those who are drinking the

chalybeate waters, ought carefully to guard against costiveness, by taking at night a little *lenitive electuary*, or a small quantity of *soda phosphorata*, the taste of which salt is so little nauseous, that it may be taken in tea or gruel, without the least disgust.

It may be supposed, by some, that the sulphur water might be drunk every day, to prevent costiveness, at the same time that they are drinking the chalybeate waters; but, I am unwilling to subscribe to this practice, till I am convinced that the chalybeate principle will not be rendered inactive, or it's power diminished by the sulphur water. In the treatise on the Crescent water, I mentioned an experiment which may be easily made by any person; and which, I shall here take the liberty to repeat: When the chalybeate waters are mixed with those from the sulphur wells, the mixture immediately becomes turbid, of a black color, and if it be allowed to stand for some time, a black precipitate falls to the bottom of the vessel, and the superincumbent liquor does not show any marks of it's containing iron, on mixing it with tincture of galls, or prussiat of potash. Hence it is evident, that the iron

is precipitated by the sulphur water. The virtues of the chalybeate waters depend, however, upon their saline state, or the solution of iron by fixed air; but, this state is destroyed by the sulphur water, and the quantity of iron which is precipitated in the form of martial æthiops, is too small to produce any sensible effect.

This precipitation would undoubtedly take place, if the chalybeate water was taken so as to mix with the sulphur water in the stomach and bowels; for which reason, I think it would be better, in general, not to drink both these waters on the same day, or at least to let a considerable time intervene.

The effects of the chalybeate waters may, in general, be much promoted by the bracing powers of the cold bath, where there is nothing to forbid it's use. It may be used two or three times a week, according to the strength of the patient; the best time for going into the bath is in the forenoon, between breakfast and dinner. The patient ought not to remain for any length of time in it, but should plunge into it, and come out immediately; his body must

then he rubbed very dry, and he should clothe himself as soon as possible, and use gentle exercise for some time after.

SECT. II.

Sulphur Water.

EARLY rising being conducive to health in general, and to the successful use of this water in par icular, I would advise invalids to repair to the well early in the morning, and drink the water at the fountain-head, that the volatile principles may not escape. With regard to the quantity to be drunk, as well as the intervals necessary to be observed between each glass, it is difficult, if not impossible, to lay down general rules, not liable to exceptions from the difference of strength, constitution, and habits of the patients.

The intervals will differ according to the intended operation of the water; for those who wish to drink it as a purgative, it will be best to begin with a glass of the common size, containing rather more than

half a pint; to walk or ride immediately after drinking it, and if no sickness come on, or if the sickness should be gone off, another glass may be taken in about ten minutes, or a quarter of an hour, and after the same interval, a third; it will be sometimes, though not often, necessary to take a fourth; but in cases where three glasses do not go readily off by stool, I would advise a small quantity of purgative salt to be dissolved in the first glass. Epsom salt will answer very well, but as it greatly augments the nauseous taste of the water, soda phosphorata will be found more agreeable.

To quicken the operation of the water, by the addition of a quantity of purgative salt, when a moderate dose of it does not produce the wished-for effect, is the best method of preventing giddiness of the head, and other disagreeable, as well as dangerous consequences, which sometimes arise from the water when taken in too great quantity, and when it does not pass off freely.

Some habits are so easily affected, that

two glasses will often be found sufficient. For children, of about five or six years of age, one half pint taken at two or three times is generally sufficient, and so in proportion for those who are older.

When the water is taken as an alterative, one or two glasses may be taken before breakfast, about half an hour distant from each other, and another glass may be taken about two hours before dinner.

Cold water, as Dr. Alexander observes, greedily swallowed when one is warm, generally does mischief, and that in proportion to the largeness of the draught, and the quickness in drinking it. The draught of the sulphur water is, he says, large enough for this purpose, and on account of it's bad taste, it is always swallowed with the utmost precipitation; on which account, though walking or riding be recommended between each draught, neither of them ought to be violent; and, if the patient happen to be very warm, when his time of drinking is come, it is best to put it off a little, and allow himself to cool, to prevent the ill-consequences which

otherwise would probably happen.* This caution ought likewise to be observed by those who drink the chalybeate waters.

To obviate the bad taste of the water, which to many is very disagreeable, some have recourse to sundry aromatic seeds, in the form of comfits, sugar-plums, &c. I have, however, generally found that a small quantity of sea-biscuit, or coarse bread, will take of the bad taste sooner than any other thing, and this without palling the appetite, or injuring the digestive powers, which an habitual use of aromatics is very apt to do. The water is generally thought most nauseous at first, and when a person has been accustomed to drink it for some time, it becomes much less disagreeable: I thought it at first very disagreeable, but can now drink it with as little disgust as common spring water.

A course of this water, as well as of the chalybeates, may require from three

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* For several years I have recommended my patients, when they first begin a course of the waters, to have a little hot put into each glass of the cold: this effectually obviates the bad effects which I have sometimes seen it have upon the stomach, when taken without this precaution.

to five or six weeks or upwards, according to the nature and violence of the disease. The sulphur water ought to be left off gradually, using, for the space of two or three weeks afterwards, a more abstemious diet, and guarding against costiveness. The propriety of this caution will appear obvious, when it is considered, that large evacuations long pursued, and then suddenly discontinued, dispose the system to plethora and all it's consequences, especially if a free course of living be imprudently indulged.*

* Dr. Fothergill, on the Cheltenham waters, p. 100.

Crescent Water.

SOON after a person has drank a glass of this water, containing about half a pint, he feels a pleasant sensation about the stomach, with a kind of agreeable warmth over the whole body; his spirits are exhilarated, and he finds himself moredisposed, and better qualified to enter upon study, business, or pleasure. If the water is taken in the forenoon, betwixt breakfast and dinner, it generally creates a sharp appetite, and the person eats his dinner with greater pleasure, than when he does not drink this water. When it is drank in a morning, and pretty brisk exercise used, it acts very powerfully as a diuretic; though when the weather is warm, or the body warmly clothed, it is more apt to increase perspiration.

From the above-mentioned effects, which I have myself frequently experienced, and learned from others, who have drank it under my direction, it appears that this water acts as a tonic, diuretic, and often

a diaphoretic: it operates as a very gentle stimulus, and constitutes a mild but active medical compound, well calculated to strengthen the stomach, and promote digestion; to cleanse the first passages, to purify the chyle and lymph, and clear the whole glandular system. By uniting with the bile, and other alimentary fluids, in it's passage through the intestines, it stimulates the glands, dispersed, upon the surface of the intestinal canal, to pour out their contents; by which it, in some measure, deterges the canals of the liver, spleen, pancreas, and other viscera, and removes obstructions in them. It likewise stimulates the lacteal or absorbent vessels, which are distributed upon the coats of the intestines, and, by innumerable mouths, take up the nutritious part of our food, and convey it to the blood, and makes them perform their functions more vigorously.

The diseases in which this water has been found useful, or in which we may expect it to be beneficial, are almost all of the *chronic* kind, by which is meant those diseases which have been of long standing, and in which there is not *immediate* imminent danger: by this term they are distin-

guished from inflammations, fevers, &c., in which the sick are generally confined to their beds, and the disease terminates in the course of a few days, either favorably or unfavorably; these last are called *acute* diseases: and in these we cannot expect much benefit from mineral waters, even if the patients could have recourse to them.

The diseases in which mineral waters are found beneficial, require their use for a considerable time, and we have frequent instances of patients who might have been cured by them, who have gone away because they found no benefit from drinking them a few days: but patients ought not to be dissatisfied if they receive no great benefit from the water in the space of a week or a fortnight; for, where diseases have continued a long time, it would be folly to expect that they could be easily and speedily removed.

The diseases in which we may expect to find the Crescent water useful, may, with propriety, be divided into the three following heads.*

* This division was suggested by the perusal of Dr.

1st, Those in which the stomach is principally affected.

2d, Those of the intestines, and other abdominal viscera.

3d, Those of the lymphatic system.

1. Those diseases in which the stomach is principally affected, are sickness, vomiting, heart-burn, acid eructations, spasmodic pains in the stomach, indigestion, and loss of appetite. In cases of gout, particularly in that species called the *atonic*, where the system has been weakened by frequent and severe attacks of that disorder, we may expect benefit from the Crescent water, when drank in a proper manner. I have placed the atonic gout among those diseases in which the stomach is principally affected; for, though in this disease, the whole habit is generally very much debilitated, yet the stomach is commonly more disordered than any other organ.

2. The diseases of the intestines, and other abdominal viscera, in which the Crescent water may be used with advan-

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Fothergill's Inquiry concerning the Cheltenham water; from which I received much information and entertainment.

tage, are colic or spasmodic pains in the bowels, flatulency, hypochondriac affections, and habitual costiveness which generally accompanies that disorder; jaundice, whether from a spasmodic affection of the biliary ducts, or from gall stones; stone and gravel; piles.

3. The diseases of the lymphatic system, in which this water may be expected to be useful, are schirrus affections of different glands; scrofula; rickets; scald head; leprosy; venerial complaints of long standing, especially those accompanied with cutaneous eruptions.

Several of the above-mentioned diseases have yielded to the use of the Crescent water, but many of them are of so obstinate a nature, that much depends upon beginning with the water early, and persevering for a sufficient length of time.

DIRECTIONS

CONCERNING THE USE OF THE

Crescent Water.

As in many complaints, in which the

Crescent water is recommended, particularly those of the nervous kind, it's efficacy is very much promoted by various concomitant circumstances, such as cheerful and agreeable company, and exercise in the open air; this points out the summer as the most proper time for drinking it, because these concomitants cannot be enjoyed in winter, in an equal degree; it may, however, in cases of necessity, be drank at any season, though perhaps not with equal advantage. The best times for drinking it, are before breakfast, betwixt breakfast and dinner, and in the evening; the usual dose is from half a pint to a pint, or from one to two glasses; though, at first, one glass will sometimes be found too large a dose, and produce sickness, and a sense of weight and oppression in the stomach; for which reason, it will be always prudent to begin with half a glass; and, if that dose is found to agree, it may be gradually increased to one or two glasses. As part of the bore of the pump always contains a little water, which has remained since the last time of pumping, and consequently will have lost part of it's fixed air, and deposited some of it's iron, it will be proper to pump once or twice into the cistern, before you receive it into the glass.

WARM BATHING.

THE greeks and romans regarded warm bathing, not only as an efficacious remedy, but also as one of the highest enjoyments of luxury; hence the great number of private and public baths, built in a superb style.

With us, warm bathing is not so much used by way of a luxury, as of a remedy, and at Harrogate, almost never with the former intention. From what has been said, p. 160, concerning the exhalent and absorbent vessels, which terminate in the skin, we shall be enabled to explain several circumstances concerning the action of the warm bath, which would otherwise be unaccountable. From this, it is easy to conceive, that when the human body is immersed in the warm bath, a quantity of the water will be absorbed, together with such substances as are dissolved in it. Hence, besides the effects of the bath in cleansing the skin, and deterging the cu-

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This water I have found of the greatest use, where the stomach was weak, the bowels relaxed, or the appetite bad; in these, as well as in bilious complaints, I have recommended it with the greatest confidence.

taneous vessels, a large quantity of medicated water is taken into the mass of blood, perhaps in a more active and less altered state, than when taken in by the stomach; for most things which are taken in by the stomach are liable to be altered by the animal processes, and are always much mixed and diluted before they enter the blood.

From this we clearly see the manner in which several of the most active remedies may be conveyed into the blood; and, can likewise easily conceive how some persons, who, on account of particular diseases, have not been able to swallow any nourishment, have been kept alive a long time, by immersing the body in warm water, impregnated with nutritious substances.

A circumstance of the greatest consequence in warm bathing, is the proper regulation of the heat of the bath; if it be too hot, the certain consequence will be, that the body being highly stimulated by the heat, will the next day be uncommonly weakened and relaxed.

No person ought to regulate the heat of

the bath by his own sense of feeling, or trust to that of the attendant, since this sense, with regard to heat is exceedingly fallacious; for agreeably to the general laws of sensation, the sensation here produced is not in proportion to the absolute force of the impression, but according as the new impression is stronger or weaker than that which had been applied immediately before. Accordingly, with respect to temperature, the sensation produced by any degree of it, depends upon the temperature to which the body had been immediately before exposed; so that, whatever is higher than this, feels warm; and, whatever is lower than it, feels cold; and it will therefore happen, that opposite sensations of heat and cold may, on different occasions, arise from the same temperature, as marked by the thermometer.*

Hence the degrees of heat of the bath, ought always to be determined by a thermometer. I would in general advise the patient never to go into the bath, heated at first to a greater temperature than the human blood, which is about 98 degrees of

* Cullen's First Lines, vol. I. p. 146.

Farenheit's thermometer; 94 or 96 degrees is the heat most commonly recommended; after he has been in the bath a few minutes, the temperature may be gradually raised three or four degrees higher; but farther than this I would not advise any one to go, as it can be productive of no good effects, but may be attended with the worst consequences.

With regard to increasing the temperature while in the bath, it ought always to be determined by means of a thermometer, which is perhaps here more necessary than for determining the heat on first going in, "for our feelings are, by the slow and gradual increase of the heat, made in a great measure insensible of it's force; and in this manner cheated out of that power they naturally have, of warning us of danger; thus we become not only able to continue in a warm bath, slowly heated to a high degree, but even to enjoy it with pleasure, when of such a degree of warmth as we could not have bore at our first going into it."*

* Alexander, on Harrogate water, p. 28.

Respecting the time of continuing in the bath, it should at first be very short; the first time, the patient may remain in it five minutes, and if he find no inconvenience from it, he may gradually increase the time to about a quarter of an hour, or if his constitution be pretty strong, to 20 minutes; beyond this time I would not advise any one to remain, since a smaller degree of heat continued for a sufficient length of time, will produce as great a relaxation, as a higher temperature continued for a short time.

One of the most common questions asked by patients, is, how often the bath may be repeated? To this it is impossible to give a general answer, not liable to exceptions, much depending on the constitution of the patient, and the nature of the disease.* In general, those afflicted with cutaneous complaints, may go in every second or third night. Some use the bath

* To those who are afflicted with any disease of the skin, and especially to those that have dry skins, I would recommend the daily use of a bath of 94 to 96 degrees of heat, taking it one or two hours before dinner, and remaining in it from 30 to 40 minutes. I should always strongly recommend the bath to be taken before dinner, (never on a full stomach) since the use of it in an evening not unfrequently causes heated and restless nights.

two nights together, and miss the third; and where the constitution is strong, this may perhaps be productive of no bad consequences; but nothing, except want of time, ought in my opinion, to induce a person to go in oftener than every second night.

I come now to mention the manner of conducting the patient, when he comes out of the bath; and here I cannot forbear congratulating the company at Harrogate, on the abolition of the absurd and indelicate customs formerly in use, which afforded just grounds of complaint, to Dr. Alexander, and of ridicule to the facetious Dr. Smollet, and the eccentric author of John Buncle. The common sweating-bed, tainted with the effluvia of hundreds, is not now to be found even in the lowest bathing-houses at Harrogate.

The method of conducting the patient, on coming out of the bath, depends on the nature of the disease, and whether it be necessary to encourage a free perspiration. If that be the object, let the patient go immediately to his bed, which is previously to be warmed: he should take

care to have by him a little white wine whey, of which he may take a little now and then, as long as he wishes the sweating to continue. If profuse perspiration be not the object, (which it seldom will be) the patient may eat a light supper; for instance, a little mutton broth; a poached egg, or a little negus with toasted bread: he must allow himself to cool gradually, and then go to bed; even in this case, the perspiration will generally continue in some degree during the night; which, in many cutaneous complaints, is a desirable object.* The patient ought to take care, if he find the perspiration free in the morning, to cool himself very gradually before he rises.

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* Many people are deterred from using the warm bath before dinner, in consequence of their apprehensions of taking cold from subsequent exposure to the air; this fear however, is wholly groundless, since the body is then in a fitter state to resist the effects of cold, than at any other time.

Sect. III.

DIET AND REGIMEN.

THE diet of the patient ought undoubtedly to be varied, according to the nature of the disease, and other circumstances, which will readily occur to himself or his physician; but the grand and fundamental rule for diet is temperance, which ought to be strictly observed in every situation of life, but particularly by the valetudinarian: for in vain will he seek access to health, if he do not pay court to her elder sister, temperance. The strong and robust may enjoy the pleasures of the table and the bottle with seeming impunity, and sometimes for many years will not find any bad effects from them; but depend upon it, if a full diet of animal food be every day indulged in, with only a moderate portion of wine after it, it's baneful influence will at last blast the

vigour and sap the foundations of the strongest constitution. The luxury of the tables at Harrogate, are sometimes apt to tempt the invalid, and lead him to excess. These pleasures, when thrown in the way, will sometimes tempt the most abstemious to deviate from the rules of temperance; but, let the valetudinarian remember, that one error, from intemperance, may entirely defeat his designs, and he may return in worse health than he came.

It is impossible to give any general rules concerning the species of diet proper for each individual, every person of common sense will judge what food agrees with him, better than any one can inform him; but as the diseases of most of the patients who resort to Harrogate, may, in a general way be divided into two classes—1st, Those depending upon, or accompanied by a state of debility—2nd, Those attended with an inflammatory or plethoric state, it may be proper to point out a necessary distinction with regard to their diet.

Those of the first class ought to observe a generous temperance, rather than a severe abstinence; their dinner should con-

sist of plain animal food, easy of digestion and nutritious; to this should be joined a due proportion of farinaceous aliment and esculent vegetables. Broths or soups, with any kind of animal food, that agrees best, may be eaten with moderation. The best drink during dinner, is pure water, and patients of this class may indulge themselves after dinner with a few glasses of generous wine, taking care to keep strictly within the bounds of temperance; for, whenever the spirits are thus artificially raised, they afterwards sink proportionally, and the next day the hypochondriac finds his anxious cares and the gloomy state of his mind redoubled.

For breakfast, milk, chocolate, or cocoa, will be much better than tea, which in nervous complaints, and weakened and relaxed stomachs, is always improper; but besides the pernicious effects of tea, upon such constitutions, it's use is highly improper for those who are drinking the chalybeate waters. It is surprising that this should not have had due attention paid to it; but, a simple experiment which I related in the treatise on the Crescent water, cannot fail to convince every

one of the impropriety of this part of the diet of such as are drinking the chalybeate waters. If a little infusion of tea be mixed with any of the chalybeate waters, the mixture assumes a purple color, nearly as deep as when tincture of galls is mixed with the same water. When it has stood for some time, the iron is all precipitated in the form of a black powder, and neither tincture of galls, nor pussiat of potash will produce any effects upon the superincumbent liquor. The same will undoubtedly take place in the stomach and first passages, if a chalybeate water be drank within an hour or two after tea. Now, since the small quantity of iron which is contained in these waters, owes it's efficacy to it's saline state, or union with and saturation by fixed air; tea, by precipitating it from this solvent, must destroy, or at least lessen the good effects expected from it.

The second class of patients, who labor under diseases accompanied with a plethoric or inflammatory disposition, and particularly those laboring under herpetic and other cutaneous complaints, ought to live more abstemiously. It would be of the greatest advantage, if such patients would

favor the general intention of promoting perspiration, by drinking plentifully of such warm diluents as stimulate but little, such as broths, gruel, barley-water, or weak sassafras tea. The solid part of their food should consist chiefly of vegetables, and a small quantity of fresh animal food at dinner only. Salted meats are, in these cases, very improper, and should be carefully avoided, as well as all kinds of foods which are perspirable with difficulty; pork is supposed to be of this kind.

With regard to fruits, there can be no objection to the use of them, provided they be perfectly ripe, and eaten with moderation; they have a tendency to cool the body, and by their mild ascescent qualities, they temper and correct the alkalescent nature of animal food. The best time for eating fruit is before dinner; when taken upon a full stomach of animal food, they seem not to agree so well, and overload that organ, perhaps already oppressed with more than it can easily digest. Upon a supposition that several herpetic complaints depend upon a superabundance of oxygen, acid and ascescent fruits will be improper, because they contain and impart a considerable

quantity of that principle to the blood, as is evident from the good effects which they produce in the sea-scurvy, which depends upon a deficiency of oxygen.

Suppers ought, at all times, to be eaten with caution, and nothing but the lightest kind of food, and the easiest of digestion ought to be allowed, such as chicken, tripe, poached eggs, gruel, jellies, &c. The evening is not the proper time for taking in much nourishment: the powers of the body, and particularly of the stomach, are then almost exhausted, and the food taken in, will be but imperfectly digested and assimilated; besides, the addition of fresh chyle to the blood, together with the stimulus of food acting on the stomach, will prevent sleep, or render it disturbed or confused; nothing contributes so much to the prevention of diseases, as well as to the restoration of health, as sound healthy sleep; this is the method nature had provided to repair the exhausted constitution, and restore the vital energy; without it's refreshing aid, our worn-out constitutions would scarcely be able to drag on a few days, or at most weeks, before the vital spring was quite run down.

EXERCISE.

OF all the various methods of preserving health and preventing diseases, which nature has suggested, there is none more efficacious than exercise; it puts the fluids all in motion, strengthens the solids, promotes perspiration, and occasions the decomposition of a larger quantity of atmospheric air in the lungs. Hence, in order to preserve the health of the body, the Author of nature has made exercise absolutely necessary to the greater part of mankind, for obtaining the means of existence. "Had not exercise been absolutely necessary for our well being," says the elegant Addison, "nature would not have made the body so proper for it, by giving such an activity to the limbs, and such a pliancy to every part as necessarily produce those compressions, extensions, contortions, dilations, and all other kinds of motions that are necessary for the preservation of such a system of tubes and

glands. And that we might not want inducements to engage us in such exercise of the body, as is proper for it's welfare, it is so ordered that nothing valuable can be procured without it. Not to mention riches and honors, even food and raiment are not to be come at, without the toil of the hands and the sweat of the brow. Providence furnishes materials, but expects that we should work them up ourselves. The earth must be labored before it gives it's increase, and when it is forced into it's several products, how many hands must they pass through, before they are fit for use. Manufactures, trade, and agriculture, naturally employ more than 19 parts of the species in 20; and as for those who are not obliged to labor, by the condition in which they are born, they are more miserable than the rest of mankind, unless they indulge themselves in that voluntary labor, which goes by the name of exercise."*

Let every one therefore, who resorts to Harrogate for the benefit of health, take as much exercise in the open air as they

* Spectator, No. 115.

can conveniently. When patients are weak, or have been accustomed to a sedentary life, their exercise should at first be very gentle, and gradually increased as their strength can bear:—

> Begin with gentle toils, and as your nerves
> Grow firm, to hardier, by just steps, aspire.
> The prudent, even in every moderate walk,
> At first but saunter, and by slow degrees
> Increase their pace. *Armstrong.*

In this manner, they will soon perform journies with ease, which, had they been attempted at first, would have been found impossible.

Of all the different kinds of exercise, there is none which conduces so much to health, as riding; it is not attended with the fatigue of walking, and the free air is more enjoyed in this way, than by any other mode of exercise. Where it cannot be used, walking or exercise in a carriage must be substituted.

The best time for taking exercise, is before dinner, for the body is then more vigorous and alert, and the mind more cheerful, and better disposed to enjoy the

pleasure of a ride or walk. Besides, the patient generally returns with a good appetite, and the stomach is enabled to perform it's functions properly.

Exercise after a full meal, disturbs digestion, and causes painful sensations in the stomach and bowels, with heart-burn and acid eructations. For this reason, it will not be proper for invalids to take exercise soon after dinner. If the day be very warm, exercise, instead of being of service to patients, exhausts their strength and spirits; in this case, it will be best to postpone riding or walking out till towards the cool of the evening, when such exercise will be much more pleasant, and contribute more to the recovery of health. But, whatever mode of exercise the patient uses, he must be particularly careful not to fatigue himself too much, for that will entirely counteract the good effects to be expected from it, and occasion weakness and relaxation instead of strength.

Dancing, as being a more laborious kind of exercise, is better suited to the strong and healthy, than to the sickly valetudinarian; yet, when this amusement is enjoyed

with moderation, it may in some diseases prove not only harmless, but beneficial; for instance, in amenorrhœa and hypochondriasis; for, by this exercise, all the muscles are brought into action, and the blood circulates more equally and freely; besides, it produces an agreeable and cheerful state of mind, which, in such diseases, is of the greatest consequence; but as dancing, especially in the summer season, generally occasions a free perspiration, particular care must be taken to prevent being exposed to the cold air, till the body is perfectly cool.

Though mineral waters often produce astonishing cures, yet their good effects are seldom evident at first, and they always require some time of trial. A very great proportion of those who come to Harrogate for the benefit of their health, do not stay a sufficient time to obtain the whole advantage that the waters are capable of imparting; and, many scarcely long enough to determine if the nature of their disease be well suited to the use of the waters. The time of their stay is generally determined before they leave home, and this time is often so unalterably fixed, that nothing

but extreme necessity can prevail on them to alter their plan; but, it is evident that the time of those whose object is the recovery of their health, should be determined by their physician, whose judgment in this has as good a right to be consulted as in any other article; and they ought not to go away dissatisfied if they have not received much benefit in the space of a week or fortnight, but should reflect, that where diseases have continued for a long time, it would be folly to expect that they could be easily and speedily removed.

APPENDIX.

CASE I.

IN 1795, I attended a lady who had been afflicted for upwards of two years with an eruption on several parts of the body, which discharged a large quantity of thin watery serum, accompanied with an itching, so violent as to prevent her taking necessary sleep, which had reduced her so much, that her life was despaired of. By the use of the sulphur water, both internally and externally, in two months she was entirely cured.

CASE II.

A lady, between 50 and 60 years of age, for a number of years had at times been afflicted with lowness of spirits, pain and soreness of the stomach, want of appetite, and restless nights. A variety of nervous and other medicines had been used, with-

out effect. I advised her to drink the Crescent water, to the extent of three glasses every day; viz. one before breakfast, another at eleven o'clock, and another at three o'clock. She found some relief in about a week, and in a fortnight thought herself much better. If she omitted the water even for a day, the complaints returned, but on having recourse to it again, she always found immediate relief. After persevering in the use of it for about three weeks, she got quite well, and has since enjoyod a good state of health.

CASE III.

In 1803, I attended a young lady, who had been afflicted for four years with a dry scaly eruption, covering almost every part of the body. Her appetite was bad, and very much debilitated. By drinking the sulphur water and using it as a bath, she soon got much better and stronger; and, in the course of seven weeks, obtained a cure.

CASE IV.

In August, 1803, I was consulted by a gentleman, who had been for three months subject to violent spasms in his stomach,

want of appetite, restless nights, and a frequent discharge of loose stools both night and day, his legs and thighs swelled, and pitted on pressure, he was so much reduced as to leave little hopes of his recovery; he had taken a great quantity of æther, laudanum, and astringent draughts, from which he had found only temporary relief. I advised him to drink the Crescent water. The first day he found his spirits better, and the complaint in his bowels somewhat relieved; the third day he had a slight attack of the spasm in his stomach, but it never returned after; and in eight days the swelling of his legs and thighs were removed, his appetite better, and his nights comfortable: and, at the end of five weeks, he left Harrogate in perfect health, and has not since had a relapse.

CASE V.

A gentleman came to Harrogate, afflicted with a number of scaly blotches upon both his hands, as also on his face, arms, and thighs; these eruptions had tormented him for five years; he had tried a variety of remedies, but without relief. The disease made it's appearance in the form of small distinct round tumours, elevated

above the skin; these were at first in a great measure insensible, but some short time after, they became very painful, accompanied with a considerable degree of itching, and discharged a thin serous fluid. I advised him to drink the sulphur water and bathe; he persevered in this plan for five weeks, in which time he found himself well, and the complaint has not since returned.

CASE VI.

I was consulted by a gentleman, who had been subject to the piles for several years; he had been confined to his bed for the greatest part of the preceding month. After drinking the sulphur water regularly for six weeks, the complaint left him; he has been here several times since, but has had no return of it.

In every case of the piles which I have seen, the sulphur water effected a cure.

CASE VII.

A gentleman had for some time been subject to a violent inflammation in his eyes, attended with a continual throbbing pain, and his sight was much impaired. By

the use of the sulphur water, for about three weeks, he was cured.

CASE VIII.

Eight years ago, a young gentleman came here from London, who had been subject to fits for upwards of four years, which came upon him regularly three times every day, which not only impaired his health very much, but also his mental faculties. He had been long attended by many of the faculty, in town, but derived no benefit from their assistance. He had also recourse to quack medicines, such as worm-lozenges and powders, without receiving the least benefit. At length he was recommended to try the effects of these waters. By drinking the sulphur water, and also using it as a glyster, agreeable to my direction, in a few days he voided large portions of the tape-worm, and continued to do so almost every day, for many weeks; and, by persevering therein for about three months, he obtained a perfect cure, and returned to his friends perfectly restored to his health.

CASE IX.

A gentleman came to Harrogate, in 1795,

and was recommended to my care by one of the faculty; who, in a letter to me, expressed his fears, that he would not be able to reach Harrogate, on account of his weak state of health. He complained of a constant and violent pain in his stomach, with an almost total loss of appetite, and frequent inclination to vomit, and slept very little. When I first saw him, he was scarcely able to move from his chair. His complaints had been of long standing, and he had tried several medicines without any effect. I advised him to drink the sulphur water in small quantities every morning, and also to drink a glass of the chalybeate water, with a few drops of elixir of vitriol, two or three times a day. In about a fortnight he began to feel his strength and appetite return; his inclination to vomit ceased, he slept much better, and the pain in his stomach was now trifling; and, in six weeks he left Harrogate, perfectly recovered.

CASE X.

A married lady, between 50 and 60 years of age, of a nervous habit, came to Harrogate in July, 1790; her complaints were pain of the stomach, nausea, and other

symptoms of indigestion; several of her family had been afflicted with the gout, but she never had the least symptom of it. I advised her to drink a glass of the Crescent water first thing in the morning, another about an hour after, the same dose at 11 o'clock in the forenoon, and again at four in the afternoon. Before she had continued it's use in this manner for a week, the pain of her stomach and symptoms of indigestion left her, and she was attacked with a pain and swelling of her hand, which continued while she remained at Harrogate, which was about a month, her general health being much better.

CASE XI.

In March, 1790, I attended a lady, aged 35, who had, for a considerable time, complained of general weakness and want of appetite, and was very much emaciated: she had tried a variety of medicines, but without any permanent relief. I advised her to drink about half a glass of the Crescent water, three or four times a day, for a few days, and then to increase it to a whole glass. She found relief from it in a few days, and has since continued in a pretty good state of health.

CASE XII.

A young lady, of a full habit, who had for two years been subject to a suppression of the natural evacuation, complained of a violent pain of her head; small pustules broke out upon her face, and other parts of her body; as one crop disappeared, another succeeded. By drinking the sulphur water, and using it as a bath, for two months, the evacuation returned, and the eruption disappeared.

CASE XIII.

A gentleman had been confined to the house for more than three months, by a chronic rheumatism. He slept very little, and the pain was so violent that he could scarcely bear to be moved. He was cured by bathing three times in the sulphur water.

FINIS.

From Hargrove's Office, Knaresbrough.