ADMINISTRATION

OF

Chloroform by Deglutition.

BY

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PRELIMINARY NOTE.

Backwoodsman No. One. What might your name be, stranger ?

Backwoodsman No. Two. It might be Sampson, but it *aint.*

THAT particular use of Chloroform, which I have here called its administration by deglutition, has been named by some writers "administration by the mouth," and by others "internal administration." But neither of these last two names seems to me to be sufficiently definite. Against the first of the two it may be urged that the taking of the liquid Chloroform into the mouth is only the first step, and by no means the most important one of the somewhat complicated process of deglutition ; and that the Chloroform vapor may also be taken into the mouth in the process of inhalation. And if any curious critic, with laudable anxiety for the perspicuity of the Queen's English, say after the manner of our Backwoodsman, "Administration by the mouth, and what *might* that mean, Doctor ?" What answer would be possible but this ? " My Dear Sir, it might mean the simple introduction of the medicine into the oral cavity and its absorption thence through the buccal membranes into the interior of the organism, but it *don't.*"

Against the other, against the phrase " internal administration," it may be urged that the administration by deglutition is not more truly an internal administration than is the administration by inhalation. In neither case does the medicine reach the interior of the organism until it passes through the mucous membrane. The mucous membrane lining the cavities of the stomach and intestines, and the mucous membrane lining the cavities of the lungs—the pulmonary tubes and vesicles, are but modifications, more or less profound, by involution, and evolution, and structural and functional differentiation, of the skin, which forms the common integument of the body. They are all

membranes of limitation, that is to say external membranes, membranes intervening between the organism and the environment. Neither food, nor medicine, nor any *tertium quid* can find its way into the organism without passing through some part of this general membranous envelope. And no product of normal or of abnormal disintegration or metamorphosis can be excluded from the system without passing along the same route. In ultimate anatomical and physiological analysis, then, anything simply enclosed in a mucous cavity is as absolutely out of the organism as when in simple contact with the skin. As the differentiation of the structure in these membranes is incomplete, so also is the differentiation of function incomplete; and each one of them can discharge vicariously, and with more or less efficiency, the proper office of each of the others. The skin is an important organ of respiration and of depuration, of the elimination from the organism of effete and redundant materials, and of the introduction into the organism, under certain contingencies, of both medicine and food. The intestinal mucous membrane is about equal in superficial extent to the skin. As an organ of elimination and depuration it is not, perhaps, of greater importance than the skin or the lungs; but it is of far greater efficiency than either, or even than both of the others as a medium of nutrition; and it is also the most common medium for the introduction of medicines into the system, as is most natural, inasmuch as medicines are but an other kind of food. For is it not evident that therapeutics bears the same relation to hygiene that pathology does to physiology? The pulmonary mucous membrane is of far greater superficial extent than is commonly imagined, being estimated by Lindenan at not less than 2642 square feet—an estimate almost exactly coincident with a calculation made by myself while a student of medicine. It is the great medium of respiration, of the introduction of oxygen into the system and the elimination of carbon; but it is also instrumental in many other offices. Through it can be brought into the system all medicines that assume the form of vapors or gases; and I believe that it is also the principal medium for the introduction of those specific poisonous miasms

which engender the long catalogue of infectious maladies that, flesh is heir to.

The comparative influence on the organism, alimentary, medicinal and toxicological, of various agents when brought in through these different mediums is a matter of curious and suggestive inquiry, but too extensive to be even glanced at in a note.

SECTION I.—HISTORICAL SKETCH OF CHLOROFORM.

Chloroform, as is well known, was discovered in the year 1831, almost simultaneously by Guthrie, in the United States, by Sauberein, in France, and by Leibig, in Germany. It came into medical use very slowly; and to the great majority of the profession remained almost unknown until the discovery, in 1847, of its marvellous anæsthetic properties. The anæsthetic power of sulphuric æther was discovered the year before, namely, in 1846; and South in his encyclopædic edition of the System of Surgery of Chelius, calls it the *annus mirabilis*—the wonderful year of Surgery. The first publication of the anæsthetic power of Chloroform was made in the Pharmaceutical Journal for February, 1847, by Mr. Jacob Bell, but does not seem to have attracted much attention. In March, of the same year, Flourens published a series of experiments on the inhalation of Chloroform by dogs. And in November, of the same year, Professor Sympson, at the suggestion of Mr. Waldie, and apparently unacquainted with Mr. Bell's recommendation, employed it to relieve the pains of parturition. The authority of his great name immediately brought it into general use. In the twenty years that have elapsed since then its reputation has grown apace; and it is not too much to say, that it is at once the safest, the most powerful, and the most pleasant of the entire family of anæsthetics.

But while in reference to the administration of Chloroform by inhalation we have facts and theories in embarrassing abundance, its administration by deglutition has received far less attention. As a comprehensive summary of what is known of this method of exhibition I quote from the United States Dispensa-

tory all that it contains under the head of "Internal Administration of Chloroform."

"When taken internally, Chloroform acts as a sedative narcotic, probably operating through the nervous system, independently of vascular action or congestion. In 1848 Dr. Henry Hartshorne tried its physiological effect in the dose of seventy-five drops on himself, and found it to produce drowsiness, and a general diminution of sensorial power, without exhilaration, or acceleration of the pulse. Since then he has used it internally in a number of cases, and finds it a safe anodyne and soporific, altogether free from the dangerous effects which sometimes follow the inhalation of its vapor. In the dose of a fluid drachm its soporific effect is about equal to that of thirty-five drops of laudanum. Dr. Hartshorne has given it in doses of from fifty to seventy-five drops every half hour for several hours together.

"Chloroform, as prepared by Mr. Guthrie, was used internally as early as 1832, by Professor Ives and Dr. Nathan B. Ives, of New Haven, in asthma, spasmodic cough, scarlet fever, and atonic quinsy, with favorable results. It was employed by Dr. Formby, of Liverpool, in hysteria in 1838; by Mr. Tusan, of London, in cancer and neuralgic affections in 1843; and by Mr. Guillot, of Paris, in asthma, in 1844. Antiperiodic properties have been attributed to it by Dr. Deliaux, of Rochefort, who proposed it as a remedy for intermittents, given during the apyrexia, in cases in which bark and quinine fail to effect a cure. Its powers as an antiperiodic have been confirmed by Dr. L. Dalton, of Logan, Ohio. Dr. Aran has employed it for four years in lead colic, administered by the mouth and rectum, and applied to the abdomen. In these cases it probably acts by relieving the intestinal spasm. One of the authors of this book has frequently used it with advantage for the relief of neuralgic and other painful affections, in the dose of from forty to eighty drops, suspended in water by means of gum arabic or yolk of egg. This dose may be repeated, if necessary, at intervals of one or two hours, or until some effect on the system is produced. Chloroform has been used internally with benefit, by Dr. Orsbony, of Dublin,

and by Dr. Gordon, Physician to the Hardwicke Fever Hospital, to allay nervous irritation and procure sleep."

This summary was written by Dr. George B. Wood, for the Dispensatory of 1850 ; and has been retained in all the subsequent editions, including the revised edition of 1865 ; a conclusive testimony that no additional knowledge of the remedy has been gained which is esteemed worthy of special note.

SECTION II.—NOTES OF CASES.

My own attention was first called to the administration of Chloroform by deglutition by an article in the Memphis Bulletin, addressed to Surgeons in the army, by Dr. A. P. Merrill. My knowledge of Dr. Merrill led me to place some confidence in his recommendations. Among other things I knew him to be an indefatigable worker. He was a Physician in full practice in the city of Memphis ; was, at the same time, Professor of the theory and the practice of medicine in the Memphis Medical College ; editor of the Memphis Medical Recorder ; superintendent of the public schools ; a member of the board of aldermen, and a frequent contributor, on matters relating to public health, to two or three daily papers. He is also the man to whom La Roche dedicated his big book on Yellow Fever. From the article I mention I copied into my note book the following suggestive paragraph :

" It appears to be nature's favorite remedy for pain. Taken into the stomach its influence over the nervous system is truly wonderful, relieving chill, spasm, sunstroke, concussion and neuralgic pain, and without the evil effects on the cerebral and digestive functions which follow the use of opium. Adults may safely take it in doses of one teaspoonful."

This was in 1861. Since that time I have administered Chloroform by deglutition very frequently, and in various kinds of diseases—in tetanus ; in spasmodic convulsions of the extremities, or of the whole system ; in epileptic convulsions of children and adults ; in hysterical convulsions ; in every form of enteral-

gia not acutely inflammatory, such as spasmodic colic, bilious colic, and lead colic ; and in several cases of Asiatic cholera.

CASE I.—A young soldier in the Military Hospital at Marion Station, Mississippi, in the summer of 1863, had an attack of tetanic convulsions. Some years before he had received a blow on the head which had fractured the skull, and he had been subject to these attacks at uncertain intervals ever since. It seemed impossible for any man to suffer more than he did. Cramps seemed to have seized on every separate muscle in his entire body. The opisthotonous was so great at times that only his head and his heels seemed to touch the bed. The spasmodic contortions and the groans of dreadful agony were horrible to see and hear. I gave him at first a large teaspoonful of Chloroform; and repeated it in ten minutes, but with very little effect. Feeling that the case belonged to that desperate class which is said to require desperate remedies, and that the man must be relieved at any risk of danger, I gave in ten minutes more, for the third dose, using a tablespoon as a rough measure, about half an ounce of the medicine. In a few minutes the patient fell into a quiet sleep, slept for hours, and waked up well. No nausea nor other unpleasant results of any kind were noticed. The whole amount of Chloroform administered in the space of twenty minutes could not have been less than three-fourths of an ounce.

CASE II.—June 1st, 1866, Jeff. Taylor, a strong, athletic negro drayman, black as his African ancestors, and whose veins were evidently innocent of any admixture of Caucasian blood, had a severe attack of bilious colic. I found him rolling and tumbling, now on his back and now on his belly, and doubling himself up in every variety of eccentric positions, covered with sweat, groaning with agony, and praying for relief. One-third of an ounce of Chloroform produced some amelioration of the symptoms, and another dose of the same size, making two-thirds of an ounce in all, sent him off to sleep. His waking up was followed by copious bilious vomiting; he had no more severe pain, but was kept four days longer under treatment with purgatives and quinine. Nearly a year has transpired and he has not been sick since.

CASE III.—On the afternoon of the 23rd of August, 1866, Mr. H. S. had an attack of cramps and pains, which commenced in the calves of both legs and gradually worked their way up until they involved the whole abdominal region. When I saw him, at 9 o'clock in the evening, he was suffering such intense agony that he prayed to die if there was no other means of relief. The pulse was full and a little fast, but gave no evidence of either fever or inflammation. Paroxysms of cramp racked him every few minutes: and in the little intervals between them he complained that he was burning up. He drank ice water with insatiable appetite, and had a towel wrung out of ice water spread over the stomach and bowels. Half an ounce of chloroform in three doses fifteen minutes apart eased him of all his troubles, in an hour after entering the house I left him asleep. When I called the next morning he was up and dressed had taken a light breakfast and felt tolerably well.

CASE IV.—Diana White was named to illustrate the theory of contrast. She was not white at all, but so black that she could not be any blacker. If not beautiful exceedingly according to the Greek ideal of the chaste goddess whose name she bore, she was at any rate unmistakably great according to the scales of cubic measure and avoirdupois weight. I was called to see her about noon on the 17th of July, and found her almost frantic with pain. She kept continually exclaiming, in most piteous tones, "Oh! my God, what shall I do? Mr. White, my head will split open! Oh! my belly! my belly! I shall die! I shall die!" She sat up in the bed; she swayed to and fro; she tumbled her huge body from side to side. She swallowed eagerly great draughts of cold water, which were thrown up again in a few minutes. The skin was hot, and wet with sweat; the pulse full and fast. She had a raging fever; she was tormented with headache; she was racked with colic. The seven devils of malaria had taken possession of her. How to drive them out, that was the question. Cold water and chloroform did it. I deluged her head with the water; and gave her four teaspoonfuls of chloroform, a teaspoonful every twenty minutes. The vomiting ceased, the

pain subsided; she went to sleep, and waked up comparatively easy. That night and the next day she took quinine. She recovered promptly.

CASE V.—I was called on the 24th of August, 1866, 8 o'clock in the evening to see Moses Thomas. The scene that met my astonished eyes when I entered his room baffles description. Not Dickens himself could do it justice. There, stretched on the floor, because he could not be kept on the bed, rolling, tumbling, groaning, and filling the startled air with clamorous invocations, was a son of Ham, cast in the mould of the giants, six feet two in his socks at the least, and evidently assailed by the whole mythology of furies at once. The room was swarming like a hive with men and women called together by his cries. The most of these, with blank, impassive faces in which no emotion took visible shape, stood helplessly about, speaking idle commonplaces in low tones one to another. But two or three old women, who called to mind the witches in Macbeth, were piling hot bricks about him as opportunity offered, benevolently trying to drench him with some villainous decoction, which he sensibly refused to swallow. And one priggish fellow, with the legs of his blue breeches stuffed daintily into the legs of a pair of shining boots, and no beard on his face, was discoursing grandiloquently on the vanities of this world, and energetically endeavoring to impress the hoary old sinner on the floor, who heard never a word of all that was said, with a becoming sense of his exceeding great wickedness. I found that my patient had been sick two or three days. He had eaten but little, and had taken some domestic remedies, hoping to wear out the disease without the aid of the Doctor. He had no fever. It was clearly a case of bilious colic. His sufferings were horrible, and the mind suffered in sympathy with the body. He was delirious from mere excess of pain, and paid no intelligent attention to any thing about him. Nature to him had been liberal of her gifts. With the frame of Hercules he had inherited also the voice of Stentor. And with this great voice at its loudest pitch he called continually for the Doctor: "Folks, why don't you send

for the Doctor? The Doctor can give me something to ease me!" When told that the Doctor had already come he would be quiet for a moment, and then break out again, "Send for the Doctor! Send for the Doctor!" I gave him at one dose a full half ounce of chloroform. When he was lifted up to take it I found that his entire vertebral column was as stiff as a board. After swallowing the chloroform the spasm rapidly relaxed, his consciousness of things about him returned, in a few minutes he was led to the bed, and in a few minutes more he fell asleep. Purgatives and quinine followed, as a matter of course, and he got well.

CASE VI.—I was called a little after midnight, July 9th, 1866, to see Mr. P. W. He had attended to business the day before, but had not felt well. He stated that he had eaten but little during the day, and particularly that he had eaten no supper at all. The bowels were constipated, and he had slight fever, and some trouble about the head; but he complained chiefly of intense abdominal pain. He drank a great deal of water, which was soon thrown up again without much change. I gave him a teaspoonful of chloroform. This also was thrown up in a few minutes, and I gave him another teaspoonful with the same result, but doubtless some part of each dose was absorbed. I now gave him still another dose of the same size, which was retained. Symptoms of alarming import quickly followed. The face became violently congested, the breathing grew stertorous, profound coma supervened, the tension of the muscles relaxed, and, to make use of a familiar phrase my patient was as limber as a rag. Soon after this he commenced vomiting, and discharged a large amount of undigested food, which must have been lying in his stomach for many hours, and which, strange to say, had not been disturbed by all the emesis, nor washed away by the water he had taken so profusely and thrown up again. The congestion, the stertor, and the coma now passed away; consciousness returned, and the abdominal pains were felt no more. But some gastric irritation remained, and the constipation continued. The subsequent treatment consisted, as usual,

of purgatives and quinine. The case was discharged on the 11th —the third day—convalescent.

CASE VII.—Sept. 2nd, 1866. Mr. E. D. This was a characteristic case of congestive chill—febris intermittens maligna. The patient was comatose, the surface cold, the features collapsed, the pulse feeble and slow, the expired air cool, and all the senses blunted. At an earlier stage of the paroxysm there had been vomiting and purging. I gave half an ounce of chloroform in three doses twenty minutes apart. The good effect of the remedy was rapidly and unmistakably manifested. Warmth returned to the skin, the circulation rallied, the respiration improved, the coma subsided. The fever was short, and quinine prevented a recurrence of the chill.

CASE VIII.—Child of Mr. P. B. This was probably a case of congestive intermittent. The child was about six months old, exceedingly frail and delicate, and had had several chills. The bowels were loose, and the head stopped up with cold. When I saw it, it had been in convulsions for about an hour, with no distinct intervals of ease, and was cold, pale and almost pulseless, and seemed indeed to be *in articula mortis*. I had but little hope of doing any good, but ventured anyhow to give at one dose a half a drachm of chloroform. The effort to swallow the medicine brought on a frightful spasm, but in five minutes after the child was asleep. The circulation was rapidly reëstablished, warmth returned to the surface, and there were no more convulsions. A few doses of quinine completed the cure.

CASE IX.—Mr. L. M. had several attacks of intermittent fever during the summer and fall. He was feeble, anæmic, and in general bad health. His mental faculties were observed to be impaired, particularly his memory. On the 25th of December, 1866, he was suddenly seized with tonic convulsions. These grew more and more violent, and in three or four hours profound coma supervened. He had locked-jaw, opisthotonos, and stertorous breathing. It was at this stage of the case that I saw him.

He was totally unconscious. The convulsions were extremely violent, and involved the muscles of the arms and legs as well as those of the body. By forcing a strong iron spoon between his teeth I managed to give him about three drachms of chloroform. This caused a temporary relaxation of the spasm, and a decided improvement of the respiration. Subsequently he had an emetic of sulphate of zinc, was purged with croton oil, and was blistered, but all to no purpose. There was no restoration of consciousness, no subsidence of the coma. He died in about forty-eight hours from the commencement of the attack. The only noticeable amelioration of the symptoms was that produced by the Chloroform. The malady was no doubt ingravescent or serous apoplexy.

Case X.—W. M., a youth of eighteen years of age, small delicate organization, and nervous temperament, convalescent, from pneumonia, ate cabbage for dinner, and the night following had an attack of colic. He was vomited and purged, but the colic instead of subsiding grew worse; and the next day, March 13th, 1867, at three o'clock P. M. he sent for me. I ordered him a drachm of chloroform, but did not see him until four o'clock. He had thrown up the medicine, and with it a small quantity of some dark substance, which had not been kept, and I was consequently not able to determine its exact nature. The colic was still giving him a good deal of trouble. I gave him at a single dose two drachms of the medicine, which was retained, and in a few minutes he fell into a quiet sleep. He slept soundly a deep, quiet sleep, all the afternoon and all night, slept as though he could never sleep enough; and when at last did wake up, he felt like a new man.

Case XI.—Sept., 1866. This was a negro girl aged about fifteen, who had been afflicted with epilepsy from childhood. The paroxysms had never been frequent nor severe; and neither the body nor the mind had been injured to any perceptible degree. In the particular instance in which I saw her, the attack was provoked by acute suppression of the catamenia, and was of

far greater violence than usual. The convulsions were of the characteristic tonic type, with deep coma, stertorous respiration, chewing of the tongue, frothing at the mouth, and the full train of attendant symptoms. They succeeded each other very rapidly, and when I reached the house, at 8 o'clock in the evening, she was in a state of almost continuous spasms. I gave her Chloroform by the teaspoonful, until she had taken three doses, at intervals of fifteen minutes, before the subsidence of the convulsions and the supervention of the chloroform sleep. The sleep was heavy, restless, and unsatisfactory, and was disturbed towards morning by occasional slight spasms for which another dose of the remedy was given. The epileptic passion was held in check but not thoroughly subdued. I put her the next day on twenty grain doses of bromide of potassium, and she had very little more trouble.

Case XII.—I was called at seven o'clock in the afternoon of the 26th of October, 1865, to see Mr. J. D., a young man who was just convalescent from a long spell of bilious fever, complicated with facial neuralgia, who sought my assistance, in the absence of his attending physician, for an intercurrent attack of some kind of abdominal pain from which he had been suffering since the middle of the day. The day before at the same hour he had an attack of similar nature, only of much less severity, which had been relieved by extract of ginger, paregoric, castor oil, and a mustard poultice; and the same remedies had been tried in the present paroxysm, but without the slightest mitigation of the symptoms. I saw at once that I had no easy case to deal with. The pain was intensest agony involving the whole abdominal region, but most severe about the umbilicus. The face wore an anxious, troubled look. The pulse was slow and full. The skin was wet with sweat, and cool to the touch; but the patient complained of feeling hot and threw off the cover. He did not vomit, nor complain of nausea; but occasionally belched up mouthfuls of semifluid brownish matter, which although it had no distinctly stercoraceous smell or appearance, I supposed might be modified chyme regurgitant from the duodenum after

the passage of the pylorus. I ordered a fluid ounce of chloroform, and gave the whole of it at three doses, the first at half past seven, the second at a quarter before eight, and the third at at a quarter past eight, measuring time by the clock that stood on the mantle in the patient's room, and making an interval of a quarter of an hour between the first two doses, and an interval of half an hour between the last two doses. The result was such as to dissappoint all my expectations. Only a very slight alleviation of the pain followed the first dose. After the seeond there was a slight and evanescent disposition to sleep, but the pain very soon grew worse again, and the man insisted that he must die if he were not speedily relieved. The third dose produced no appreciable effect, and the pain grew steadily more and more intense. Ten or fifteen minutes after the last dose there was a tolerably copious discharge of urine smelling strongly of the drug. During all this time the pulse and respiration remained about the same, and there was very little change in any of the symptoms except that the skin grew dryer and warmer. The choloroform had occasioned no nausea, nor any sensation of burning in the stomach, nor any other unpleasant symptom whatever. As well as I could judge it had simply *failed* to relieve the pain, and that was all.

What to do next was a matter of anxious consideration. It did not seem expedient to give more chloroform under the circumstances. The amount already used was large beyond all precedent, and the system was already saturated with it as was evident from its rapid elimination by the kidneys, and, as I had also reason to believe, by the skin and the lungs. I ordered a solution of sulphate of morphine, five grains to one ounce of rose water. I gave about three fourths of this at three doses between nine and ten o'clock. Ten o'clock, brought the blessed release from pain ; and with it tired nature's sweet restorer, balmy sleep. When I left at half past ten the patient was sleeping soundly and quietly ; and neither the circulation nor the respiration, nor any of the great functions, gave warning of approaching danger. I saw the case no more, but I learned that he slept well through the whole night and waked up spontaneously

the next morning ; that the attending physician prescribed croton oil ; that the man died before noon ; and that the sexton's report gave intussusception as the cause of his death.

CASE XIII.—One day towards the end of August, 1866, the boy who attended to my gray horse Fooshee, went to the stable after breakfast to harness him up, and found him sick. Great was the excitement that followed the publication of the fact. For it must be understood that Fooshee is a great favorite in the family, as he well deserves to be. Because he is a good honest horse ; and was bred and raised by an honest man, which can't be said of every body's horse ; and, most of all, because of the honored name he bears—that of one of my best friend's, who bought and trained him for me. As I proceeded, with sedate professional step, towards the stable to investigate the matter, I was met by half a dozen separate messengers, all at full speed as if shot out of a catapult and running over with the same dreadful intelligence, "*Fooshee is sick!*" Last of all, because his little feet were not able to run as fast as the rest, came toddling breathlessly up, a flaxened haired two-year old, who rejoices in the name of Bowling, exclaiming like the others, but in imperfectly articulated baby speech, "*Papa, Fooshee sick*". When I entered the lot Fooshee too came meeting me, as if I did not make haste enough ; and looked into my face with his great brown eyes ; and seemed after his dumb, brute fashion to be pleading for human sympathy and the assistance of human science. The diagnosis of the case was not difficult. It was easy to see that the horse, like so many of my human patients, had the colic. His belly was tense and tympanitic ; he walked restlessly about ; he swayed to and fro ; he lay down, and got up, and lay down again, and stretched out his legs ; and rolled over; and groaned a little; and put his mouth to his belly as if to show where the pain was. In short he acted as much like a man as he could, only he sufered with a great deal more of dignity and fortitude. I gave him, at once, half a fluid ounce of chloroform. The effect was wonderful. No talismanic elixir of Eastern fable ever wrought so powerfully or promptly. In five minutes he

was eating hay with evident apetite ; and in half an hour he was hitched to the buggy, and drew me as usual through my usual round of morning visits.

SECTION III.—METHODUS MEDENDI.

The precise nature of the action of chloroform on the human organism has not been certainly determined. Professor Wood, as we have seen, gives it a place among the sedative narcotics, and believes that it acts immediately on the nerves, and through the medium of the nervous system upon the rest of the body. This seems to me the only tenable theory. Other authorities however, maintain that it acts directly upon the blood ; and that it produces narcosis indirectly, by virtue of a property which it shares with all the other narcotics, of diminishing the power of the organic constituents of the blood to combine with oxygen and to give off carbonic acid. This theory is applied to the whole family of æthers by Dr. Charles A. Lee, the American editor of Copland,s Dictionary. It is also advocated by Mr. Sansom in his recent book on " Chloroform and its Administration." The facts from which Mr. Sansom makes his deductions are not devoid of interest, and as I have not read the book, I quote here a summary statement of them from the Westminster Review for October, 1865 :

" By microscopical examination of the capillaries of the frog's foot when Chloroform had been administered to the animal by the mouth, he has found the effects of it, as of other anæsthetics, upon the circulation, to be, in the order of their sequence, first, an increase of the flow of blood through the arterial system ; secondly, a decided contraction of the arteries, the current maintaining its original force ; thirdly, a sluggishness of the flow of blood in the capillaries ; and, fourthly, dilatation of the artery, with an increasing sluggishness of the flow of blood that may pass to actual stasis. A state of anæsthesia does not then, as has been commonly thought, imply hyperæmia of the brain ; but the quantity of blood in the vessels is diminished, as is now also known to be in natural sleep. This has been actually seen in the case of a patient in America, who had suffered a

fracture of the skull that exposed the brain ; when he was fully under the influence of Chloroform, the brain was remarkably pale, but its surface became florid and injected as the anæsthesia passed off." I give these facts for what they are worth ; and with the highest respect for the one indubitable fact that there are more false facts than false theories in the world. Certainly they afford no presumption, not even the faintest, against the doctrine that Chloroform, by virtue of elective affinity, or by virtue of some other inexplicable attraction, exerts its specific influence immediately on the nervous system, and mediately through nervous instrumentality on the rest of the organism, blood, muscles, viscera, etc. But if it is indeed true that there is a smaller amount of blood in the brain during natural sleep, than at other times ; and if it is also true that the amount of blood in the brain is diminished under the anæsthetic influence of Choloform, it is evident that these facts are of immense importance in relation to practical therapeutics. They afford *apriori* presumption, for example, of the propriety of the use of Chloroform in the treatment of the various forms of cerebral congestion and cerebral apoplexy ; and furnish means for at least the partial explanation of its hypnotic and anæsthetic efficiency.

Choloroform is of somewhat complex chemical constitution ; and, so far as I know, no attempt has been made to trace in its influence on the human system, the specific effect of any of its proximate constituents. It is a terchloride of formyle. Chlorine, I believe, is not used in medicine except as a disinfectant ; and formic acid and formyle are not used medicinally at all. Yet there is some reason to believe that the formyle is the active anæsthetic principle of Chloroform. Formyle is the hypothetical radicle of *formic acid.* Formic acid was originally derived, by some process of distillation, from the large red ant, the *formica rufa* of Linnæus, whence its name, and is the substance that gives to that enterprising little animal it peculiar penetrating odor. It is a theme of curious speculative interest that while neither formyle nor formic acid has ever been used medicinally, the red ant itself the *formica rufa,* has an unwritten therapeutic history. Thereby hangs a tale.

An acquaintance of mine had, many years ago, an old negro man who had been brought from Africa. This man was the subject of frequent and very distressing attacks of cramp colic, which, in blissful ignorance of the therapeutic opulence of Caucasian civilization, he was accustomed to treat with a remedy *he* had learned the use of in his native country—the land of Obi and Fetish. The remedy in question was the *formica rufa*. Whenever he came across a nest of these creatures he would mark the place so that it could be found when wanted ; and whenever he was visited by a paroxism of his habitual malady he might be seen rushing with breathless haste to one of his nests, tearing away the earth that covered it with impatient hands, eagerly cramming the living animals into his voracious mouth, and crushing and swallowing them as fast as he could without any preliminary employment of the art of Soyer and Francatelli. This singular medicine always gave him relief. I take it for granted that it owes its efficacy to the formic acid it contains ; and that African therapeutics can thus plausibly lay claim to the first practical anticipation of the great anæsthetic.

SECTION IV.—MODUS ADMINISTRANDI.

When Chloroform is applied to the skin in such way as to prevent evaporation, vesication is rapidly and certainly produced ; when it is left free to follow its natural tendency to pass into the state of vapor, its cutaneous influence is simply refrigerant. When Chloroform is held in the mouth, it causes a sensation of burning in the mucous membrane, which is, however, less intense than that produced on the skin, for the reason, probably, that the mucous membrane is protected by the mucus with which it is covered ; and the Chloroform vapor finding its way into the air passages gives rise to cough and strangulation. But if Chloroform is rapidly swallowed, only a warm and sweetish taste is excited, and none of these unpleasant sensations are induced.

Various preparations have been devised to facilitate its administration. It has been proposed to hold it in watery solution by means of alcohol or glycerine ; and there is an officinal emul-

sion in the French Codex. But the best vehicle is simple cold water. It is true that the Chloroform is not dissolved, but the water envelops it in the act of deglutition, and washes it down without any trouble to the patient. The amount of water used ought to be small, so as to be taken at a single swallow, say about a tablespoonful to each dose; and the patient ought to be raised to the sitting position if the state of the case allows it. But it is not necessary to use any vehicle at all. The unmixed Chloroform can be swallowed without difficulty; and particularly if the sensations subservient to deglutition are much blunted. In some cases, indeed, where the prostration of the system is so great that the nerves and muscles of deglutition are insensible to the familiar stimulus of cold water they will still respond to the more powerful influence of the Chloroform, and the Chloroform can be swallowed when the water cannot.

I have been most accustomed to make use of Chloroform in cases requiring the most prompt and energetic treatment. In these cases I give it in doses ranging from one fluid drachm to half a fluid ounce, repeated at intervals ranging from ten to thirty minutes. I know that this kind of practice smacks of the heroic. But when some tremendous pathological influence threatens to subvert the very foundations of life, or when some great pain is clamorous for relief, there is neither rhyme nor reason in any treatment which is not heroic; and in such cases I am certain that the doses I have mentioned may be prudently and safely given.

Although I have not been much in the habit of giving Chloroform in small doses, in slight maladies, nor in combination with other medicines, there is one somewhat complex formula which I have used with good results, in cases of gastric and intestinal irritation, and as a general antispasmodic and carminative. It is this: *Recipe*—Spiritûs Ammoniæ Aromatici; Spiritûs Cinnamoni; Spiritûs Camphoræ; Tincturæ Opii; Chloroformyli, AA f℥j. Misce. Of this one to two teaspoonfuls is added to a glass of water—ice water if most agreeable—and from a teaspoonful to a tablespoonful of this solution, according to the age of the patient and the urgency of the symptoms, is

to be given every few minutes, so that the whole of it may be taken in one or two hours. It is pleasant to the taste, and combines a good many valuable properties.

One remarkable property of Chloroform, which must not be overlooked, is its emetic power. It is not an emetic *per se.* Indeed, in many cases it is found to be a very efficient remedy for gastric irritability. If the stomach is empty at the time of its administration it produces no emesis, and even no nausea; but whether given by inhalation or by deglutition—by the lungs or by the stomach—if there is in the stomach any accumulation of food, digested or undigested, or of chyle or bile regurgitant from the duodenum, it is a prompt and certain emetic, and whatever the stomach may happen to contain is inevitably thrown off. When the stomach has been effectually emptied, any subsequent dose of the medicine is retained without difficulty. This property is well illustrated in my case six, above. The half-digested food with which this man's stomach was oppressed, which had resisted the expulsive efforts of several hours of severe vomiting, was removed in a few minutes by a little Chloroform. Another illustration will be found in the inefficiency of the emetic of sulphate of zinc given after the Chloroform in case nine. The emetic draught was too potent not to be rejected itself, but the gastric load it was expected to dislodge was not forthcoming.

Professor Wood's retention, without alteration or addition, in the last edition of the Dispensatory, of the scanty summary on the internal administration of Chloroform, written fifteen years ago, affords suggestive evidence of the slowness with which this method of exhibiting the medicine is coming into use. It appears from this that but little is known on the subject, and that this little does not increase; a condition of things which admits of but two explanations. Either the trials that have been made of it have not yielded favorable results, because of the inherent unfitness of the medicine for this kind of use; or else the results have not been favorable, because the common impression of the dangerous character of the remedy has stood in the way of its efficient employment. Or, which is still more probable, both of these causes have acted in combination; the apprehension of

danger leading to its timid administration, and this, in turn, leading to unsatisfactory consequences. That the doses in which it is sometimes given are too small to do much good, I am well satisfied. I am also well satisfied that its poisonous energy is far less than is generally believed. During the last four years I have given it a great many times, and I have never known any bad consequences to follow its use, of a more serious kind than sick stomach, or occasional vomiting. It is not true in any sense that Chloroform is one of the most energetic of poisons. On the contrary, there are very few medicines that can be given so safely in doses so large and so frequently repeated.

The common tincture of opium is not commonly considered to be a very dangerous drug; and yet common tincture of opium is a far more powerful agent of evil than Chloroform. I have already quoted from the United States Dispensatory the statement that a fluid drachm of chloroform is equal in soporific effect, to thirty-five drops of laudanum. Now a fluid drachm of laudanum contains a hundred and twenty drops, which would make a drachm of laudanum equal to three drachms and a half of chloroform, or almost half a fluid ounce, whence it seems to follow that half an ounce of chloroform may be given with as little hesitation as a drachm of laudanum, and with as little dread of subsequent danger. And if there are cases in which a drachm of laudanum would not be considered an extravagant dose, as there certainly are, it seems fair to conclude that there are also cases in which half an ounce of chloroform could be prudently and safely given.

Dr. Hartshorne, as we have seen, speaks of Chloroform taken into the stomach as a safe anodyne and soporific, *altogether free* from the dangerous effects which sometimes follow the inhalation of its vapor. And Dr. Copland, in the article on poisons in the third volume of his great Dictionary, says of the whole class of æthers, "I am not acquainted with any dangerous effects which have occurred from swallowing any of these æthers; and I believe that they may be taken in larger doses than are usually prescribed, and be productive, in certain states of disease, of much benefit.

Some very suggestive views bearing on this point of doses are very well expressed by Sir Henry Holland, in his discussion of the use of opium in his Medical Notes and Reflections. He says: "Its use is not to be measured timidly by tables of doses, but by fulfilment of the purpose for which it is given. A repetition of small quantities will often fail, which concentrated in a single dose, would safely effect all we require. On this subject," he continues, "we must refer to a fact regarding opium, singular in itself, and affording many curious inferences. I mean the frequent absence of its ordinary effects in producing constipation, headache, and nervous symptoms, when given for the relief of acute pain or spasmodic actions in some part of the system. It would seem (however vague the expression) that the medicine, expending all its specific power in quieting these disorders of the nervous system, loses at the time every other influence on the body. Even the sleep peculiar to opium appears in such instances to be wanting, or produced chiefly in effect of the release suffering. Though certain analogies may be quoted in illustration of these facts, nothing like explanation of them is furnished by our present knowledge. Their reality, however, cannot be doubted as a matter of practical experience; and the instances are further remarkable in the large doses which may frequently be given in such cases, with impunity as to all the ordinary effects of the medicine."

The principles here noted by Sir Henry Holland, are not to be restricted in their application to opiates alone; but are equally true, I imagine of the whole class of sedative remedies; and not alone of sedatives either, but, in strictest logic, of all the medicines of the pharmacopeia. To express the doctrine in its most general form, there is always, in disease, a certain abnormal tension of the nervous system to be overcome—a certain abnormal polarity to be altered. And as this nervous tension is greater or less, as this vital polarity is in a state of greater or less deflection, so is a larger or smaller quantity of antagonistic influence necessary to overcome it and bring it back to its natural healthy condition. The greater the tension, the greater the dose necessary to relieve it. And the amount of powerful drugs that

can sometimes be borne with impunity is not a little astonishing. I myself know an opium-eater who has assured me that he has taken an entire drachm of morphine at a single dose. Dr. Alonzo Clark relates a case of puerperal fever treated by him in Bellevue Hospital, in which there was given during the first twenty-six hours, sixty-eight grains of opium, and seven grains of morphine; during the next twenty-four hours one hundred and forty-eight grains of opium and eighty-one grains of morphine—equivalent to four hundred and seventy-two grains of opium, or to two drachms of morphine. On the the third day, two hundred and thirty-six grains of opium. On fourth, one hundred and twenty grains. In reference to this case, Dr. Clark says: "This woman was not addicted to drinking, and after her recovery, she assured me repeatedly that she did not know opium by sight, and had never taken it, or any of its preparations, unless it had been prescribed by a physician. This is, perhaps, 'horrible dosing,' and only justifiable as an experiment on a desperate disease. Yet this woman is alive to tell her story, as are several others who took surprising quantities of this drug. But later observations have shown that the tenth to the twentieth part of this maximum is efficient in controlling the disease. So this case is referred to, not for imitation, but because, with similar cases, it is a medical curiosity; and may, perhaps, open some new therapeutical views."

Cases of this kind in which immense quantities of medicine have been taken without injury, might be multiplied almost without limit—and might, also, be extended so as to include a large number of drugs belonging to several classes of materia medica, but it is not necessary to my purpose to increase the list.

The theory of doses is a part of the general theory of the tolerance of the organism for different kinds of food and medicine, under the special conditions of age, sex, race, constitutional idiosyncrasy, and the correlative influence, of concurrence or of antagonism, of different agents acting at the same time, in health and in disease. What is called tolerance is itself included in the reciprocal relations of action and reaction, physical, chemical, and vital, between the organism and the environment. And these

relations are found in the last analysis to be only special phases of the great law of Polarity. Here we reach the utmost limit of speculation. Polarity is the ultimate fact of the natural world, and is therefore, of necessity, the last word of all natural science. Polarity, in the most abstract and general statement, is the equilibrium of differences—Swedenborg's doctrine of correspondences, and Emerson's law of compensation from a different point of view.

I will close this somewhat desultory essay with a summary statement of the conclusions which seem to me to be warranted by the facts which I have detailed.

1st. Chloroform may be administered by deglutition, with reasonable expectation of benefit, in all cases where the paramount indication is the relief of pain.

2d. In all adult cases it may be given in doses of from one to two drachms frequently repeated; and where the pain is exceedingly severe and obstinate half a fluid ounce may be given at a dose safely and prudently.

3d. Chloroform passes into the system with great facility, and is with equal facility eliminated from the system. The organs of elimination are the lungs, the kidneys and the skin.

4th. Whether any part of the drug is decomposed in the system, I am not able to conjecture; but it is certain that at least a part of what is given is eliminated without change.

5th. The rapidity of its absoption and elimination, and the promptness of its action on the organism indicate that where more doses than one are needed they should follow each other in rapid sucession, so that the anæsthetic effect of each additional dose may be added to the anæsthetic effect of the doses that have gone before, until the pain is overpowered.

6th. I believe that Chloroform does not act immediately on the blood and by the arrest of molecular change, as Mr. Sansom and Dr. Lee, and some others have taught; but that the more common opinion that it acts primarily on the nervous system through some power of elective affinity, is nearest the truth.

7th. Although somewhat foreign to the subject of this essay, I may be allowed to add here, that for the production of anæs-

thesia by inhalation, pure Chloroform is in my opinion, more pleasant, more prompt, more powerful and at the same time *safer* than sulphuric æther, or than any combination of the two.

8th. By any method of administration by inhalation or by deglutition, it is not by any means so dangerous a poison even in the medical profession as it is commonly believed to be.

9th. Professor Merrill is right. It is nature's favorite remedy for pain by whatever means produced. It combines in itself more good qualities and fewer bad ones than any other article of the Materia Medica which approaches it even remotely in power and in range of application. And I can not share in Mr. Bowman's sanguine anticipation that "in the sure progress of our art some other anæsthetic shall be found without even the slight inconveniences of Choloroform."

NOTE—This Essay, with the exception of a part of the cases which have occured since, was read before the Mobile Medical Society on the —— day of April, 1866.