

stronger dichromate solution gives somewhat higher rates, but is objectionable on account of the too rapid oxidation of the phosphorus. These jars are set in a shallow copper water-bath (not shown in the figure), by means of which their temperature can always be maintained at or near 24° C., the temperature that Prof. Leeds has shown to be the temperature of maximum evolution of ozone.

It is essential that the phosphorus should be cast into segments of spheres, which can be quickly done by melting it in watch-glasses of equal size heated under water. If employed in the form of sticks, their irregular wasting away not only rapidly diminishes the ozonizing surface, but greatly increases the danger of inflammation. Each segment exposes 9 sq. cm. of area above the surface of liquid, or 150 sq. cm. in the three bells.

The ozonator is connected with a wash-bottle by means of flexible tubing. Since India-rubber is instantly destroyed, great difficulty was encountered in procuring a substitute. After many experiments a variety of "kerite" was manufactured by Mr. A. G. Day, the patentee, which has not been visibly affected after many weeks of service.

It will be seen from the diagram that the amount of ozone generated when one bell is employed and water in the jar (curve O) is much less than when the dichromate mixture is employed under like circumstances (curve I.). In the former case, at 25° each liter of air drawn through the apparatus contains 1.05 mgrm. ozone, or 0.494 c.c.; in the latter, at 24°, each liter contains 1.86 mgrm., or 0.87 c.c. The volume-ratio is as 9.9 to 17.4 (see figures at left of diagram). When two bells with dichromate were employed, the ozone generated at 24° amounted to 2.46 mgrms. per liter (curve II.), and generally at any temperature it was 25 per cent. greater than for the same temperature with one bell-jar. With three bells the amount formed at 24° was 2.68 mgrms., or 1.26 c.c. ozone per liter. No ozone is given off at 6°, and after passing the maximum the curve again falls off rapidly. It is curious to note that the elements of curve I. satisfy the equation of an oblique hyperbola of the primary order.

#### COLD WATER IN TYPHOID.\*

By J. W. KIBBEE, M.D., New York.

In the spring of 1878 I took my family from this city to Highlands, Macon County, North Carolina, in order that they might reap the benefits offered by its climate, which, I am fully persuaded, is the best in North America for chest diseases—functional or organic—and for nervous affections. These Highlands are near the southwestern terminus of the Blue Ridge Mountains, and rise abruptly to what is called a plateau—really an undulating level—whose average height above the ocean is about 4,000 feet, with numerous peaks shooting up a thousand feet or so. The atmosphere of this elevated region is almost "moteless" (Tyn-dall), not one of the zymotic diseases having ever been known to originate in it, due doubtless to the fact that the air is of the upper strata, unmixed with that which floats over the surrounding low country. Just below this plateau, however, at an altitude of some two thousand feet or less, fevers of every type common to our country prevail. I had not sojournd long at Highlands before receiving calls for the treatment of typhoid fever. The case I am about to present is peculiarly interesting on account of its apparently mild beginning, and its resulting in congestion and hemorrhage before the patient or his friends were aware that there was fever at all. On the 4th of July we had a little celebration at Highlands, and the patient, Evan Nicholson, a school-teacher, aged twenty-five, rode from his home in Oconee County, South Carolina, fifteen miles, on horseback, with his friends. In conversation with me that day he stated that he had felt unusually bad for several weeks, that there had been for some time a tenderness in the hypogastric region, and occasional vertigo, with a dull headache that was almost constant. He did not ask for a prescription, but said he would consult me soon in regard to a chronic nasal catarrh. I afterward learned that on his return home the jolting of horseback riding occasioned great pain in his bowels and head. . . . At daylight on the morning of the 25th of July I was called in haste to visit him. The messenger, his brother, stated that he had kept up about the house all the time since the 4th, until the morning before, having taken large quantities of patent pills, salts, oil, etc., to keep his bowels open, that he had had a slow, weak pulse, and, although the weather was very hot, was inclined to keep his coat on during the heat of the day. At about 12 M. the day before there commenced a great excitement in the circulatory and respiratory systems, the pulse running up to 140 per minute and the respirations to 30. This account of the circulation and respiration is a matter of judgment formed from the accounts of the patient and his friends; the heat, it was also said, was intense. At 7 P.M. of that day, the 25th, there was a deflection of about two quarts of blood, very putrid and offensive to the sense of smell. Several dejections followed, resulting in a loss, at midnight, of a large quantity of blood, when syncope occurred. I found him, eight hours afterward, with very cold extremities and just a thread of pulse at the wrist. Notwithstanding the coldness of the limbs, the hypogastrium was quite hot, so a thickly-folded cloth was wet in cold water and laid over it, and the legs and feet, arms and hands, were wrapped in heated flannels, both being renewed at short intervals. An infusion of the leaves of the *hamamelis virginica*, well sweetened with loaf-sugar, was given, two tablespoonfuls every half-hour. No more dejections followed; the patient remained in the supine position until four o'clock on the morning of the 26th, when reaction, which had been slowly returning, was fully established. The pulse was then 130 per minute, strong but wiry, and the heat, having been to a great extent controlled by the cold wet compresses over the bowels, was general, and rapidly evolved by the exalted vital action. Having, unfortunately, broken my thermometer, I had no means of determining the exact temperature, and was compelled to fall back upon a plan I had adopted many years ago while treating fever by the cooling process. After considerable experimenting, I found that in fever of any name the thermometer would show a heat of 98½° to 9° Fahr., when the skin of the whole trunk was kept, by either pouring or packing, so that it felt cool to the hand of the healthy attendant.

At four o'clock, then, on the morning of the 26th, twenty hours from the beginning of the treatment, and twenty-eight from the period of syncope, when the hemorrhage ceased, thorough treatment of the fever was begun by placing the patient on a well-filled straw bed, folding a sheet so that it would reach entirely round the body from the hips to the arm-pits, and wetting in spring water at about 60° Fahr. The patient, still supine, was gently raised to a recumbent position, the wet sheet laid on the bed under him, when he

was placed upon it and it was folded entirely around the trunk. For the eight following days the wet sheets were cooled and freshly applied every twenty minutes to half an hour, according to the exacerbations of heat, as determined by the hands of the attendants, placed upon the skin of the trunk. The extremities all this time were kept warm by the use of flannels, and woolen blankets when needful. About thirty hours after the syncope an enema was administered, composed of an infusion of hamamelis leaves and mucilage of slippery elm. The patient was quiet while fully two quarts were gently injected, which thoroughly cleansed the lower bowels from the clotted, putrid blood that remained in them after the syncope and reaction.

Twenty-four hours afterward a mild cathartic was administered, composed as follows: R. *aa* senna, 3 ss.; jalap, ʒj.; caryoph., gr. ij.; aqua ferv., ʒiv. Sweeten with coffee or loaf-sugar, and drink warm. This brought away in a few hours the putrid blood that remained above the reach of the enema, and with it considerable fecal matter. No other medicine was given save a weak infusion of the hamamelis, and, for the first three or four days, an occasional spoonful of the slippery elm. The pulse, after the first application of the cold wet sheet, was about 120 for eight days, after which time it fluctuated between 90 and 100 for two weeks, when it became full and soft at 75, the patient being then clear of morbid matter. The appetite was good, even keen, after cooling the heated blood on the morning of the 26th; and gruel, fresh milk, and fruit—apples, peaches, and blackberries—were taken freely, fully enough to support a well man if lying still. After the first movement from the medicine, the bowels acted every morning, under the stimulus of a warm-water enema, the fecal matter being of the proper consistence, color, and quantity. The urine was abundant, rather highly colored, and strongly scented. The sleep was quiet and refreshing, and there was no nervousness or delirium, the tongue was clean, and the breath not particularly offensive. For the first two weeks the patient was wholly unable to turn himself in bed, but gradually gained strength, so that three weeks from the hemorrhagic crisis he was able to sit up in a rocking-chair for an hour at a time, bear his weight on his feet, and walk across the floor with assistance. There are several points of interest attaching to this case, which we will now consider. In the first place, we notice that the young man's vitality was so depressed or oppressed by inimical matters or conditions, that it had not sufficient force to manifest the two essential phenomena of fever—the exalted action of the heart and lungs, and the consequent excess of heat—hence the slow, weak pulse, and the constant chilliness of the surface until the reaction after the hemorrhage and syncope. We see that the cause of the congestion was the oppressed vitality, or the inability of the heart to drive the blood along through the intestinal capillaries, where it lodged, became devitalized from want of oxygenation, and was at last driven through the relaxed depurating surface into the prima via by the aroused and almost expiring efforts of the vital force, producing hemorrhage of the bowels, a very grave symptom, not so much on account of the loss of blood as by showing the little vitality in that remaining, and the amount and power of the cause of vital disturbance. We notice in this case that there was vitality sufficient to cause reaction from the syncope, or contractile power enough to close the relaxed walls of the capillaries after the devitalized blood had passed through. We see that after the expulsion of the devitalized blood there was power to cause the heart to beat with considerable force at 130 per minute, the lungs being excited to a correspondingly increased action, causing a rapid evolution of vital heat.

Let us consider for a moment the results of the cooling treatment in this case. In cases of local injuries, and severe operations with the knife, as Dr. Thomas has shown, the exalted action of the heart and lungs consequent upon the local lesion is greatly reduced upon removing the excess of heat; but, where the cause of the vital disturbance affects the whole system—as the zymotic causes, for instance—the reduction of the cardiac and pulmonary action by the cooling process is but slight. In typhoid, in pneumonia, in scarlet fever, in yellow fever, and in other high grades of vital action, I have rarely seen the cardiac action lessen more than ten beats per minute upon the reduction of heat from 4° to 6° by the cooling process. In this case the pulse fell from 130 to 120 upon cooling the blood, and remained there for about eight days, when it gradually fell off to the normal beat, the evolution of heat decreasing in exact ratio. We are shown by this that, while the circulatory and respiratory action is nearly double the normal, if the excess of heat be removed as fast as it is evolved, every depurative function is performed as perfectly as in health; and, what is of equal consequence, digestion and assimilation are but slightly disturbed. During the eight days of cardiac and pulmonary excitement, this young man ate heartily and with excellent relish, and the proof that digestion and assimilation were perfect was the fact that the feces were natural in color, consistence, and quantity. Were this case as given here, were all the very numerous and varied cases of fever that I have treated on the cooling principle for many years brought only into the count as proof of the great benefits of equalizing the temperature with water in all vital disturbances, there might be room for question, for doubt, in this matter; but the medical world is finding similar proofs of the value of water as an antipyretic from all quarters of the globe; and the conviction is becoming settled, in the minds of the thoughtful in our profession, that we are on the eve of a great revolution in the treatment of fever—a revolution which will practically sweep away all the distinctions heretofore made on account of the inherent differences in the vital or non-vital causes of our vital disturbances—variola, rubella, scarlet fever, yellow fever, etc., for instance—and place the practice of medicine on a sure foundation, a practical basis, one that cannot be mistaken in its primary and great central requirement, the normalization of the temperature with water. When this is done, as is easily seen, none of the morbid symptoms attending fever of every name will occur at all, since they can all be traced directly to the influence of excessive heat, and in no instance to the exalted vital action.

This young man was treated by the frequent packing of the trunk with the folded sheet, made dripping wet, the straw bed being changed every day; but it occasioned a great amount of care from several assistants, since he was wholly unable to help himself in the least for a long time. This extra labor would all have been obviated had the fever-cot been available. Some two weeks after the hemorrhagic crisis of Evan, his brother, James Nicholson, aged 30, came down with the same disease, but in a much more violent form, he being possessed of a larger share of vitality, which, of course, showed a greater resistance to the offending causes. This time a fever-cot was procured, and the excess

of heat was controlled with comparatively little trouble, the patient going through the whole period of exalted vital action with a good appetite, the digestive, assimilative, and depurative functions being well performed. Can we do less than form the conclusion that all the morbid phenomena attending fever of any name are directly due to excessive heat, and that its removal with water is a sure remedy?

#### BRONCHIAL ASTHMA.

From a lecture delivered at the Medical Society of London in February, 1879, by JOHN C. THOROWGOOD, M.D., F.R.C.P., Physician to Victoria Park Hospital for Diseases of the Chest, Physician to the West London Hospital, and Lecturer on Materia Medica at Middlesex Hospital.

EXPERIMENT and observation have proved how much the action of the lungs is under the influence of the pneumogastric nerve, and reflection on the course and connections of this widely distributed nerve will help to explain why it is that our treatment of asthma must be varying in its nature, and cannot always be as certain in result as we could wish.

To cure asthma we often have to direct our remedies to organs other than those of respiration. The way to success may lie in the correct adjustment of a displaced womb, in the administration of a dose of extract of male fern to destroy a tapeworm, or in a course of Carlsbad waters to eradicate gout from the system.

The capriciousness of bronchial asthma with regard to external influences is well exemplified by the effect of climate on the complaint. To many asthmatics the pure clear air of such places as Margate, Whitby, or Nice is absolutely unbearable, and we find patients hurrying away from such climates, almost in terror of their lives if another night be passed therein. Dr. Salter has gone into the history of twenty-one cases of asthma powerfully influenced by atmospheric surroundings, and the outcome of evidence is conflicting and unpractical. Fourteen could respire with comfort only in the smoky air of populous cities; eleven, indeed, seemed cured by the air of London. Seven others were unable to live in close towns, and did best in the country.

One patient of my own, a great sufferer from asthma at his house in the country, passed six weeks in Queen Anne street, Cavendish square, without experiencing a single attack of breath spasm. On returning home he was at once taken in the night with so alarming a seizure that he had to send urgently for his regular medical adviser. Another patient was glad to quit his well furnished abode in the northern outskirts of London and take up his residence at his business premises in Cornhill, for there he could rest at night without fear of an attack of asthma. Those who have read Walshe's work on the lungs will remember the instance of the man, sorely tormented with incurable asthma near Hampstead, who was absolutely cured by changing his residence to the more central region of Seven Dials.

I once thought it might be the absence of ozone in the air of cities that renders it sedative to irritable air tubes, but though experiment and observation clearly show that ozone produces catarrh, and even pulmonary inflammation, yet bad asthmatics have been known to make a voyage to Australia without experiencing any approach to a seizure the whole time, though the air was shown to be often highly charged with ozone.

Among remedial agents employed during a bad paroxysm of asthma, few are more universally known and employed than the smoke of burning niter paper. Ordinary blotting paper is soaked in a strong solution of nitrate of potash, and, when dry, is burnt till the patient's room is filled with a cloud of nitrous fume, and often it is not till the room is thus filled with smoke that the sufferer finds relief. As long ago as 1846 we find this use of niter paper highly extolled in the *Medical Gazette*; and in the *Lancet* of April 5th, 1845, we learn how a friend of Mr. Harrison's tried burning paper that had been soaked in saturated solution of nitrate of potash, and felt the inhaled smoke to clear the passages and open the air tubes, and so conduce to free and easy respiration. Though some amount of emphysema and bronchitis does not invalidate the action of the nitrous fume, yet it is in the spasmodic sudden attacks of breath stoppage where its curative action is most marked. The chemical constituents of the fume have been examined by M. Vohl, and he found the nitrous vapor to contain cyanogen, carbonic acid, nitrogen, ammonia, and nitrite of potash. To the ammonia and nitrite of potash the anti-spasmodic property of the fume is attributed.

Noticing that the constituents of the nitrous vapor are closely allied to some of the adventitious matters found in the close air of towns, I went over Salter's table of 223 asthmatics to see if I could discover that those persons who are set down in the table as being notably relieved by the inhalation of the nitrous vapor were identical with those to whom town air proved so beneficial. I found that, of twenty-one who are said to have been greatly benefited by the air of London, there were nine to whom the niter paper was of marked service. Two, who are reported as cured by the London air, found niter paper inhalations more serviceable than anything else. One patient, whose sufferings were intensified in London, reports that niter paper seemed to do harm rather than good.

Probably it is to the ammonia and carbonic acid gas that we may attribute the anti-spasmodic action of the burning paper.

It has been shown by Trousseau how useful the inhalation of diluted ammonia can be in asthma; and Salter records a case where asthmatic spasm was at once stopped by breathing the vapor of diluted ammonia. The fact that the emanation from certain gas products is reputed good against the convulsion of whooping cough, and that an asthmatic sea captain could always breathe with facility when conveying a cargo of guano, are additional proofs of the anti-spasmodic action of ammoniacal vapor.

Among internal medicines that are good against spasmodic asthma, even when some degree of chronic bronchitis co-exists, a high place should be given to the arseniate of soda. In a commencing dose of one-twentieth of a grain, either in pill or solution, this salt has a great power of promoting respiratory action, and appears, moreover, to act as a tonic to the system, for I have noticed patients to gain appetite and weight during its administration. The Bourboule water, so beneficial as a drink for those subject to asthma, apparently owes its efficacy to a trace of arseniate of soda in its composition.

Arsenic smoking, by means of cigarettes containing from

\* See Notes on Asthma, fourth edition, p. 97.