APPENDIX.

No. I.

OF WATER.

Syn. Aqua (*Lat.*), ὕδωρ (*Greek*), Eau (*F.*) Agua (*S.*), Acqua (*Ital.*), Aae (*Dan.*), A (*Swed.*), Ea, Eha (*old Saxon*), Awe (*Pers.*), Aw (*Welch*), Aa (*Low Germ. Islandic*), Ab (*Shans.*), Abh (*Gaelic*), Immek (*Esquimaux*), Tannee (*Tam.*), Panic (*Duk.*), Mah (*Arab.*), Watoora (*Cyng.*), Ayer (*Malay*), Panicum (*Sans.*), Hai (*Tonquinese*), A (*Gothic*).

WATER is an agent of great importance, independent of the part it sustains in the magnificent operations of Nature. Its efficacy in the cure of diseases is indubitable; yet it is not admitted into the list of materia medica of any of the British Pharmacopœias, either in the state in which it is most commonly procured, or that in which it holds in solution substances from which it receives new properties, and is rendered capable of producing important changes in the animal œconomy. In the first state it is denominated COMMON WATER: in the second, MINERAL WATER; and under both of these forms, it is necessary that its qualities and effects should be known to the medical practitioner.

I. COMMON WATER.

The usual appearance of water is too well known to require description. It retains its fluidity under the ordinary pressure of the atmosphere, at any degree of temperature between 32° and 212° [1], Fah.: but under 32° it crystallizes and becomes solid, or is changed into ice; and above 212° [2] assumes an aëriform character, or becomes steam, expanding to 1698 times its ordinary bulk. One cubic inch of pure water at 60°, and under a pressure of the atmosphere indicated by 30° of the barometer, weighs 252·42 grains, or nearly $\frac{1}{1000}$th part of a grain less than two hundred and fifty-two grains and a half.

Although water is almost universally diffused over the surface of the earth, yet it is not found perfectly pure in any place; which is owing to its great solvent powers enabling it to take up a portion of many things with which it must come into contact in its natural state. These impregnations, however, are not sufficient in general to give it any very sensible taste or odour, or to render it unfit for the ordinary purposes of life; and it is in this state that common water is usually obtained. Common water varies considerably according to the source whence it is derived, and other circumstances; but all the varieties may be reduced under the three following heads:

1. Rain Water — *Aqua pluvialis.*
2. Spring Water — *Aqua fontana.*
3. River Water — *Aqua fluviatilis.*

1. RAIN WATER is the purest kind of natural water; but it, nevertheless, contains in solution, in every 100 cubic inches, about 3½ cubic inches of air, rather more oxygenous than common atmospherical air, and about one cubic inch of carbonic acid gas, besides minute portions of carbonate of lime and muriate of lime. Its specific gravity scarcely differs from that of distilled water; and after precipitating the muriate of lime, by dropping into it a little barytic water, and exposing it to the atmosphere until the precipitate be totally deposited, it is sufficiently pure for most pharmaceutical purposes. [3] When rain water, how-

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[1] This degree varies according to the pressure of the atmosphere. Thus, in Gemmilaro's hut, on the side of Etna, about 11332 feet from the level of the sea, Dr. Irvine found that water boiled at 191°. Vide *Letters on Sicily*, 8vo. p. 153.

[2] Guy Lussac.

[3] Morveau, *Annales de Chimie*, xxiv. 320.

ever, is collected in towns, or from the roofs of houses, it contains a small portion of sulphate of lime, soot, and other impurities, and requires to be boiled and filtered before dropping in the barytic water.

Snow water, when newly melted, is destitute of air, which is the reason that fish cannot live in it; but, when allowed to remain for some time exposed to the atmosphere, it does not differ in its qualities from rain water.

2. SPRING WATER, if it have not filtered through a very soluble soil, is almost as pure as rain water. The best springs are those which rise through sand or gravel, at a small depth. [1] It generally contains, besides the ingredients which are found in rain water, a small portion of muriate of soda.

Well or pump water, which is spring water obtained by digging to a considerable depth, is by no means so pure. It is commonly distinguished by a property named hardness, implying an incapability of dissolving soap [2]; which is owing to its containing many earthy salts, the principle of which is sulphate of lime. It, also, contains more carbonic acid gas than common spring-water. Many of the foreign ingredients contained in hard water are simply suspended in it; for pump water is rendered softer and purer by only passing it through a filtering stone. The best mode of freeing hard water of its earthy salts, is first to boil it; then, after it has cooled, to drop into it an alkaline carbonate; and, lastly, to filter it. It cannot be employed for pharmaceutical purposes.

3. RIVER WATER, when the stream is rapid, and runs over a pebbly or a siliceous channel, is as pure as the softer spring water; but when the current is slow, and the bed clayey, it approaches nearer to the nature of well water, and frequently contains putrefied vegetable and animal matters, as is generally the case in the water of lakes and marshes.

Such are the foreign ingredients contained in *common water*. Boiling frees it from air and gases, and precipitates many of the earthy salts: but distillation in glass vessels frees it entirely from these ingredients, and it is obtained almost perfectly pure, transparent, colourless, insipid and inodorous.

The varieties of water enumerated above may be almost indiscriminately employed as diluents, the small proportion of foreign ingredients they contain occasioning no difference in their diluent properties. When the quantity of sulphate of lime and aluminous matter, however, is very considerable, as is the case in the water of many pumps, there is some reason for concluding that deleterious effects may arise from the use of the water; although it may be doubted whether the scrophulous and glandular swellings, peculiar to some populous towns, can be justly ascribed to this cause. [3] Even a few of the waters which are regarded as mineral waters owe more to the diluent property of the water for their efficacy, than to the impregnations they contain. This is particularly the case with the Malvern spring, which has been found to contain very little foreign matter. The diluting power of water is much modified by temperature; warm or tepid water being a much better diluent than cold water.

The medicinal properties of water as a diluent were well known to the ancients; and cold water, used as a drink in fevers, was the principal remedy of the father of physic in these complaints. The temperature of 60° is the proper degree, when it is intended that water should produce its diluent effects without the aid of heat. Under 45° it produces a sedative and astringent effect; above 60° and under 100°, it relaxes the fibres of the stomach, and is apt to induce nausea, particularly when bulk is added to this range of temperature; but at a higher temperature, the stimulus of heat, in the same manner as the addition of other stimulants, prevents that effect. Simple water may supersede the use of all other diluents; but

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[1] The water conveyed to Hodsdon, in Hertfordshire, rises through a fine, white sand, and is so pure, that Dr. Hales affirms it left no incrustation in a boiler which had been in constant use for fifteen years. *Statical Essays*, ii. 242.

[2] Soap when agitated with hard water is decomposed; the alkali of the soap uniting with the acid of the earthy salts, while the oil and earths combine, and form new, nearly insoluble soaps, which swim in a curdy form on the surface of the water.

[3] Percival ascribes the glandular swellings common in Manchester to this cause. See *Essays*, i. 291.

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animal and vegetable infusions are generally employed; or toast and water (*infusum panis tosti*), which is more agreeable to most palates, and is an excellent diluent in fevers and inflammatory diseases. The temperature of water as a diluent should be regulated by the nature of the disease: in internal hæmorrhagies the temperature should not exceed 45°, but it may be 60° in fevers; unless in the cold stage of the paroxysm of fever, when thirst should be allayed by tepid or warm water or other bland fluids; and the same precaution is necessary when the sweat has become general and profuse. In cases in which there exists a morbid increase of bile disturbing the functions of the stomach and irritating the bowels, the temperature of the water used as drink may be from 90° to 114°; and in some cases of dyspepsia, which are attended with the sensation of coldness at the stomach, and with cold extremities, a cup full of water, taken as hot as it can be drank, affords very considerable relief. In cases of redundant bile, by drinking half a pint of tepid water every morning before breakfast, and taking immediately afterwards moderate exercise, the acrid bile is diluted, and its passage through the bowels assisted, without the irritation which, in its undiluted state, it always excites; and it produces the same benefit in cholera morbus in the commencement of the disease, the stomach being rendered by it more fit to receive opiates and other remedies. Some medicines, as sudorifics, diuretics, and emetics, scarcely produce their effects, unless their operation be assisted by copious dilution with water, or watery fluids.

Water is also an external remedy of great importance, but its effects are much modified by the degree of temperature at which it is applied.

COLD WATER, or of a temperature under 70°, gives the sensation of cold to the skin, and is applied under the form of *bath* and of *affusion*.

The cold Bath, (*balneum frigidum*,) is water of any temperature, from 42° to 85° of Fahrenheit. When the body is immersed in it, it first induces the sensation of cold, excites shivering, renders the skin pale, and contracts it so as to produce the papillous appearance denominated goose skin (*cutis anserina*); the respiration at the same time is quickened and rendered irregular, producing sobbing; and the pulse is diminished in force and velocity, but is also rendered firmer and more regular. If the immersion be not long continued, re-action takes place on coming out of the bath, a glow, or agreeable sensation of heat, is felt over the whole body, the tone and vigour of the muscles are increased, a buoyancy of spirit and aptitude for action succeed, and a sense of general refreshment is experienced by the bather. The protraction, however, of the immersion for a considerable space of time, particularly if the temperature of the bath be under 50°, is not followed by this re-action, but the cold water operates as a powerful sedative; the action of the heart and arteries becomes languid, the pulse ceases at the wrist, the animal heat is rapidly diminished, and a sensation of coldness at the stomach is felt, which is succeeded by faintness, delirium, torpor, and sometimes death. These unpleasant effects are occasionally experienced in some degree, even when the immersion is not protracted, and the temperature of the bath is not under 60°; in which case cold bathing proves always hurtful, and ought not to be repeated: but when the contrary effects are experienced it is found to be useful in many diseases of debility, particularly in scrophula, if the water be impregnated with salt, or sea-bathing be resorted to. The debilitated, however, in whom the use of sea-bathing produces these effects, when it is employed before breakfast, are not always affected in the same manner when it is used after breakfast, or when the stomach is full; but, on the contrary, receive the same benefit from it as those with whom it agrees at all times. The use of cold water as a general bath is never employed with a view of producing its sedative effects: but for this purpose it is partially applied, either by the immersion of the affected parts, or by means of cloths dipped in very cold water, and laid over or near the parts. It is used as a remedy in active uterine hæmorrhagies, burns, and scalds, and in local inflammations, even when arising from general disease, as gout and acute rheumatism, when the surface of the pained part appears red and inflamed.

The cold affusion, or the suddenly pouring cold water over the whole surface of the body, operates as a powerful remedy, although its effects as such are of short duration. They are produced by the suddenness of the application affecting the nervous energy, and by the shock rousing the dormant sensibility, so as to

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induce a new action, as it were, of the nervous system, dissolving the spasm on the extreme vessels of the surface, carrying off a large portion of morbid heat by general evaporation, and the remainder by insensible perspiration; thence restoring the healthy action of the exhalants and the capillaries. In typhus fever this mode of applying cold water has been productive of the best effects.[1] It should be applied in the first hot stage of the disease, if possible, and repeated every time the morbid heat returns. If the water can be impregnated with salt, so much the better; but when the disease is advanced, its temperature should not be more than 26°[2] under the heat of the body. It often stops suddenly the disease, if it be used during the three first days, and sometimes so late even as the fifth; but after this period it can be regarded as an useful auxiliary only even when properly employed. In tetanus, Currie affirms[3] that the cold affusion also proves useful, particularly when the shock is considerable, and applied during the convulsions. It is, however, in idiopathic tetanus only that it proves useful, no advantage being obtained from using it in tetanus arising from wounds.[4] Its utility has also been proved in many of the exanthemata; for instance, during the hot stage of the eruptive fever of small-pox; and we can bear ample testimony to its efficacy in scarlatina maligna, when the heat arises to above 100°.[5] This remedy, however, is productive of much mischief when misapplied; and therefore it is necessary to observe, that it is contra-indicated in the cold stage of fevers, and when a sense of chilliness is present, although the thermometer indicate the real heat to be more than natural. It is also said to be improper in fevers, when diarrhœa or dysentery are present; after the sweating stage in intermittents is formed; after the eruption is completely formed in confluent small-pox; and in symptomatic fever occasioned by great local inflammation: but Dr. A. Nicoll found it useful in India, in remittent and intermittent fevers accompanied with *dysentery*; when the heat of the surface has exceeded 98° Fahrenheit; for as in these cases the dysenteric symptoms seem to depend on the degree of febrile excitement, the cold water, by producing a solution of these, allays the griping and tenesmus, and natural stools follow. The affusion should always, in such cases, be preceded by bleeding and other depletory[6] means. The water should be dashed from a height of ten or twenty feet; and its temperature should be nearly that of the air at the time. The cold affusion, in the form of the shower-bath, is advantageously employed as a stimulant and tonic in diseases of general debility, when no fever or increased heat is present. I know of no remedy so generally useful in those affections which are known by the name of nervous complaints.

WARM WATER, or of a temperature from 86° to 100°, gives the sensation of warmth to the body, and is applied both locally and generally, in the form of vapour, fomentation, and bath. Water is found in a state of nature combined with different quantities of caloric within the above range of temperature. In the Buxton hot springs the temperature is about 82°; at Bristol it is from 76° to 84°; and at Bath the range is from 110° to 114°.[7] The necessary degree of temperature, however, is generally obtained by artificially heating the water.

The general application of warm water is obtained by means of baths. When the greater part of the entire body is immersed, the water constitutes properly a

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[1] The cold affusion was employed by Antonius Musa, physician to Augustus, when that emperor was affected with a bowel complaint, which had resisted every other remedy. *Vide Q. Horatii F. Epistol. lib.* xv. *ad Num. Valam. C. Sueton. Tranq. Octavius Aug.* ii. *cap.* 81. *p.* 104. Cold affusions in the fevers of Asia are also prescribed by the Koran, and used in India by the Mahomedan and Hindoo physicians in various diseases.

[2] Currie — *Reports on Cold Water*, i. 31. [3] *Ibid.* i. 138. [4] *Ibid.* i. 159.

[5] Currie gives the following results of the affusion: — The heat of the body in fever, as indicated by the thermometer, being 103°, was by it reduced to 98° in half an hour; and the pulse from 112 to 80 beats, (vol. i. 22.); the heat 101° was reduced to 99°; and the pulse from 112 to 98 in the same time. The heat 106° was reduced to 98°; and the pulse from 130 to 90. Vol. i. 46.

[6] *Lond. Med Repository*, vol. ix. p. 123.

[7] The temperature of the Cross Bath pump is 110°; the King's Bath 112°; and the Hot Bath, 114°.

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bath (*balneum*); but when half only is immersed, it is a half bath (*semicupium*). These may be either,

a. The hot bath (*balneum calidum*), from 97° to 100°.
b. The tepid bath (*balneum tepidum*), from 86° to 97°.
c. The vapour bath (*balneum vaporis*), from 100° to 130°.

The two first differ in temperature only; but the last, from the water being applied in a very minutely divided state, acts with much greater effect than water in the liquid form. The operation of the first of these forms of applying water is stimulant; it augments the action of the heart and arteries, renders the skin red, quickens respiration, and produces a copious flow of sweat; but the others, although they excite the sensation of heat, yet lessen the frequency of the pulse, relax powerfully the skin and simple solids, and diminish generally increased excitement. It has been a question of some interest, whether water be ever taken into the body by the cutaneous absorbents? That it is taken in has been denied by many philosophers, and facts brought forward to support the opinion. Dr. Currie and Dr. Pearson, after half an hour's immersion in the Buxton bath, at 82°, found that the weight of the body was rather diminished than increased; and in a case of disphagia, in which neither food nor drink was taken by the mouth for a considerable time, the patient, when put into the tepid bath, felt his thirst alleviated, and received much comfort, without his weight being at all increased. Dr. Currie supposed, that the abatement of thirst in this case arose from the relaxation of the exhalants of the surface produced by the bath, and those of the stomach sympathizing; and that although the exhalants terminate by open mouths, which pierce the epidermis, yet as the mouths of the absorbents terminate under it, and do not come into contact with the open air; so while the epidermis remains unirritated and entire, no absorption of fluid can therefore take place from the surface. Many experiments made by Seguin are also in favour of the opinion that no cutaneous absorption is effected in the bath. Among others, he immersed venereal patients in baths containing oxymuriate of mercury in solution, and found that while the cuticle remained entire, no salivation, nor other effect of the mercury on the system, was apparent; but the specific effect of the remedy always took place when the epidermis was injured or destroyed, as in itch. It must, however, be observed, that in the case of disphagia the urine flowed as if drink had been taken by the mouth; a circumstance which Currie supposes to depend on the absorption from the atmosphere by the lungs. This, however, is an assumed position; the free exhalation from the lungs is evident, but it is by no means proved that any absorption takes place. It is true that the weight of the body in the above case was diminished; but from the sum of this loss we must abstract the cutaneous exhalation of the part of the body not immersed, the pulmonary exhalation, and the weight of the egesta; and were a supposition to be admitted as argument, it might be suggested that the relaxant power of the warm water acting on the epidermis as on inert matter, may open a way through it to the mouths of the absorbents. The question is still undecided, and, fortunately, it is not of much importance in a practical point of view.

Warm and vapour baths[1] are efficaciously employed in acute rheumatism, inflammation of the abdominal viscera, of the kidneys, bladder, and uterus; in suppression of urine, and in spasmodic affections, particularly those to which infants are liable, arising from dentition and other irritations. The general relaxation produced by their use has been taken advantage of, also, for assisting the reduction of strangulated hernia; for, although the effect be not topical as it regards the hernial tumour, yet the general relaxation produced gives a disposition

[1] A very simple and convenient vapour bath for military practice has been recommended by my friend Dr. A. Nicoll. It may be formed of a common beer or spirit barrel, with a false bottom, placed about a foot from the bottom of the cask, that is, the end on which it is standing, and perforated with numerous small holes. A gun barrel connected with the spout of a tea-kettle placed on a fire, is to be introduced into an opening in the side of the cask between the real and false bottom; and the patient, being seated on the false bottom, the steam or vapour from the boiling kettle soon surrounds him by rising through the holes. It must be prevented from escaping by means of a blanket, which should cover the open end of the cask, and apply closely round the neck of the patient.

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to all the parts to regain their proper place. The tepid bath is found to be very useful in the rigidities which follow some acute diseases, as gout and rheumatism, nodosities of the joints [1], and, according to some, the rigidities attendant on old age.[2] Its effects in promoting the natural excretions by the skin render it very serviceable in promoting the cure of herpetic eruptions; in slight cases of lepra the use of it with friction is all that is required; and in all cutaneous foulnesses it is a most important auxiliary. It has also been found very beneficial in cases of insanity. In general the period of immersion should not be less than twenty minutes, nor exceed one hour.[3]

The partial application of warm water as a remedy is made by means of

1. *a.* The foot bath (*pediluvium*);
   b. The hip bath (*coxæluvium*); and
   c. The hand bath (*manuluvium*).
2. *d.* Fomentations of vegetable decoctions; and
   e. Flannel cloths wrung out of boiling water, by which the moisture is applied in a state of vapour.

These partial baths are useful in the same diseases for which the general baths are employed; but are better adapted for relieving the rigidity of single joints, and topical inflammation; and the hip bath has lately been found to be very beneficial in suppressed menstruation, and for relieving the pains of cancer in utero.

For fomentations it is the practice to employ vegetable decoctions; but the best of these can be regarded only as vehicles for retaining the heat and moisture. At all times, flannel cloths wrung out of boiling water are superior; both because the water is applied in the form of vapour, and also, while they continue as long warm, they do not wet the bed and linen of the patient. The flannel cloths should be each about two yards long, with the ends sewed together, so that by means of two sticks, one being at each end, turned in opposite directions, they may be wrung much dryer, when taken out of the boiling water, than could be effected by the hands. The principal circumstance to be attended to in the application of fomentations is the frequent renewal of them, in order that a steady and constant heat may be applied to the fomented part.

No. II. MINERAL WATERS.[4]

IT has been already noticed, that although no natural water is found in a state of absolute purity, yet that in general the quantity of foreign matters is not sufficient to give it any very sensible taste or odour. In some instances, however, these are so considerable, and of such a nature, as to prevent the water from forming a part of the nourishment of animals; in which case it is denominated a MINERAL WATER, and can be useful to mankind only in a medicinal point of view.

The substances found in mineral waters may be arranged under four heads.

I. AIR and GASES:

1. Atmospheric Air, (*very common.*) It is generally in the proportion of $\frac{1}{16}$ of the bulk of the water.
2. Oxygen Gas, (*rare.*) [5]
3. Azotic Gas, (*Buxton* [6], *Harrowgate* [7], *Lymington Priors* [8], *Bath.* [9])
4. Sulphureted Hydrogen Gas, (*Harrowgate, Moffat.*)

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[1] Haygarth, *Clinical History of Diseases*, 8vo. Lond. 1805.

[2] Tepid bathing with friction is said by one author, "vitam sæpe per plures menses, interdum etiam per aliquot annos, protraxisse." — Gregory, *Conspectus Med.* ii. 100.

[3] The Arabian physicians used the vapour bath in a singular mode, in scrophulous affections, which they denominated Bother, "ponatur sub puero olla plena aquâ calidâ, in principio apparitionis pustularum, ut attrahat ab interioribus superfluum humorem ad corporis superficiem." *Rhazes de Morbis Infant.* cap. 19. by Willan, p. 31.

[4] The greater part of the chemical observations on mineral waters has been taken from Thomson's System of Chemistry. [5] First detected by Scheele.

[6] Dr. Pearson. [7] Dr. Garnet. [8] Dr. Lambe. [9] Dr. Priestley.