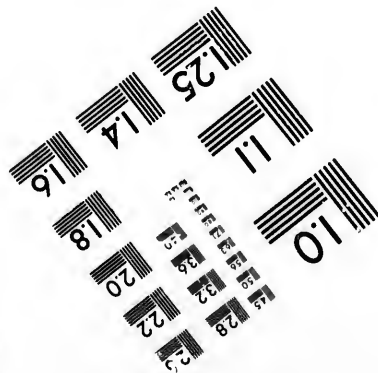
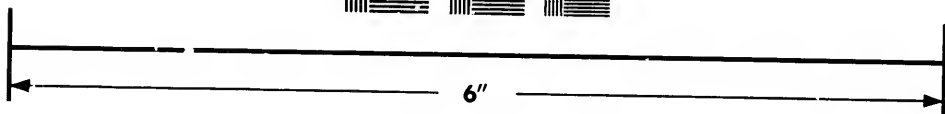
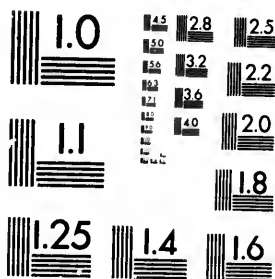


**IMAGE EVALUATION  
TEST TARGET (MT-3)**



**Photographic  
Sciences  
Corporation**

23 WEST MAIN STREET  
WEBSTER, N.Y. 14580  
(716) 872-4503

**CIHM/ICMH  
Microfiche  
Series.**

**CIHM/ICMH  
Collection de  
microfiches.**



**Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques**

**© 1981**

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured covers/  
Couverture de couleur
- Covers damaged/  
Couverture endommagée
- Covers restored and/or laminated/  
Couverture restaurée et/ou pelliculée
- Cover title missing/  
Le titre de couverture manque
- Coloured maps/  
Cartes géographiques en couleur
- Coloured ink (i.e. other than blue or black)/  
Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations/  
Planches et/ou illustrations en couleur
- Bound with other material/  
Relié avec d'autres documents
- Tight binding may cause shadows or distortion along interior margin/  
La reliure serrée peut causer de l'ombre ou de la distortion le long de la marge intérieure
- Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/  
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- Additional comments:  
Commentaires supplémentaires:

- Coloured pages/  
Pages de couleur
- Pages damaged/  
Pages endommagées
- Pages restored and/or laminated/  
Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed/  
Pages décolorées, tachetées ou piquées
- Pages detached/  
Pages détachées
- Showthrough/  
Transparence
- Quality of print varies/  
Qualité inégale de l'impression
- Includes supplementary material/  
Comprend du matériel supplémentaire
- Only edition available/  
Seule édition disponible
- Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image/  
Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/  
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	14X	18X	22X	26X	30X
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12X	16X	20X	24X	28X	32X

The copy filmed here has been reproduced thanks to the generosity of:

National Library of Canada

L'exemplaire filmé fut reproduit grâce à la générosité de:

Bibliothèque nationale du Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

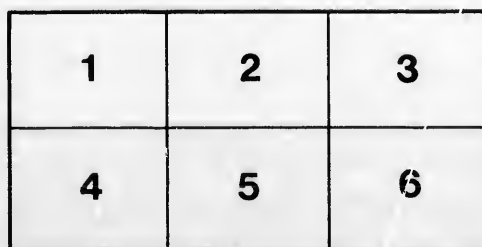
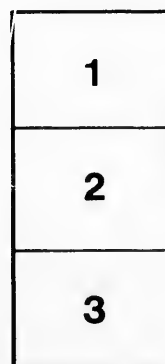
Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

The last recorded frame on each microfiche shall contain the symbol  $\rightarrow$  (meaning "CONTINUED"), or the symbol  $\nabla$  (meaning "END"), whichever applies.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole  $\rightarrow$  signifie "A SUIVRE", le symbole  $\nabla$  signifie "FIN".

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



ON THE  
TREATMENT  
OF  
SOME FEBRILE DISEASES  
BY THE  
EXTERNAL APPLICATION OF COLD.

BY T. K. HOLMES, M.D.,

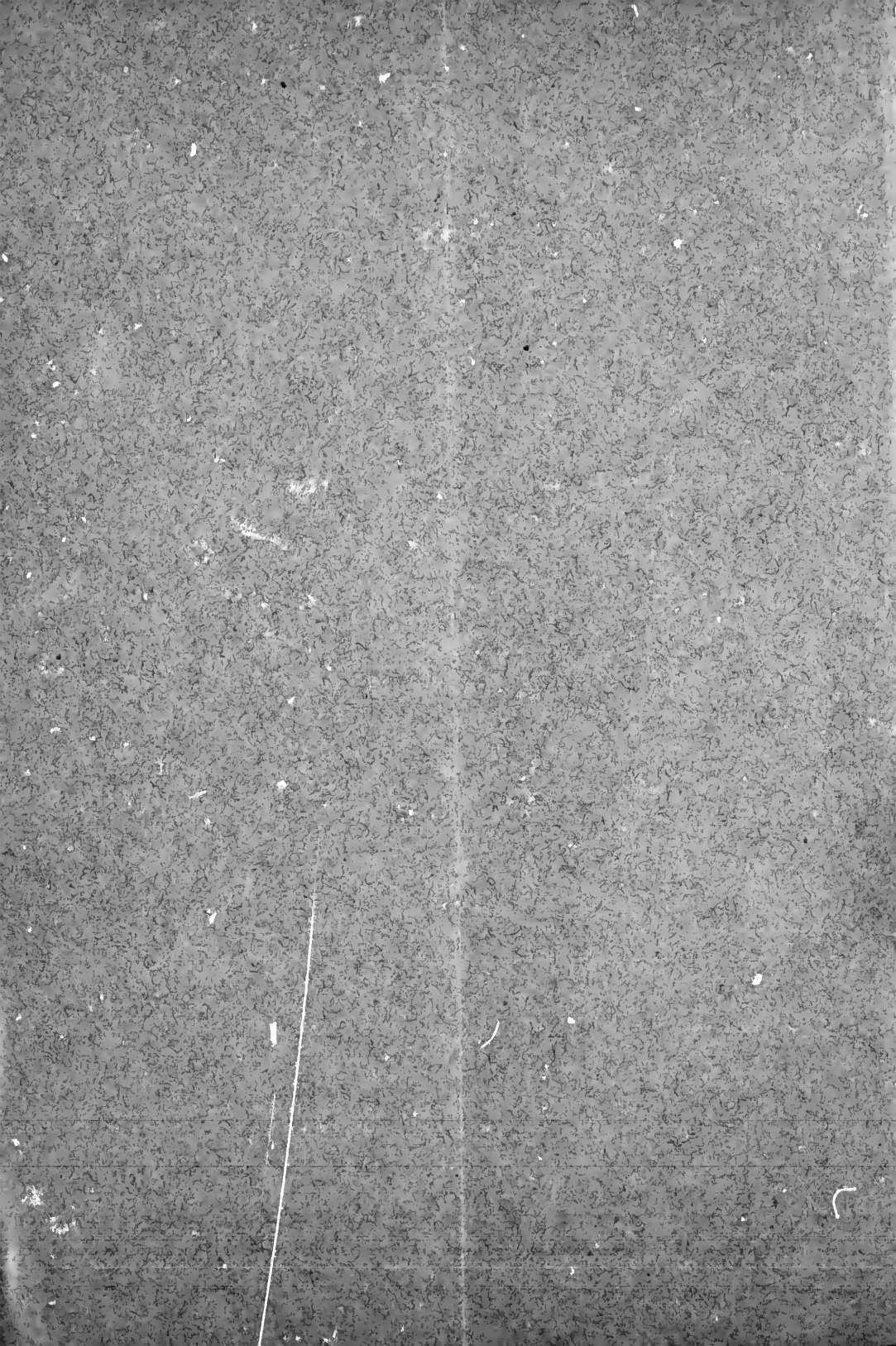
CHATRAM, ONT.

Presented to the Canada Medical Association in London,  
September 11, 1879.

Montreal:

W. B. CHAMBERLAIN AND PUBLISHING COMPANY.

1879.



*Carey*  
*Holmes, T. K.*  
7

ON THE  
TREATMENT

OF

SOME FEBRILE DISEASES

BY THE

EXTERNAL APPLICATION OF COLD.

BY T. K. HOLMES, M. D.,  
CHATHAM, ONT.

~~~~~  
Read before the Canada Medical Association in London,  
September 11, 1879.  
~~~~~

Montreal:

LOVELL PRINTING AND PUBLISHING COMPANY.  
1879.

1654



ON THE  
TREATMENT  
OF  
SOME FEBRILE DISEASES BY THE EXTERNAL  
APPLICATION OF COLD.

---

GENTLEMEN,—I intend in this paper to present for your consideration some observations on the therapeutic uses of cold applied externally. The subject commends itself to me on account of the great efficiency of this agent in properly selected cases, and also on account of the neglect it has suffered at the hands of the profession generally.

There is reason for believing that beyond sponging the bodies of fever patients with cold water for a few minutes night and morning, its employment is seldom resorted to by medical men in general practice. While sponging the skin for ten minutes with cold water may cleanse it, and so render a patient more comfortable, it will not reduce the temperature when much above the normal one half of one degree Fahr. It is as an antipyretic that cold applications will be considered in this paper; it is therefore desirable to inquire into some of the phenomena of the febrile state. No question in experimental science presents greater difficulties than that of the causes of fever and their mode of action in producing it. By the light already shed on this subject it is justifiable to believe that essential fevers result in most cases from the introduction of a poison into

the system, and that its presence initiates that complex of morbid phenomena known as essential fever. As heat is only a mode of motion, all abnormal elevation of temperature in the animal organism must be the result of excessive motion therein, and is only an index of morbid processes taking place in disturbed cystogeny and retrograde metamorphosis.

An eminent English writer, whose name I forget, believes the heat of fever to be the result of intensely rapid cell generation ; but as the elevation of protoplasm to more complex matter is a synthetical process, heat would be used and not produced in accomplishing it. It may be, however, that cells thus rapidly formed, being ephemeral in their nature, undergo equally rapid disintegration, and are decomposed into substances much simpler in chemical composition than the protoplasm from which they were formed, and that the excess of heat so produced over the amount used in the cell formation accounts for the increased heat observed in the pyrexial state. If to heat so produced be added that resulting from rapid retrograde metamorphosis of tissue previously formed, a plausible explanation of the rise in temperature is reached. In whatever way produced, the abnormal temperature becomes the chief factor in a chain of morbid action always injurious and often dangerous.

I have here the heart of a turtle recently removed from the body. It will be observed that when heat is applied by holding the plate over a lamp the pulsations become more frequent, and that placing it on a piece of ice causes the heart to beat more slowly. Placing it again over the lamp the pulsations immediately increase in frequency, and again changing it to the ice the pulsations fall as before. This phenomenon was first observed by Dr. Brunton, and suggested to my mind the propriety of instituting a series of observations on the action of cold applied to the surface of the human body during febrile action.

The result of these observations has convinced me that in

the external application of cold we possess an agent that merits far more attention from the profession than it receives. Although we cannot apply heat and cold directly to the human heart, as has been witnessed in the experiment just made, we can deprive the blood in the superficial capillaries of its heat, and send it back in a cooler stream to the laboring and exhausted heart, and so produce a similar effect to that produced by cold upon the heart of the turtle. The nerves of the heart are not alone susceptible to the influence of heat and cold, but every organ under the control of the great sympathetic responds to the influence of these agents. Nor is this all: it will be shown in this paper that they are also capable of producing by reflex action through the cerebro-spinal system the most marked effects upon the organs normally under volitional control.

The sequence of morbid processes in fever seems to me to be as follows: 1st. The generation within the body or the introduction from without of a poison. 2nd. Excessive molecular motion in tissue undergoing disintegration as a result of the presence of such poison. 3rd. The transmission of the resulting heat to nervous centres by the sympathetic filaments to their ganglia, by afferent nerves to the centres of the cerebro-spinal system, and to both by the blood. 4th. Reconversion of heat into motion, as seen in increased functional activity of the heart, lungs, skin and some other organs, and in some cases in the violent explosions of force as manifested in convulsions of the voluntary muscles.

It will be found on examination that the successful treatment of fever has for its object the arrest of one or all of these diseased actions. We attempt to eliminate the poison that has initiated the train of morbid action, or, failing to do so, we try to arrest the undue metamorphosis of tissue by diminishing the oxygen carrying power of the blood. We try to allay reflex action in the nervous tissue, or we endeavor to convey from the body the excess of heat generated.

If we succeed in eliminating the poison, or in neutralizing

it, the patient is cured, and our aim accomplished, but from the nature of the poison we are often unable, in the present state of medical knowledge, to do either, and so excessive molecular motion goes on, heat continues to be generated in too great amount, and we have no alternative but to interpose obstacles to the passage of oxygen to the tissues in which the morbid process is being carried on, and at the same time to aid in the removal of heat as fast as it is generated. The former we accomplish by the administration of various antipyretics, as quinine, veratrum viride, aconite, digitalis, etc., while the latter is best accomplished by abstracting heat from the body by the external application of cold. Heat generally produces such violent action in the circulatory organs as to rapidly exhaust them, and render them incapable of bearing further depression by therapeutic agents, so that many drugs acting as most of those just named are inadmissible. Their action, moreover, is often too slow to render them availing in the preservation of life.

It is under these circumstances that the rapid abstraction of heat becomes of paramount importance in affording relief or in saving life. We know that a temperature of  $107^{\circ}$  F., or higher, is incompatible with life if continued for even a comparatively short time, whatever the disease may be, and we know of no internal remedy that will reduce it to the health standard as quickly, safely and certainly as cold applied externally.

If a well-developed child, weighing thirty pounds, and having a temperature of  $106^{\circ}$  F., be placed in a bath of water at  $50^{\circ}$  F., there will be no perceptible fall in the axillary temperature for three minutes; the mercury will then begin to fall very slowly, and in about fifteen minutes will stand at  $98\frac{1}{2}^{\circ}$ , falling much more rapidly the last three degrees. The rapidity with which the temperature falls is not the same in every case, and cannot be prognosticated; it is well, therefore, to always keep a clinical thermometer in the axilla, and remove the patient from the water when

the mercury has fallen to  $99\frac{1}{2}^{\circ}$ , as there will be a further fall after removal from the bath.

The temperature may be reduced with almost equal facility by sponging the whole body with whiskey or brandy, and fanning the wet skin at the same time to promote evaporation. This method, indeed, is often preferable, as cold water is apt to alarm young patients and is unpleasant. At first it is better to have the bath tepid, and rapidly cool it by the addition of cold water or ice until our object is attained. This precaution is unnecessary when from any cause the patient is insensible, which is generally the case in infantile convulsions.

The most notable changes that accompany the fall in temperature are those pertaining to the nervous and circulatory systems. The pulse becomes less frequent, slower and softer, nervous excitability is allayed, muscular spasm ceases, sleep is often induced while the patient is still in the water, and is almost certain to supervene on removal from it.

In some cases, the temperature having been thus reduced, there is no subsequent rise, the case progressing to rapid recovery; but in many diseases it is necessary to repeat the bath at such intervals as will be indicated by the rise in temperature.

By keeping the patient in a cool, well-ventilated room, and resorting to the use of the sponge bath and the use of a fan, the repetition of the cold bath will only be required at long intervals, and may not be required at all. Experience has led me to the conclusion that children are more intolerant of increased temperature than adults, and that it is in febrile diseases of the former we can accomplish most by the use of cold externally.

The febrile diseases in which I have found this treatment to be most useful are diarrhœa, dysentery, scarlet fever, acute bronchitis and convulsions complicating febrile action. I have also treated acute pleurisy, pneumonia and cerebro-spinal meningitis in this way, but not a sufficient number of

cases on which to base any conclusions. I may say, however, that the cases of pleurisy seemed to be benefited, but the cases of pneumonia and cerebro-spinal meningitis terminated fatally, although not, I believe, on account of the cold water treatment.

A large number of children die every summer from acute diarrhœa. The attack usually comes on suddenly, the stools are frequent, the stomach sick and the temperature high. If seen a few hours from the beginning of the disease the child will be found restless and pained, the stools offensive and unnatural in color, the features pinched and ~~sunken~~<sup>pale</sup>, the eyes sunken, and often the feet and hands cold. The patient moans and moves the tongue about the mouth in a peculiar manner, and often makes efforts to vomit when no food or drink has been taken. If the case be allowed to go on, the pupils become contracted, the breathing labored, the extremities colder and bluish in color, the pulse frequent and feeble, the fontanelles depressed, and the child rolls its head from side to side on the pillow. If the axillary temperature of that child be tested, it will almost certainly be found to be between 103° and 106° F., notwithstanding the coldness of the extremities. Such cases must have relief promptly or they will all die. The indications are to rid the bowels of offensive accumulations, to arrest the vomiting, to preserve the strength and to reduce the temperature. Purgatives will seldom remain on the stomach, nourishment and stimulants are rejected in the same manner; it is generally useless to administer anti-emetics, and even if we could wait for the action of drugs that reduce the temperature, they would as a rule be inadmissible on account of their depressing influence on the circulation. If a child in this condition be placed in a cold bath for from five to twenty minutes, according to the heat of its body and the coldness of the water, the temperature will fall to the normal standard, the heart will beat with more force, the thirst will be less intense, the circulation will become equalized, sleep will generally be procured, and the stomach will retain nourishment and

medicine. If after a few hours the temperature rise again, the bath can be repeated, but, by allowing the child to lie naked and be sponged and fanned, its repetition may not be necessary, for if, in the meantime, a purgative dose of rhubarb or castor oil be given, the tendency to a rise of temperature will not be so great.

I have frequently seen children, that had tossed and moaned for hours, fall into a quiet sound sleep in the water in a few minutes, and continue to sleep well after being taken out.

As an illustration I have transcribed from my case book the following typical cases.

CASE I. July 27th, 1878.—J. Ellson, *at.* 5 months, strong and well nourished, has had diarrhœa for forty eight hours, and the mother thinks fever also. Looks distressed, temperature  $105^{\circ}$  F., pulse 130, evacuations greenish and offensive, and about twelve a day. Ordered rhubarb and soda bic. aa gr. iv. every two hours.

28th, 10 o'clock a.m.—The child has not rested, but cries and tosses about incessantly. The extremities cold, and temperature  $105^{\circ}$  F. No pulse at wrist, breathing labored, fontanelles depressed, eyes sunken, features pinched and bluish, and it refuses to nurse.

Put it into water from the well until axillary temperature fell to  $99\frac{1}{2}^{\circ}$ , when the child fell asleep. Soon after its removal from the water the pulse returned at the wrist, and the body and extremities became of about uniform warmth.

At 1.20 p.m. the temperature had risen to  $104^{\circ}$ , and the child was again restless. Repeated bath with same result as first.

29th.—Rested well all night, and has nursed several times. Temperature  $99\frac{1}{2}^{\circ}$ . Parents had used sponge bath and fan frequently through the night. Stools greenish. Ordered a dose of castor oil, and chloral enough to make it rest.

30th.—Passed a comfortable night, and nurses well; has been sponged several times during last twelve hours; temperature  $99\frac{1}{2}^{\circ}$ . After this an occasional dose of rhubarb and

soda was the only medicine given, and the child soon recovered entirely.

CASE II. July 12th, 1876, 10 o'clock a.m.—Caspar Schweinler, a robust child five months old, has had diarrhœa for three days, but not very ill until yesterday, since when it has neither nursed nor slept, but has constantly uttered half suppressed cries. It is pale, hands and feet cool and skin dry. Gave a purgative dose of rhubarb and calomel.

3 o'clock p.m.—Bowels well moved by the medicine, the last evacuation being natural in color. Extremities cold, pulse imperceptible, pupils contracted, face leaden hue, and thirst intense.

The axillary temperature to my surprise was  $105^{\circ}$ , for I had been deceived by the coldness of the extremities and the general appearance of the patient, and did not expect to find temperature so high.

Gave half a drachm of brandy, and put it into a tepid bath, and rapidly cooled it by the addition of cold water. In ten minutes the temperature fell to  $102^{\circ}$ , and sleep came on for the first time in thirty hours.

When the mercury fell to  $100^{\circ}$  I removed the child from the water, and it slept most of the afternoon, and was not thirsty. As the temperature fell, the pulse became better and the pupils larger.

8 o'clock p.m.—Temperature  $103^{\circ}$ , child sleeps well, and looks comfortable. Bath repeated, and temperature reduced to  $99^{\circ}$  in five minutes.

13th, 10 o'clock a.m.—Rested well all night and nurses, temperature  $103^{\circ}$ . Ordered a dose of castor oil.

11 o'clock a.m.—Child has had two convulsions within last few minutes, is insensible, and temperature  $105\frac{1}{2}^{\circ}$ . Repeated the bath, and reduced temperature to  $98\frac{1}{2}^{\circ}$ . After this the temperature never rose above  $101^{\circ}$ , the bath was not resorted to again, and in a few days the child was well.

CASE III. Bronchitis. Jan. 5th, 1879.—N. Clarke, æt. 14 months, ill five days with what the parents thought an ordinary cold.



I saw it on the fifth day of its illness, and found it with well-marked acute bronchitis, temperature  $105^{\circ}$ , pulse 140. Abundant râles over both lungs.

For the next five days the treatment consisted of hot fomentations to the thorax, with occasional applications of turpentine to keep up slight counter-irritation and the administration of quinine with small quantities of Dover's powder. An aperient was given when required, and the child was allowed to nurse.

The symptoms underwent but little change until the 10th, when great restlessness came on. The breathing was very rapid, and there was constant moaning and rolling of the head. Extremities cold, pupils small, tongue dry, pulse too frequent to count, and temperature  $106^{\circ}$ .

Fearing the child would die unless relieved promptly, I felt justified in trying the effect of cold externally, which I did by removing hot fomentations, sponging the body with brandy and fanning it vigorously. At the end of half an hour the temperature had fallen to  $99^{\circ}$  and the patient was sound asleep, pulse slower and fuller, breathing easy and extremities warmer. I then instructed the attendants in the use of the thermometer, with the request to keep the axillary temperature as nearly  $100^{\circ}$  as possible by the means just used.

11th.—Instructions have been observed, and child has rested well and has not been very thirsty. Temperature  $100^{\circ}$ , respiration 35, pulse 130. Thinking the disease had passed the climax, and that convalescence would go on, I advised the mother to put on the child a thin night dress and to omit the applications of the brandy.

12th.—The parents informed me that in four hours from the time the sponging was stopped the child became restless and seemed worse in every respect, and that the temperature rose to  $104^{\circ}$ , when they again resorted to the cold sponging with same beneficial result as before. For the next three days it was necessary to continue the cold appli-

eration several times daily, after which time the fever disappeared, and the child made a good recovery.

In my own experience eighty per cent. of all cases of convulsions in children occur during fever, and I believe are nearly always caused by the elevation of temperature alone. The ordinary treatment of such cases is unsatisfactory: chloroform, first recommended by Sir James Simpson, will control the spasms, but in many cases these occur in such rapid succession that no intermission can be perceived; they continue whenever the anæsthetic is stopped, and our only recourse is to continue its administration until the fever yields to medicine or subsides spontaneously. I have followed out this plan of treatment in many cases, often successfully, and frequently not so.

I have notes of four fatal cases in which the inhalation of chloroform was continued from six to thirty hours. The administration of medicine in these cases is always difficult, sometimes impossible, and is generally attempted with risk to the already weakened heart. This is true of bromide of potassium, chloral, veratrum, aconite, &c., while quinine acts too slowly to be depended upon in any severe case. Warm or hot baths are sometimes useful when, by inducing perspiration, they reduce the temperature, but every medical man knows that they often fail to arrest the convulsions.

The cold bath fails so seldom that it may be considered a specific. The spasms will frequently continue until the temperature has been reduced to  $98\frac{1}{2}^{\circ}$ , but at this point they are almost invariably arrested. Several years' experience with this plan of treatment has inspired me with the strongest confidence in its usefulness, and yet a desire not to have its value over-estimated compels me to admit that there are cases in which convulsions will return or continue notwithstanding the reduction of temperature, but such cases are rare, and probably are complicated by organic lesions, as tubercular meningitis.

The following cases will illustrate the comparative value of the cold water treatment of convulsions complicating fever:

CASE IV. July 3rd, 1876.—M. A., æt. 2 years, strong and well-developed, was taken suddenly ill last evening with dysentery and fever, which lasted all night, and at seven this morning there was a convulsion. At 8 o'clock I saw him, temperature  $103^{\circ}$ , restless. Ordered a large dose of castor oil, and one-third of a drop of the fluid extract of aconite every hour while fever lasted. Another convulsion occurred at ten a.m., and another at half-past ten, when I began the administration of chloroform. At noon the oil had operated well. At 2 p.m. the convulsions recurred, and continued for two hours with no intermission, although the patient was partially under the influence of chloroform during the time. At 4 p.m. they were as violent as possible, temperature  $105^{\circ}$ , pulse 150, breathing noisy and labored, a light frothy foam was constantly discharging from the mouth and nostrils, and death seemed inevitable. I now put child into bath at  $50^{\circ}$ , and added ice and ice water. In ten minutes the breathing became easier, in fifteen minutes the temperature was  $102^{\circ}$ , and in twenty minutes  $99^{\circ}$  and the pulse 110. All spasm had ceased, and the child was replaced in bed. It slept soundly for half an hour, and awoke with no bad symptoms. There was no return of fever, and no further treatment was required.

CASE V. Feb. 5th, 1871.—L. Lamont, æt. 6 years, was first ill this morning with chill followed by fever (malarious).

At one p.m. convulsions came on, and continued without intermission <sup>until 3 p.m.</sup> when she died.

The treatment consisted of warm baths, castor oil, injection to move bowels, bromide of potassium and hydrate of chloral. The temperature the whole afternoon was  $104^{\circ}$ . Chloroform was administered part of the time.

CASE VI. Sept. 26th, 1872.—P. T., a strong boy, 8 years old, was well until noon to-day when chill came on, followed by fever and convulsions, which still continued when I arrived, at one o'clock p.m. The attendants had just removed him from a warm bath. It was impossible

to get him to swallow anything. Applied cold to the head, gave an enema, and put him under chloroform, which controlled the spasms, but they always returned when it was omitted.

The enema acted well, the chloroform was continued, the temperature remained at  $106^{\circ}$ , the pulse became gradually weaker and more frequent, and after three hours he died.

CASE VII. Oct. 23th, 1876.—C. Gore, æt. one year, was never ill till last evening, when fever came on and lasted all night. At 7 o'clock this morning convulsions began, and lasted without intermission until half-past eleven a.m., when I saw the child, and found him convulsed and senseless, with a temperature of  $104^{\circ}$ . Used cold bath, and in ten minutes temperature fell to  $99^{\circ}$ , the spasms ceased, and consciousness returned. The child remained well until the following Thursday (4 days), when it again had fever, and convulsions began as before. The parents, having witnessed the beneficial effects of the former treatment, put the child into a cold bath, and in a few minutes he was well and remained so afterwards.

In carrying out this plan of treatment care is required to protect the bulb of the thermometer from contact with the water, by keeping the arm pressed firmly to the side.

The application of cold should not be continued after the temperature has been reduced to  $99\frac{1}{2}^{\circ}$ , as there will be a further fall after it has been stopped.

