

— *Alij hinc saltem, hac data via, felici-
cioribus freti ingenijs, rei rectius gerendæ
et melius inquirendi occasionem capiant.*

G. HARVEIJ. Op.

EXPERIMENTS AND OBSERVATIONS
ON THE WATERS OF
BUXTON AND MATLOCK,
In DERBYSHIRE.

THE water of St. Ann's well at Bux-
TON, is found, by analysis, to contain
calcareous earth, fossil alkali, and sea salt;
but in very small proportions. For a gal-
lon of the water, when evaporated, yields
only twenty-three or twenty-four grains
of sediment. It strikes a slight green co-
lour with syrup of violets, suffers no
change from an infusion of galls, from
the fixed vegetable alkali, or from the

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minutes pulse 100. Head ach. In an hour and a half pulse 95. Head ach abated.

EXPERIMENT III.

October 13th. EIGHT o'clock in the morning. The day cold. Pulse 92. I drank the quantity of water above-mentioned. In five minutes pulse 86. In fifteen minutes pulse 86, full and hard. In twenty minutes pulse 100. In half an hour pulse 92.

FROM the first and third experiments it appears that the coldness of the morning counteracted, for a time, the effects of the Buxton water, and reduced the vibrations of my pulse from 84 to 80, and from 92 to 86. But the stimulus of the water soon became superiour to the sedative powers of the cold to which I was exposed; for within the space of half an hour my pulse rose to 90 in the first, and
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to 100 strokes in the second trial. At eleven o'clock before noon, when the air was warm and serene, the water in a much shorter time exerted its full force, increasing the velocity of my pulse from 90 to 109 vibrations in a minute.

THESE experiments evince the heating quality of Buxton water, and suggest to us the precautions to be observed in the use of it. Small quantities only should be drunk at once, and frequently repeated; the belly should be kept soluble with lenitive electuary, or any other mild purgative; and at the beginning of the course, the patient may be directed to suffer the water to remain a few seconds in the glass, before he swallows it. For this celebrated spring abounds with a mineral spirit, or mephitic air, in which its stimulus, and indeed its efficacy resides, and which is quickly dissipated by exposure to the air.

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THE hon^{ble}. and ingenious Mr. Cavendish has shewn, by his Experiments on Rathboneplace water, Philof. Transact. vol. 57, that calcareous earths may be rendered soluble in water, by furnishing them with more than their natural proportion of fixed air. And it has lately been discovered that iron also may be suspended by this principle, in the same *menstruum*. (*b*) It appeared, therefore, highly probable to me, that a chalybeate impregnation might, with great facility, be communicated to the Buxton water, when fresh drawn from the spring; a quality which in many cases would add greatly to its medicinal efficacy. I suggested the trial to Mr. Buxton, a worthy and sensible Apothecary near the wells, who has lately, at my request, made the following experiment.

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(*b*) Vid. Mr. Lane's Experiments, Phil. Transf. vol. 59.

EXPERIMENT IV.

A QUART bottle, containing twodrachms of iron filings, was filled by immersion, with the water of St. Ann's well, corked and agitated briskly under the surface of the water. It was then suffered to remain in the well till the filings had subsided, when the water was carefully decanted into a half pint glass. To this were added three drops of the tincture of galls, which immediately occasioned a deep purple colour; and the transparency was presently restored, by a few drops of the acid of vitriol; evident proofs that a solution of the iron was effected in a few minutes. The water also, without the tincture of galls, had a chalybeate taste, and left an agreeable astringency upon the palate.

By this experiment it appears that a warm chalybeate, abounding with a mineral

neral spirit, and grateful to the taste, may with very little trouble be obtained. And this method of impregnating the Buxton water with iron, must increase its tonic powers, and in many cases improve its medicinal virtues. It is a common practice to join the use of a chalybeate spring, in the neighbourhood of St. Ann's well, with that of the Buxton water. But the superiority of this artificial mineral water must be apparent, if we consider its agreeable warmth, volatility, levity, and gratefulness to the palate.

Buxton bath is very frequently employed as a temperate cold bath. For as the heat of the water is sixteen or eighteen degrees below that of the human body, a gentle shock is produced on the first immersion, the heart and arteries are made to contract more powerfully, and the whole system is braced and invigorated. But this salutary operation must be greatly diminished, often indeed more than

than counterbalanced, by the relaxing vapours which copiously exhale from the bath, to which the patients are exposed during the time of dressing and undressing. A separate room is indeed provided for the ladies; but the gentlemen have no other accommodations than what the vault affords in which the bath is contained, and are therefore liable to all the inconveniences which arise from warmth and moisture.

June 12th, 1772. THE mercury in Fahrenheit's thermometer stood in the shade at 65; but in this vault quickly rose to 78 degrees.

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EXPERIMENTS

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MATLOCK WATER.

EXPERIMENT I.

A Thermometer made by Dollond, and graduated according to Fahrenheit's scale, was exposed for a sufficient length of time to the stream of water as it gushes out of the rock, and also immersed in the basin which receives it. The mercury rose to 66 degrees.

EXPERIMENT II.

Six drops of *sp. sal. ammon. vol.* were poured into a glass of the spring water, which

which contained about the sixth of a pint; a very slight cloudiness immediately ensued; but no precipitation was afterwards observable.

EXPERIMENT III.

Six drops of a solution of salt of tartar occasioned a cloudiness just perceptible, in the same quantity of water. No precipitation ensued.

EXPERIMENT IV.

Six drops of a solution of *saccharum saturni* immediately produced a milkiness in the water, but no sensible precipitation.

EXPERIMENT V.

Six drops of a solution of silver in the nitrous acid instantly occasioned a milkiness in the water; and after standing an hour, a grey powder was observable at the bottom of the glass.

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EXPERIMENT VI.

TEN drops of the infusion of galls neither produced any change of colour in the water at the time they were added, nor was the slightest purple hue perceptible two hours afterwards.

EXPERIMENT VII.

A PIECE of paper besmeared with fresh syrup of violets was dipped into a glass full of water. No change of colour ensued.

EXPERIMENT VIII.

ANOTHER piece of paper, moistened in the same manner with the syrup, was placed over a glass of water, as soon as it was taken from the spring. The paper suffered no change of colour, although it remained an hour upon the glass.

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EXPERIMENT IX.

MY pulse beat 84 strokes in a minute at the time when I drank a half pint glass of the Matlock water. In twenty minutes my pulse rose to 88. In half an hour they sunk to 82; and continued to vibrate the same number of times for an hour, which was as long as I thought it necessary to examine them.

EXPERIMENT X.

THE mercury in Fahrenheit's thermometer, when immersed in each of the baths stood at 68; in the river Derwent, which flows through the valley of Matlock, at 52. These experiments were made on the 12th of June 1772, and the weather was warm.

EXPERIMENT XI.

A four ounce phial, after being accurately counterpoised in a very nice balance, was filled to the brim with distilled

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led water, which weighed three ounces, four drachms, forty-five grains and a half. The same phial, exactly balanced as before, was then filled to the brim with Matlock water of the same temperature with the distilled water, which weighed three ounces, four drachms and forty-six grains.

MATLOCK water is grateful to the palate, and of an agreeable warmth, but exhibits no marks of any mineral spirit, either by its taste, sparkling appearance in the glass, or by the chemical test employed in experiment VIII. The second and third experiments shew, that it is very slightly impregnated with *selenites*, or other earthy salts; and of this its comparative levity affords also a further proof. For it weighs twenty-six grains in a pint lighter than the Manchester pump water, (a) and only four grains heavier than distilled water.

(a) Vid. the Author's Treatise on the Pump Water of Manchester, *Essays Medical and Experimental*, p. 287, 2d. Edit.

water. The precipitation of a grey powder by the addition of a solution of silver in *aqua fortis* to the water, renders it probable that a small portion of sea salt is contained in it. For the powder is found to consist of the particles of silver combined with the muriatic acid, which is separated from the fossil alkali by the superior affinity the nitrous acid bears to it; and thus a double elective attraction takes place in this experiment.

THIS water has been said to contain iron. But the assertion is at least rendered doubtful by the sixth experiment, which was made with the utmost accuracy; and I am inclined to think that it is entirely without foundation. The spring is justly celebrated for its efficacy in hæmoptoes; and hence it may have been too hastily concluded that it possesses some slight degree of stypticity, by means of a chalybeate impregnation.

THE ninth experiment, which my short

stay at Matlock would not allow me leisure to repeat, affords a presumption, that the water is not possessed of any stimulating powers. For the small increase of quickness in my pulse on drinking half a pint of it, may be ascribed more to the quantity received into the stomach, than to the heating quality of the water.

THE Bristol and Matlock waters appear to resemble each other both in their chemical and medicinal qualities. I have examined and compared them together by the tests mentioned above; and so far as such trials may be deemed conclusive, there seems to be no other than the following slight difference between them. The Bristol water becomes a little more milky on the addition of a solution of fixed alkali, and of *saccharum saturni*, than that of Matlock. The former also weighs near a grain in a pint heavier than the latter. Is it not to be lamented therefore that so little attention is paid to Matlock, even by the Physicians who reside in the
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neighbourhood of it? In hectic cases, hæmoptoes, the diabetes, and other disorders in which the circulation of the blood is rapid and irregular, I should apprehend that Matlock water, on some accounts, claims the preference to that of Bristol. For as it is not sensibly impregnated with any mineral spirit, it should seem to be less disposed to quicken the pulse, and may therefore be drunk in larger quantities. But it must be acknowledged that the climate of Bristol is superior to that of Matlock; a circumstance of the highest importance to consumptive patients. Situated in a deep though delightful valley, and surrounded by very high mountains, the sun disappears at Matlock earlier in the evening, the fogs are longer in dispersing, and it may be presumed that rain falls here more frequently and copiously, than in other places. For at Chatsworth, which is encompassed also with hills, and is about ten miles distant, in 1764, 1765, 1767, and 1768, about thirty-three inches of rain at a medium fell each year.

70 ON MATLOCK WATER.

THE following Table exhibits a comparative view of the different temperatures of Bath, Buxton, Bristol, and Matlock waters, measured by Fahrenheit's thermometer.

* B A T H.

King's Bath Pump	- -	112°.
Hot Bath Pump	- -	114 $\frac{1}{2}$.
Cross Bath Pump	- -	110.

* B R I S T O L.

Hot Well Pump	- -	76.
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B U X T O N.

Bath	- - -	82.
St. Ann's Well	- -	81 $\frac{1}{2}$.

M A T L O C K.

Baths	- - -	68.
Spring	- - -	66.

* Vid. Mr. Canton's Experiments, Phil. Trans. vol. 57. page 203.

ON

ON FIXED AIR. 71

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MEDICINAL USES

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F I X E D A I R.

IN a course of experiments, which is yet too unfinished to lay before the public, I have had frequent opportunities of observing that fixed air may, in no inconsiderable quantity, be breathed without danger or uneasiness. And it is a confirmation of this conclusion, that at Bath, where the waters copiously exhale this mineral spirit, (a) the bathers inspire it

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(a) See Dr. Falconer's very useful and ingenious Treatise on the Bath Waters, 2d. Edit. p. 313.