capillary vessels were much larger, and the meshes narrower than in the brain—the proportion being one to three or four. (Müller.)

The mean size of the blood-globule in the human subject, taking the average of admeasurement by different observers, (*viz.*, Young, Kater, Wollaston, Home and Bauer, Prevost and Dumas, Hodgkin and Lister, E. H. Weber, R. Wagner, Milne Edwards, and Müller,) is 1-3904 part of an English inch; the size of the capillaries in the brain, according to E. H. Weber, is 1-4700, and in the skin 1-1149; in the former the smallest, in the latter the largest in the body.

The size of the blood-globule is of course the same in all parts of the system, while that of the capillary varies; which is less in diameter in the brain, than in any other part.

From these considerations it is apparent that the capillary part of the circulation of the brain, however large the quantity of blood sent to the encephalon, is not of an ample character, though rapid. The diameter of its capillary vessels not exceeding greatly that of the blood-globules, and the incompressible texture of cerebral tissue;—to these circumstances, the law in physics, that the force of the heart is in an inverse ratio to the diameter of the vessels, applies strictly, and indicates at least a rapid circulation through the central nervous mass.

But their exists no fact or argument to prove that the laws of capillary circulation, such as have been announced in these pages, do not hold good within the encephalon. All the conditions requisite for the operation of the laws in question are established within the brain, and therein hold good quite as much proportionately as in the lungs and mesentery, where, under the control of the sympathetic ganglia, (solely so in the latter,) excito-capillary functions were ascertained by experiment to have existed, being disturbed and suspended by the same causes as affected in like manner the excito-capillary functions of spinal ganglia.

The nerves which accompany the ramifications of the internal carotid and vertebral arteries to the brain are derived from cervical ganglia—the superior and inferior. The former is prolonged into the carotid branch, which divides into two, one of which takes the inner, the other the outer side of the artery, before communicating with each other, subdividing, and forming the carotid, afterwards the cavernous plexus; which latter gives off those smaller plexuses by which the internal carotid and its branches are enveloped. The inferior cervical ganglion yields an ascending branch, which, with its fellow, forms a plexus, (vertebral,) upon the artery which it accompanies, maintaining communications during its ascent with the cervical nerves.

These details show the existence of a capillary and excito-capillary system in the brain, of which neither the one nor the other presents any deviation from conditions requisite to maintain the capillary functions in the lungs, mesentery, or other parts.

This important point established, it is strictly philosophical to judge of morbid capillary phenomena occurring within the brain, where they are invisible, by those which are demonstrable, the same causes being at work in both cases.

Coma, a cerebral symptom of a fearful description,

and therefore worthy of deep study and research, occurs in collapse caused by burns, operations for chronic diseases, intense cold, and loss of blood. (Table III.—3.)

As loss of blood is sufficient to cause coma, it may be in the first instance asked in what manner such an agency operates. The question is answered by experiment.

1st. If blood be let to flow in moderate quantity from the femoral artery of a frog, and the web examined microscopically, the capillary vessels will appear more empty, the globules more thinly scattered through them than before the experiment; but the circulation proceeds as quickly as before.

2nd. If a further quantity of blood be made to flow from the artery, the capillary vessels become here and there nearly or quite empty and narrowed; the minute arteries and veins adjoining the capillary meshes are by turns full and nearly empty; the circulation generally becoming oscillating and rapid by turns.

3rd. If a still further quantity of blood be removed, the capillaries become void on the slightest exertion, as well as the minute arteries and veins. The entire web is then anæmic.

Sensibility remains; also the excito-capillary function, for a puncture wholly arrests circulation.

On a comparison of these results with the state of the capillaries induced by a persistence of cold weather alluded to above, the thermometer being at 32°—35° Fahrenheit, it is perceptible that no difference exists between them, except that in the former case anæmia of the web is accompanied by insensibility.

The same conclusion applies to a comparison of the effects of shock also above alluded to, which resemble those of loss of blood in each respect.

The absence of sensibility in the case of intense cold does not affect the result of the comparison for the present purpose; its bearings will be dwelt upon presently.

A perusal of the above effects of loss of blood on the circulation of the web, affords a complete insight into what is going on in the brain prior to syncope, and when syncope continues without any recovery of consciousness, coma is the result.

The progressive symptoms of coma from loss of blood are, dimness of vision, (table III.—37); vertigo, (41); mind distracted, (1); consciousness diminished, (42); tinnitus aurium, (43); sense of darkness, (44); syncope, (38); pupils dilated, (6.)

ON THE MEDICINAL SPRINGS OF HARROGATE.

By GEORGE KENNION, M.D.

(Read before the Anniversary Meeting of the Provincial Medical and Surgical Association, at Sheffield, Thursday, July 31, 1845.)

Harrogate has long been celebrated for its medicinal springs. The first of these, which was brought into notice nearly three centuries ago, was a chalybeate water. Soon afterwards the old sulphureous water was discovered; and since that time, and especially within the last thirty years, the number of important springs which have come into notice has greatly increased.

The village or town of Harrogate is popularly divided into two parts, which are termed High and Low Harrogate. The greater part of what is called High Harrogate is built upon a high table land, which commands a magnificent and extensive view all round; while Lower Harrogate is situated in a basin, which is bounded on the south and east sides by the High Harrogate hill, and on the west by the Harlow hill. The upper stratum of the soil is sandstone; below this is a bed of shale, (in some places of considerable depth,) and below this again is the carboniferous limestone. The air of Harrogate is peculiarly pure and bracing, and, as is commonly remarked, possesses more of the freshness and elasticity of the sea air than almost any other inland place; and to this, without doubt, we are indebted for much of the improved health and strength which so many invalids find there. I trust, however, that I shall not be thought to extol the place of my own residence too highly when I state, that not only in this respect does Harrogate stand pre-eminent, but that in the number, the variety, and the importance of its springs, it is unequalled by any watering place in *this*, and I believe I may add, in any country. I shall endeavour very briefly to bring the principal varieties of these waters under your notice, in the respectful hope that by doing so I may be able to impress upon your minds, and through your influence, to circulate among others, the advantages to a very large proportion of invalids, of a watering place which has so much to recommend it; which, thanks to the improvements of the age, is easily accessible from all parts of the kingdom; and which, although the yearly increasing numbers of its visitors testify to its great importance, is not, I do honestly believe, as yet so fully appreciated as it deserves to be.

The different medicinal springs of Harrogate are naturally divided into four classes, viz.:—The sulphureous, the saline, the chalybeate, and the saline chalybeate.

The sulphureous springs may be divided into the strongly, and the weakly-impregnated water. The stronger sulphureous springs contain in each gallon from fourteen to seventeen cubic inches of sulphuretted hydrogen gas, and from 800 to 900 grains of saline matter, of which nearly nine-tenths consist of muriate of soda. There are also present, muriate of lime, muriate of magnesia, and bicarbonate of soda.

Your time will not allow of my entering into any minute account of the various diseases, external and internal, in which these waters may be used with advantage, I shall therefore endeavour to arrange my observations under four or five different heads.

The first effect of sulphuretted hydrogen taken into the system in small doses, is that of a powerful diffusible stimulus. If this gas is taken in too strong doses, or if its use in moderate doses is too long continued, it acts as a sedative upon the nervous system. We may take this as our key to the application of the sulphureous water to the treatment of disease, bearing in mind, that in addition to this active principle, we have also present in the water, a large quantity of active saline matters.

From this, we shall readily understand how this water is useful in cases of dyspepsia arising from long continued functional derangement of the digestive

organs; where the vessels of the mucous membrane and of the follicular system of the stomach are in a relaxed and congested state—where the secretions are consequently irregular, unhealthy, or suppressed—where the peristaltic action of the bowels is diminished, and the skin is harsh, dry, and unperspirable.

2nd. In cases also, where from long residence in hot climates, or from other causes, the liver has become torpid in its secreting or its excreting functions, we have a powerful remedy in the sulphur water; for while the sulphuretted hydrogen produces its physiological effect upon this organ, the saline contents act upon the mouth of the gall duct, and a healthy secretion, as well as a free discharge of bile, are thus promoted.

3rd. From the beneficial effects which is derived from the use of these waters in cases of dyspepsia, we shall be prepared to expect a corresponding improvement from their administration in gouty and rheumatic subjects. We have, in fact, in these cases, a double benefit from their use; we find them efficacious, not only in restoring a healthy state of the secretions—a point of the first moment,—but in this very effect we have a natural means of eliminating from the system, that “*materies morbi*” which, there can be no doubt, does exert so powerful an influence in the immediate induction of the disease; and thus we find a safe and a happy mode of removing at the same time, both cause and effect; and in reference, especially to gout, where this *materies morbi* does so pre-eminently exist, I may observe, that where this is present in the system to so great an extent, as not to be thus easily got rid of, and yet where the constitutional powers are in so atonic a state, where there is such a want of vigour in the system as to render it incapable of shaking off the incubus, many are the cases where the effect of the waters has been such as to procure, what medicine and art have in vain attempted to induce, so complete and healthy an attack of gout, as entirely to restore the patient's health.

4th. In a large number of cases, where there has existed for some time great functional derangement of the uterus, I have seen the sulphur waters of very great service. They frequently have the effect of inducing the menstrual discharge, where amenorrhœa has existed; and on the other hand, where menorrhagia has long prevailed, and has been connected with passive congestion of the uterine vessels, I have known this water produce a perfect cure. In either case the *modus operandi* has been similar, and the object has been attained by means of the stimulant nature of the sulphuretted agent.

5th. To this important agent may also be traced the great benefit which is derived at Harrogate by patients, and especially young people, who are subject to strumous glandular swellings. The improvement in such cases has been frequently most marked; for not only are these enlargements often gradually resolved, but in connexion with this, the general health and strength improve, the appetite becomes more healthy, the power of the digestive organs is increased, and a new and vigorous state of the system is produced. It will be sufficiently evident, from what I have said, that where inflammatory symptoms are present, or where there is any fever or excited action of the nervous or the circulating systems, this water is contra-indicated;

nor can we safely use it where any organic derangement exists of the valvular apparatus of the heart; indeed, the presence of cardiac disease, in almost any form, is a barrier to its exhibition. This objection applies also to its use in diseases of the lungs, excepting in chronic bronchitis, which in very many cases is greatly benefitted.

6th. I have reserved to the last any notice of the efficacy of the sulphureous waters in cutaneous diseases, partly because I am aware of a general feeling which prevails that it is in these cases chiefly that "Harrogate waters" are useful; and my aim has been to show that the therapeutic effect of these waters is seen in a large variety of other cases; and partly, also, from the firm conviction that there are very few cutaneous diseases whose origin may not be traced to one or more of those classes of functional disorder which I have already mentioned as being benefitted by the sulphur water. And I need not remind you, gentlemen, that if the poisoned source be cut off, the baneful stream will cease to flow. And thus, while I would readily admit the beneficial or specific effect of the sulphuretted hydrogen upon some few of these cases, yet, as in the vast majority of such complaints, we must view the external irritation as but a symptom of the internal disorder, so we must look to the remedial effect of these waters upon the former as but an index of the still greater improvement which they produce in the latter; and by the aid of this index, by thus bringing the principle of induction to bear upon the subject, you will yourselves be able to test the correctness of the opinions which I have ventured to lay before you. Thus, if we take a case of acne, or of psoriasis, no one will affirm that these disorders are *idiopathic*; every practical man is well aware, that they are but symptoms of what is going on elsewhere. They may arise from dyspepsia—they may depend upon a gouty habit—they may be caused by uterine irritation. But these cases are sent promiscuously to Harrogate without reference to the cause, and a majority of such cases get well there. But to what cause are we to attribute the improvement? Not surely to any specific effect of the sulphur waters upon these cases, viewed merely as cutaneous diseases, and depending as they do, upon such varied causes, but to their power of removing the causes of these complaints—to their effect in restoring to a state of health the digestive organs—in relieving the gouty predisposition—in promoting the healthy functions of the uterus—in building up the debilitated and strumous habit. If, then, a *single symptom*—I grant it one of great and painful annoyance—but still, a single symptom—be thus marked, as it commonly is, as being so peculiarly adapted for the exhibition of the sulphureous waters; and if, as I have endeavoured to show, the removal of that symptom is produced by, and attended with, a corresponding improvement in the perhaps less evident, but not therefore uncertain cause, why should we withhold this remedy for the internal disease because the external symptom is not present? Why should not these complaints in an unmixed form be considered just as appropriate for the exhibition of the sulphur waters, as if they had superadded the complication of cutaneous disease. I ought, perhaps, to apologize for making these observations; to most of you, I am aware, they are quite uncalled for, but from

the daily opportunities which I have of knowing the opinions of many of our medical brethren throughout the country, I am convinced that they are not entirely out of place.

I need not detain you long by any remarks upon the *external* use of the sulphur water; not that its value in this respect is unimportant, but as the use of the ordinary warm bath is of course understood by all, and as the superiority of the sulphur water for this purpose arises from the presence of its active ingredients, it would be unnecessarily occupying your time were I to dilate upon this head, when, from what I have already said as to the nature of these principles, you will be able so readily to draw your own conclusions. One remark, however, I may make, which is, that as on the one hand the presence of these agents in so large a proportion constitutes the superiority of this water for external use, so on the other hand it renders it inapplicable for this purpose in some cases of cutaneous disease, where there is much inflammatory action going on, for example, in the active stages of eczema and impetigo. And this leads me to speak of the mild sulphur waters.

The leading character of these waters is, that they contain sulphuretted hydrogen in much smaller quantity than it exists in the strong waters; and a very much less quantity of saline matter, of which the principal part consists of muriate of lime and carbonate of soda, while in some the muriate of soda is entirely absent. For my present purpose it is sufficient that I group these waters under one class, although, in actual practice, we have the opportunity, of adopting the peculiarities of the different springs which come under this head to the different circumstances of our patients. From what I have said of their composition, you will readily perceive how high a value attaches to their use in cases where we require the aid of the sulphur, and yet are prevented from using the strong sulphureous waters on account of the large quantity which they contain of this stimulating gas, and of the irritating salt. Used externally, they leave a soft silkiness upon the skin, which resembles that produced by the Schlangenbad waters. They have a powerful effect in allaying any irritation which may exist in the skin, and hence may be considered as invaluable in such cases. Taken internally, they act either upon the bowels or the kidneys, according to the habit of the patient. If the bowels are irritable, either from chronic irritation, or even inflammation of the mucous membrane, I have seen these waters gradually restore this membrane to its healthy state, and the red glazed tongue, which so often is its index, to resume its normal condition. Upon this very state of the mucous membrane, as you are well aware, depend many of the most obstinate cutaneous eruptions. In such a case, how serious an aggravation of all the symptoms is produced by the stronger sulphur waters; how valuable the aid which is afforded us by this class. The efficacy of the fixed alkalis, and of the muriate of lime, in allaying irritation of the mucous membrane, is universally known; for such cases these remedies find a place in our daily prescriptions. Shall we suppose that nature's laboratory is less useful than that where we gain the assistance of art?

But in another class of cases these waters are most

valuable. I refer to calculous affections of the kidneys, and certainly their effect in such cases is surprising. They act powerfully upon the kidneys, the small calculous deposits which find a nidus in their structure are mechanically washed away, and by their chemical agency upon the fluids of the body, they tend to remove that acid condition, which leads to such fearful results. As a remarkable proof of their value in such cases, I may mention what was said to me by a lady five or six years ago, whom I had recommended to drink them. "I have been at Vichy," she said, "every year, for six years, and in all that time I did not gain half the benefit which I have derived from the use of these waters for six weeks."

But I fear, gentlemen, I have already trespassed too much upon your time, and I hasten to bring this paper to a close.

I shall pass over the subject of the pure saline waters, with this one observation, that we find them a valuable remedy in delicate constitutions, where we wish to have the effect of a mild laxative produced daily; and I come to notice lastly, the chalybeate, and the saline chalybeate springs. I consider these waters as being of at least as great importance in a therapeutic point of view, as the better known sulphur waters; but I need not occupy your time with any prolonged account of them, because, aware of their existence, you will readily perceive of how great an advantage they must prove to a large class of invalids.

The pure chalybeate springs are strong, containing about two grains and a half of iron in each gallon, which is held in solution by an excess of carbonic acid. I need say nothing of their therapeutic effects, with which you must be perfectly acquainted. But I am desirous of speaking in strong terms of the valuable remedy which we have in the saline chalybeate waters. In these we have, in addition to the iron, a considerable quantity of muriate of soda, and of sulphate of soda. The effect of this is to act gently, but in most cases sufficiently, as an aperient; and we are thus enabled in this form, to administer with great benefit, a chalybeate in cases where it has long been indicated, but where, from a morbid excitability of the nervous system, or from other causes, it has been found impossible to continue its use for any length of time. I may also speak in strong and even unqualified terms, of the value of this water in a class of cases which are constantly met with in practice, where the secretions have become impaired or depraved, the bowels confined, the action of the liver sluggish, and all these symptoms depending upon a want of healthy tone and energy in the system, which, while it produces the symptoms, prevents that persevering continuance in the treatment which they appear to demand. In many other cases, into which your time will not allow me to enter, but which you will readily judge of, this water will be found a most valuable agent.

In the observations which I have had the honour to lay before you, I trust that I may not be thought to have unnecessarily occupied your time; I have been anxious to spread more widely through the country a knowledge of the valuable remedies which Harrogate affords. And to those among you, who know the place, or are in the habit of sending your patients there, I can confidently appeal for a confirmation of every word which I have uttered.

CASE OF ULCERATED STOMACH, CAUSING DEATH BY BEING SUDDENLY DETACHED FROM ITS ADHESION TO THE PERITONEAL LINING OF THE ABDOMEN.

By WILLIAM COLLYNS, Esq., Surgeon, Kenton.

(Read at the Annual Meeting of the South-Western District Branch of the Provincial Medical and Surgical Association.)

"I was requested by a friend to open the body of a female relative, who had died suddenly under circumstances which he could not satisfactorily account for, and I extract from my case-book the following particulars which he gave me, and the result of the autopsy."

E. W., aged 21, a very fine young woman, inclined to be corpulent, with a florid complexion, robust, and of active habits, had occasionally complained of rather acute pain in the left hypochondrium, after taking a full meal, but as it never lasted an hour at a time, and as her digestion was good, nothing was prescribed for her but some aperient pills. Being corpulent she was accustomed to have her stays laced very tight, and used to wear also a broad band round her waist, which was always made excessively tight, and it was thought the pressure might have occasioned the pain. One morning, after having used great exertion dancing all night at a ball, she eat a hearty breakfast, and quickly after walked out with some young friends. Suddenly she was seized with very severe pain in her left side, from which she said there was something tearing away; she shrieked violently, became faint, and fell down in the street; she was immediately removed to the house of her relative, which she had just left, efficient medical aid was instantly obtained, but after suffering intense agony for three hours, she expired.

Twelve hours after death I opened the abdominal cavity, there did not appear to be any omentum, but merely a ragged sort of fringe along the greater curvature of the stomach; there was no appearance of inflammation on the outer coat of the stomach or intestines; but on that portion of the lesser curvature of the stomach anteriorly, which in the erect position of the body would have been in contact with the abdominal parietes on the left side, there was a considerable deposit of coagulable lymph, and a perforation through the coats of the stomach from internal ulceration, there being also a corresponding deposit of lymph on the membranous lining of the abdominal cavity, to which it was apparent the stomach had adhered, and it was opposite this spot she had always complained of pain. The stomach was very large, and contained a good deal of undigested food, but the fluid parts had escaped into the cavity of the abdomen. All the other abdominal viscera were perfectly sound.

The stomach was produced for inspection.

A CASE OF TETANUS SUCCESSFULLY TREATED.

By WILLIAM GILLARD, Esq., Surgeon, Totness.

(Read at the Annual Meeting of the South-Western District Branch of the Provincial Medical and Surgical Association.)

December 28, 1838. R. L.—, aged 20 years, a healthy young man, received the whole charge of a gun in the front of the right thigh, about midway