

The Uses of Water in Modern Medicine,
PART I.

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THE USES OF WATER

IN MODERN MEDICINE.

BY

SIMON BARUCH, M. D.



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TO

DR. WILHELM WINTERNITZ,

PROFESSOR OF HYDROTHERAPY IN THE VIENNA UNIVERSITY,

THE FATHER OF MODERN HYDROTHERAPY,

THIS WORK IS DEDICATED

BY THE AUTHOR,

As a token of appreciation of the hospitality and instruction
received by him at the Institute in
Kaltenleutgeben.

TABLE OF CONTENTS.

PREFACE.

	Page
No Other Original Work in the English Language— Author's Indebtedness to Prof. Winternitz—Hydro- therapy Severed from Hydropathy—Water to be Used as Any Other Remedial Agent, Not to be En- tirely Substituted for the Latter—Importance of Recent Pharmacological Investigations—Distinction between Hydrotherapy and Hydropathy—Definition of Water Cure—The Subject of Water to be Pre- sented upon a Rational Physiological and Clinical Basis	XI-XIII

CHAPTER I.

DEFINITION AND HISTORY.

Definition of Hydrotherapy—Division of the Subject—
History—Water an Orthodox Remedy Since the Days
of Hippocrates, Galen, and Celsus—Asclepiades—
Alexander of Tralles—Paulus Ægineta—Van der
Heyden—Floyer of England, Pitcairn, Cheyne, Hux-
ham—Friedrich Hoffman—Wright, Currie, Joseph
Franck, Hufeland, Priessnitz and the Empirics—Op-
position of the Paris Academy Overcome by Clinical
Demonstration—Bouilland Convinced—Scoutetten,
Lubanski, Fleury, Duval, Charcot—Modern Fever
Treatment—Ernst Brand—Testimony of Niemeyer,
Dujardin-Beaumetz, Peter, Erb of Heidelberg, Sem-
mola of Naples, Hoffman of Leipzig, Hiram Corson
of Pennsylvania—History Repeats Itself—The Best
Men Advocate Water in All Epochs—Therapeutic
Nihilism of the Moderns—Water Again Triumphant

under Brand, Juergensen, and Ziemssen—Antipyresis Misleads—Chemical Antipyretics Abused; Water Suffers in Consequence—Fallacies Exposed—New Dangers—Naturärzte—Father Kneippe—Institute for Naturheilkunde at Chemnitz, Saxony—Good Results Obtained by these Empirics Warrant More Careful Study of the Subject by Physicians. . . 1-22

CHAPTER II.

MODE OF ACTION OF WATER.

Internal Use—Effect on Pulse—Physiological Investigations of Böcker—Effect on Tissue Metamorphosis—Peristalsis—Biliary Secretion—Clinical Value Demonstrated by Meigs, Cantani, Debove—Abused by the Empirics—External Use of Water—Water as an Agent for Absorbing and Giving Off Heat and Cold—Its Physical Flexibility—Effect of Temperatures—Limits—Special Terminal Nerve Centres—Illustration of Reflex Effect in Syncope—Anæsthesia—Difference of Effect according to Duration—Influence of Thermic Application upon the Circulation—Reaction—Hyperæmia Not from Vascular Paralysis—Effects upon Distant Parts—Prof. Semmola's Remarkable Clinical Experience—Damage Possible—Increased Blood-Pressure → Sphygmographic Evidence—Cold Enhances, Heat Lowers, Vascular Tone—Practical Deductions—Increased Urination—Reflex Effects—Naumann's Experiments on Frogs—Max Schüller's Graphic Demonstrations on Trephined Rabbits—Practical Deductions—Influence of Thermic Applications upon the Respiration—Montefiore Home—Hot-Air Boxes—Influence of Thermic Applications upon Tissue Change—Chiefly on Non-Nitrogenous

	Page
Matter—Increase of CO ₂ and O Interchange—Practical Deductions—Influence of Thermic Applications upon the Body Temperature—Local Temperature Depends on Arterial Blood Supply—Peripheral Circulation the Chief Element in Heat Regulation—Compensatory Action—Fallacies Exposed—Difference between Mouth and Rectal Temperature After Cold Baths—Reaction Aimed At—Laws of Fleury and Winternitz—Practical Deductions—Summary—Mechanical Irritation a Valuable Aid to Baths—Rationale of Cooling—Experiments in Zunz Laboratory—Temperature Changes Depend Chiefly on Heat Dissipation—Practical Application of These Truths.	23-70

CHAPTER III.

TECHNIQUE AND CLINICAL APPLICATION OF HYDROTHERAPY.

Necessity of Precision—Illustrations of "How Not to Do It"—Procedures for Local Effects—Mechanical Influence of Water in Cavities—Emetic—Enema—Drinking Hot Water—Irrigation in Gastric and Intestinal Disturbances of Infants—Lavage for Diagnosis and Treatment—Technique Detailed—Illustrations—Gastric Irrigation for Treatment—Lavage and External Hydrotherapy Combined—Lavage—Dilatation of Stomach—Gastralgia—Intestinal Obstruction—Colic from Gall Stones—Catarrhal Jaundice—Dysentery—Lead Colic—Water in Gynæcology—Dr. Emmet's Practice, Illustrating Importance of Details—Water in Surgery—Old and New Wound Treatments Compared—Hot Water as an Antiseptic; as a Styptic—Contra-indications to the Use of Water: Eczema; Otitis Media; Normal Puerperal Condition—Water Powerful for Evil as well as for Good.	71-116
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PREFACE.

That the proper methods of applying water in disease require to be brought before the American medical public in a comprehensive, practical form, has long been the author's observation. He has, therefore, undertaken to write a succinct account of the present status of water as a therapeutic agent. The only work in the English language which has not the taint of quackery, the valuable treatise of Winternitz in Ziemssen's Handbook of Therapeutics, has long been out of print. Owing to its being a portion of a large work, it has escaped the attention of the profession, and has not received the appreciation it deserves as a scientific exposition of the views of an author who has rendered medicine the incalculable service of rescuing the remedial virtues of water from the empirical environment into which it had fallen, and to which the medical profession appeared until recently to be inclined to abandon it.

As Ziemssen has justly said, "whatever we know of hydrotherapy, we owe to Winternitz." To Prof. Winternitz I am personally indebted, not only for knowledge derived from his numerous scientific and clinical writings, each one of which is replete with logically stated truths, but also for personal guidance and instruction during a sojourn at his institution in Kaltenleutgeben, where the best informed hydrotherapeutists in Europe have received their instruction.

In this monograph it is not proposed to furnish an exposition of hydropathy or the water-cure system, that method of treatment whose enthusiastic followers claim that it will inaugurate the millennium of therapeutics, because its efficacy is not less marvelous than its methods are simple and easily comprehended. It is the author's purpose to

sever hydrotherapy from any connection with hydropathy or water-cure, and so present the subject that the general practitioner may avail himself of the former, just as he does of the medicinal agents, of whose action he really is capable of learning much less.

The author desires to emphasize the fact, however, that, while he recognizes the undoubted value of water as a therapeutic agent, he is not prepared to substitute it for all other therapeutic agents. He would not be guided by his own clinical experience at the bedside, were he to disregard the result of clinical and physiological investigations which have given us concentrated alkaloids of positive action to replace crude drugs, and which have brought forth an entire series of new products of the mineral world—chiefly the coal-tar series, whose effects upon some of our most important physiological processes border on the marvelous. Drugs which possess the power of reducing or increasing the rate of the pulse, of diminishing or enhancing its tension, of lowering at will the temperature when elevated by disease, of lulling to rest the wearied brain, of completely abolishing local or general sensation, one or both, of supplying deficient elements in gastric juices, neutralizing peccant matter in the gastro-intestinal tract, etc.—such drugs are entitled to the respectful and careful attention of the conscientious physician. Of all men the physician should be broad and liberal, and should shrink from all exclusive or universal remedies. For this reason I beg to emphasize my belief in all those drugs whose effects have been positively demonstrated in the laboratory and at the bedside, while I espouse water as perhaps the most potent of all remedial measures, upon the historical, physiological, and clinical grounds succinctly set forth in the following pages. Herein lies the distinction between hydrotherapy and hydropathy: the former accepting water as one important remedial agent, the latter regarding

XIII.

it as a universal remedy. The term water-cure, too, is unfortunate, inasmuch as it implies a specific certain effect. It is translated from the German Wasser-Kur, which in German really does not convey the meaning of a *cure*, but simply a treatment, as is indicated by its Latin derivation, *cura*, "a care."

The subject will be presented in an aspect different from that in which it has been treated hitherto. Recent advances in therapeutics have developed important effects of water which are out of the limits of the lines usually drawn by authors on this subject.

It is the aim of this work to present the subject entirely from the standpoint of the clinical observer, who, standing at the bedside, weighs the claims of water in the balance, and selects from the best scientific work and from the enormous quantity of chaff in which the teaching and practice of empirics have buried the golden wheat such truths as have not only a rational theoretical basis, but have been actually verified by large clinical and hospital experience—larger, indeed, than most other therapeutic measures may boast of.

CHAPTER I.

HISTORY.

The application of pure water in or upon any part of the human body for remedial purposes is known as Hydrotherapy. This term, therefore, includes the use of water in any form, from ice to vapor, internally or externally.

It is not an infrequent error to regard the external application of *cold* water, or its combination with cold-water drinking, as in the so-called water-cure, as the only aim of hydrotherapy. The modern application of the term, on the contrary, embraces every method by which pure and unadulterated water is utilized in the treatment of disease. The surgical use of hot water for purposes of asepsis, its gynæcological application in the treatment of pelvic inflammation, its internal use in gastric derangements, the need of tepid temperature in intestinal diseases, all these belong to the field of hydrotherapeutics, because they depend upon the mechanical and temperature effects of water alone.

The successful application of ice (frozen water) in cardiac and inflammatory affections, furnishes another illustration of the value of modern hydrotherapy. The use of vapor in rheumatic and other affections belongs to the same category. The author does not propose to confine himself to the external

and internal use of cold water, as is the practice of hydropaths, but to expand into a broader and more fruitful field, whose limitations shall be that water in some shape is the agent applied in the treatment.

DIVISION OF THE SUBJECT.

It is the aim of this work to present the claims of hydrotherapy to the reader's attention by arguments derived from historical, physiological, and clinical data; in other words, to treat it precisely as all other remedies are presented in an essay on therapeutics.

HISTORY.

It is a singular fact that, while other professions and trades regard the study of the history of their subject as an important element in their education, the physician alone permits this profitable field to remain uncultivated. The history of the world, says Kant, is the forum of the world. It alone presents to us a portrayal of truth, and guards us against error.

The history of water as a therapeutic agent is not only one of the most interesting chapters, but it affords the clearest demonstration of the instability of therapeutic propositions and the manner in which prevailing ideas influence them. Although the literature of the subject is the most extensive published with regard to any remedy, recent works on therapeutics treat it with a decidedly stepmotherly regard; they dismiss it in a few beggarly lines, preferring to

devote their columns to essays upon the action of remedies which have been chiefly tested on animals, and whose actual clinical value is, in most instances at least, problematical. The history of water teaches clearly that no one remedy has so creditably passed through vicissitudes of depression, and that, despite professional and lay prejudice, it stands to-day unscathed and rendered secure against assault by the panoply obtained from physiology and bedside results. The works of Hippocrates, the father of systematic medicine, illustrate how a master-mind may grasp facts and make deductions which may stand the test of time. Appearing upon the stage of action at a time when the greatest confusion had been brought into the treatment of disease by priests, philosophers, and physicians, this great genius brought order out of chaos in every branch of medicine, and endeavored to endow with true scientific dignity the empirical knowledge of the day. In his tract on the Use of Fluids he laid down rules for the treatment of acute and chronic diseases by water, which are to-day followed by empirics as well as physicians, and which, together with subsequent developments, place hydrotherapy among orthodox and scientific methods of treatment.

Among the Greek physicians and philosophers who, during the rise of Roman greatness, emigrated from their native land to seek fame and fortune amid the world-conquering people, was Asclepiades, of

Prusa. Leaving Alexandria and Athens one hundred years B. C., he entered Rome under Marius and Sulla. Though belonging to a despised class, he became the bosom friend of Cicero, and won for himself eminence, respect, and professional reputation because of his great medical talents, his marvelous cures, and especially on account of his genial and sympathetic nature. It was his chief aim to cure *cito, tuto, et jucunde*. Hence he cast aside all active medication. Although he practiced bleeding, he did so cautiously, and he depended chiefly on diet, rubbing, exercise, and *baths*.

It will be remarked in the history of this subject that the same men whose judicial medical thought elevated them so far beyond their contemporaries as to resist the prevalent practice of excessive venesection and active medication, exhibiting a regard for the conservative tendencies of nature—the men who, in those dark days of medical history, approached most nearly the spirit which governs the therapeutics of the present enlightened era—these were the men who were invariably pronounced advocates of water as a remedy. Asclepiades, the philosophical founder of the school from which sprang Themison, Antonius Musa, Cornelius Celsus, Cœlius Aurelianus, was so warm an advocate of baths and douches that he was dubbed “Psychrolutus.” Through him hydrotherapy was popularized in Rome.

A member of his school it was, Antonius Musa,

who maintained the aim of his noble master to rescue his calling from the disrespect with which it was regarded. To him the Emperor Augustus owed restoration to health, by a vigorous cold-water treatment. Suetonius tells us that the grateful Cæsar bestowed upon Musa—and not upon him alone, but upon the whole medical profession—the privileges of citizenship, besides erecting to him a statue next to Æsculapius.

Horace, too, was his patient. His first book, epistle VI (Smart's Translation), tells us: "Antonius Musa pronounces Baiaë to be of no use to me, yet makes me obnoxious to the place, when I am bathed in cold water even in the midst of frost, by his prescription."

Cornelius Celsus, the learned Roman (called *Latinorum Hippocrates, Medicorum Cicero*), the bosom friend of Ovid and companion of Fabius Maximus, prescribed water freely in acute and chronic diseases. His opinions on the prevalent blood-letting mania mark him as an eclectic of the highest type. The same may be said of Cœlius Aurelianus, who was the originator of the abdominal compress of wet sponge for hypochondriacs. Galen, too, was an able and judicious advocate of cold-water baths, and advised cold affusions upon the head, the body being immersed in warm water.

In the dark days of medicine which followed the death of Galen, when all branches of human knowl-

edge suffered from the ignorance, witchcraft, and fraud arising from the barbarism of migratory peoples, from the destruction of the Alexandrian library and school, from the demolition of the Roman Empire, the plundering of Saracens, and the conquest of Spain, science and art lay prostrate. At this time appeared Alexander of Tralles, and Paulus Ægineta. The former refused to rely upon any system of medicine, but insisted, with a true philosophical spirit which would do credit to him to-day, that the physician must depend in each single case upon the age, constitution, natural powers, and mode of life of the patient, as well as upon the climate and allied conditions and effects of nature. He furnished directions for bathing and rubbing in many diseases.

Paulus Ægineta, who is regarded as the greatest physician of the seventh and eighth centuries, was an enthusiastic advocate of water, and he it was who first advised the cold douche for sunstroke and anuria. The next prominent figure in the history of hydrotherapy is Savonarola, the grandfather of the unhappily famous professor of Ferrara. He recommended baths in fevers, dysentery, leucorrhœa, and debility.

No history seems to be complete without the Chinese. Julien (*Comptes Rendus*, 1849) tells us that in the annals of the dynasty of Hâ, the biography of Hoa, a celebrated physician, is written. Hoa used hydrotherapy by sweating and cold water. The historian relates that in a case of rheumatism Hoa

ordered one hundred affusions. After the seventeenth the woman thought herself dying; after the twenty-fourth, reaction ensued, "the internal heat came through all her pores, rising in vapor two feet above her head. After the one hundredth she was put into a warm bed."

In the seventeenth century Herman van der Heyden regarded water as a panacea, reporting three hundred and sixty cases of malignant dysentery cured by its use. Van Helmont and his son advocated ablutions and affusions.

Passing over lesser events, we come to an epoch in hydrotherapy created by Floyer, an educated English physician, whose book, published in 1697, passed through six editions, and was translated into German forty years later. He energetically propagated his views by his writings, making many converts at home and abroad.

Those who are familiar with the names of great English physicians will appreciate the value of such names as Pitcairne Blair, Cheyne, Huxham, who were advocates of water in disease. Floyer was succeeded in the advocacy of hydrotherapy by Friedrich Hoffman, the most illustrious physician of Europe at that time. He held a professorial chair, and, commanding great respect, found many followers. The first distinct recognition of the influence of water upon the tone of the tissue came from this philosophical clinical teacher. His doctrines were imported into

Italy, and thence found their way to France and back again to England, where Floyer had prepared the way. Theden, the surgeon of Frederick the Great, was the first to use water in smallpox, malignant fever, rheumatism, and inflammation of the joints. He improved the shower bath, and warmly advised its use. In 1743 a Silesian physician, Johann Sigmund Hahn, and his son, established the principles of modern hydrotherapy in Germany, applying it in acute and chronic diseases, especially in smallpox and the other exanthemata.

Hence the same country which later produced the first great empiric, Priessnitz, may be credited also with the first great hydrotherapeutist.

During the prevalence of the pest in Moscow in 1881, cold water was used very successfully.

English-speaking physicians are perhaps better acquainted with the works of Wright and Currie in the treatment of acute fever than with any other historical fact in hydrotherapy. Currie's work was translated into several foreign languages, and his practice was introduced into the Vienna hospitals by Joseph Franck. His application of water was not limited to fevers. In gout and convulsions, paralysis, tetanus, and other diseases, he claims to have obtained good results. To mention Hufeland, the enthusiastic and yet judicious advocate of hydrotherapy, is to give the imprint of true medical wisdom to it, and to indicate its wide adoption among the profession. He

offered a prize for the best treatise on the action of cold water in fevers, determined by scientific thermometrical study. Dr. Froelich, a Vienna professor, was the most successful of three competitors, all of whose essays were published in 1823 by Hufeland.

But, despite these eminent and enthusiastic advocates, hydrotherapy did not become popular until the appearance of the peasant Priessnitz. His history is so familiar that he is erroneously regarded by many as the father of the water treatment. In 1840 he had treated over 1,500 patients from all parts of the world by the methods he had invented; and when he died, twelve years later, he had amassed several millions. The impression made by this empiric marks an epoch in hydrotherapy. His success was brilliant because he was a careful observer, a good judge of human nature, and his mechanical skill enabled him to invent various technical modifications of the water treatment, many of which have been adopted by the profession and are still in use. A copious literature sprang up in all parts of the world, and many institutions were modeled after his. The Government built roads to facilitate access to his establishment; monuments and fountains were erected to his memory. Physicians from all countries, who had been attracted to the Silesian peasant's mountain home, became converts to and missionaries of his practice.

An interesting chapter in the history of hydrotherapy is furnished by an incident in 1839. Doctors

Engel and Wertheim petitioned the French Government for permission to open a hydropathic institution. The petition was referred to the French Academy of Medicine, which appointed a committee consisting of Bouilland, Velpeau, and Roche. The last named delivered such a tirade against hydrotherapy, characterizing it as dangerous, unscientific, chimerical, and opposed to the simplest laws of physiology and pathology, that the sixty members present made an adverse report—amid great applause. On this report the Minister of Instruction refused to grant permission for the erection of hydropathic establishments to Engel and Wertheim. These physicians appealed from the decision of the Academy, and requested the authorities to investigate hydrotherapy in the hospitals. This was done in the Hospital Saint Louis, under MM. Gibert and Devergie, in 1841. These made a favorable report, resulting in the withdrawal of the interdiction previously ordered. Thus has it ever been when the biased views of inexperienced opponents were met by clinical demonstrations in hydrotherapy. Bouilland, the chairman of the committee, recanted after obtaining such practical evidence.

A few years later, Scoutetten was sent to Germany by Marshal Soult to study hydropathy. He reported that, while it cannot be reckoned a universal method, it exercises an undoubted influence on the public health, and the numerous permanent cures it has wrought in intelligent persons recommend it to

popular attention, etc. "It lies in the interest of humanity and medical science that demonstration of the forms and aids of hydropathy in Paris should take place under the eyes of able physicians." This report gave a great impetus to the development of hydrotherapy among French physicians, to whose honor it redounds to-day in the works of Lubanski, La Tour, Schedel, Fleury, Duval, Dujardin-Beaumetz, Charcot, Valleix, Delmas, Keller, and others.

The great Magendie aided its propagation by physiological demonstrations. But Fleury founded almost a separate school of hydrotherapy by the introduction of douches as the chief method, fortifying his clinical results by physiological and rational deductions.

Modern fever treatment received its great initiative from Ernest Brand, who in 1861 published his remarkable results from immersion and compresses of water from 54° to 68° F. Bartels and Juergensen are names familiar to the present generation. Vienna became a great centre of hydrotherapy, which it has remained under Winternitz, its chief modern promoter, the corypheus of scientific hydrotherapy.

This rapid and imperfect review brings us down to the present day, when great clinical teachers reaffirm their faith in a method of treatment which had received the highest encomiums from Hippocrates, Asclepiades, Celsus, Hufeland, and Currie.

Niemeyer, in his book on Practice, says of it in

scrofula: "A series of cases are on record in which complete and perfect cures have been obtained by these means, after all other methods of treatment had been applied in vain."

Dujardin-Beaumetz said in his lectures at l'Hôpital Cochin in 1887: "The benefits we obtain from cold water in the cure of disease arise from its physiological effect upon the circulation, the nervous system, the nutrition, and from its revulsive and heat-lowering influence."

Prof. M. Peter, of the Paris School of Medicine, in his preface to the magnificent clinical work on hydrotherapy of Duval, published by Baillièrè, says: "Hydrotherapy suffices in most cases of disease; added to other treatment, it is a most powerful auxiliary. Can any one speak better or say more of it?" he asks.

In his classical contribution to V. Ziemssen's cyclopedia, Prof. Erb offers this testimony: "To the most important and most active agents in the therapeutics of our field (nervous diseases) belong cool and cold baths, viz., the application of cold water in the most varied forms—that which is usually termed 'cold water treatment.' Having been in recent times practiced more rationally and studied more exactly, it has attained remarkable prominence. *Its results in all possible forms of chronic nervous diseases are extraordinarily favorable.* If we add to this the heightened skin and muscular action induced by

various methods of bathing, the influence of diet, etc., it becomes evident that *we possess few remedies which produce an equally powerful effect upon the nervous system.*" The italics are mine.

Semmola, Professor of Therapeutics in the Naples University, whose lectures (1890) have been translated into German and have received a laudatory preface from Prof. Nothnagel, says:

"Hydrotherapy stimulates cutaneous activity, and with it all functions of tissue change and organic purification, so that often real marvels of restoration in severe and desperate cases are accomplished. Unfortunately, these remarkable results are more rare to-day than they were in the time of Priessnitz, of which I was myself a witness. The reason appears to lie in the fact that hydrotherapy has become the monopoly of the exclusively trade doctors, who treat the various maladies without strict selection of the hydriatic procedure in each case, etc. Without going here into the mechanism by which a rational and earnestly practiced hydrotherapy may lead to a rapid and truly organic renovation, provided that the apparatus of the economy is capable of responding to the increased labor thrown upon it, one thing is certain, that restoration of the organs can only be attained by physiological agencies, *i. e.*, by measures which act in accord with normal functions.

"It is to be regretted that physicians in general do not place the estimate upon hydriatic treatment which it

deserves, for, with the exception of diseases of the nervous system (in which the water treatment is often used in a most senseless manner), little and bad use is made of it in diathetic affections.

“Those who were in the position to follow up the cures of Priessnitz will remember well what remarkable and unexpected curative successes were obtained at Gräfenberg by means of the cold-water treatment.

“Let me impress upon you firmly this classical method of evoking and furthering a rational therapy, which powerfully contributes to rejuvenate the powers of the organism, and thus best secures therapeutic success. There are other diseases of tissue change in which hydrotherapy offers a rational etiological therapy. I refer to those alterations in tissue change which are exclusively the result of vicious modes of life. In all these cases, which may be united under the common term of retardation of tissue-metamorphosis, *hydrotherapy presents a truly rational treatment, and therefore certain and unfailing effects*, unless the local processes have reached incurable limits (atheroma, visceral arterio-sclerosis, etc.). In these cases, indeed, pharmacology alone is also powerless in its results.”

Prof. F. A. Hoffman, of Leipsic University, in his lectures on General Therapeutics (F. C. Vogel, 1888), which were regarded by the reviewer, Prof. Ewald, as the most able exposition of the subject in

recent times, says (p. 82): "Herein lies the unsurpassed value of cold water in therapeutics; we invigorate the nervous system, and through it the capacity for work may be enhanced in the heart itself. Experience at the bedside occasionally presents to us really surprising things. . . . What we have learned in the most varied cerebral and spinal diseases, we may apply also to other organs. Cold water is a therapeutic agent by whose correct application we may most surely and without danger of reaction exercise and invigorate the nervous system, and herein I seek its fundamental significance in the treatment of all possible internal diseases."

On page 41 he says of baths: "We shall have much to say of them, and see that they are much more important by reason of their effect upon the nutrition and activity of the inner organs, so that their direct effect upon the skin falls into the background."

On page 385 he sums up as follows: "If we review briefly the bath treatment, we find very great uniformity in its effects; almost everywhere do we see the treatment of gout, rheumatism, scrofula, chronic infarctions and exudations, brought forward as indications.

"If we add old cases of syphilis, we have enumerated nearly all diseases which are treated by baths. Effects upon the heart, lungs, liver, stomach, intestines, and kidneys are rarely thought of. *I believe that a great gap exists here.*

“We have spoken everywhere of the significance of baths for the improvement of all organs, but we also have become convinced of the great difficulty of correctly estimating their effect with precision. Nevertheless *I am convinced that in time all chronic diseases of the organs will be drawn into the domain of the bath treatment.*” The italics are mine.

The following testimony from one of the most justly eminent general practitioners in America is interesting in this connection. The University Medical Magazine (November, 1891) contains the following letter:

PROFESSOR H. C. WOOD:

Dear Doctor: Your paper on the Local Treatment of Dysentery should surely impel others to give it a trial. What you accomplished by the introduction of pieces of ice might, however, be obtained more pleasantly to the patient by the application of ice-water cloths over the belly, especially over the course of the lower colon, with half-pint or pint injections of cold water into the rectum. *It is amazing to me that so few physicians use cold as a remedy in inflammatory affections. Of all means of cure in such affections, wherever situated so that the remedy can be applied, there is not one to equal it.* In pleurisy, pneumonia, peritonitis, and all other “ites,” it is a most efficient remedy. Moderately applied in measles, smallpox, and scarlet fever, no remedy equals it. Think of the one fact that in sixty years, with thousands of children with measles, I never lost one from that disease. In scarlet fever I never had a remedy to equal the application of cold. I scarcely ever did anything in measles, save gave a laxative, and then kept the patient cool—*often* sponged the whole

body with cool water, and *always* gave cold drink in abundance—gave it copiously as a cooling remedy. I am not boasting—only forcing on your attention facts—regular “Gradgrind” facts. And I do it because I know that if you can be convinced of the value of the remedy, you have the manliness and the courage to advocate it. Farewell.

As ever, your friend,

HIRAM CORSON.

MAPLE HILL, August 16, 1891.

I might multiply these opinions *ad infinitum*. But I have selected them from men who are not special hydrotherapists, but who are teachers of medicine in the best schools of Germany, Italy, and France—men, too, who are known everywhere as representatives of good clinical teaching.

History has repeated itself here as in other departments. The opinions of the most judicious, philosophical, and successful physicians of past ages have been sustained by the judgment of the most enlightened era. The student of the history of hydrotherapy must observe that it has passed through many cycles in the estimation of physicians. *The causes of these fluctuations* must be brought out, in order to avoid their adverse influence in the future.

With the dawn of systematic medicine came the promise of a rational appreciation of water as a remedy, which, however, was overshadowed by the tendency of its followers to build pseudo-philosophic systems rather than to enlarge the practical domain of therapeutics. Just as among the ancients we find

the most renowned physicians the most active advocates of water as a remedy, so does its history in modern times develop the same fact. The simplicity of this remedy, however, antagonized the pedantic and self-important members of the profession; and when laymen, who must have learned its value from observing its effects in the hands of physicians, espoused it, the latter became entirely estranged. Thus did it come about that Priessnitz created a sect, the Hydropaths, whose influence for the popularization of the treatment was in inverse ratio to its adoption by the profession. And this blighting effect of the empirical espousal of water as a remedy is to-day mainly responsible for the aversion which physicians feel to its adoption. Are we just to ourselves or to those who entrust their lives and health into our keeping in maintaining this attitude? Due reflection must bring us to realize the fact that the application of water in disease is the most orthodox therapeutic measure in medicine, having (as I have shown) been fully treated by Hippocrates, and taught by those most eminent and judicious men who have made medical history. Even many of those methods which are usually regarded as inventions of Priessnitz owe their origin to physicians who lived long before his time. The abdominal wet compress, for instance, was originated by Cœlius Aurelianus.* And nearly one hundred

* Lucas: An Essay on Water. London, 1756.

years before this Silesian peasant became famous, the Doctors Hahn, who were also Silesians, applied water in acute and chronic diseases, including smallpox, scarlatina, and measles.

The broad catholicism which characterizes modern medicine had liberated hydrotherapy from the absurd stigma of its empirical relationship. The violent methods of treatment prevalent in the first five *decennia* of this century were gradually superseded by more rational methods. When, in fact, a therapeutic nihilism threatened to take their place, water again came to the fore as the one substantial and promising remedial agent, in acute diseases at least. Again, Brand, Juergensen, Ziemssen, and their followers, brought the value of hydrotherapy to the attention of the profession by undoubted tests at the bedside. The battle was almost won; from all countries the echo of victory was resounding; but the erroneous idea that the sole object of the bath was the reduction of temperature, proved the rock upon which this invaluable antipyretic was again to split, as it had done after the days of Hippocrates, of Hahn, Hufeland, and Currie. Antipyresis became the misleading watchword of fever treatment. Before the invention of chemical antipyretics, water was the only reliable agent for reducing temperature, against which quinine struggled in vain for rivalry. Now the busy chemist came to the fore and astonished the medical world by the discovery of true antithermic agents whose

influence upon temperature reduction was undoubted and marvelous in its precision. It was not long, however, ere the clinical tests discovered the inadequacy, indeed the perniciousness, of relying upon mere temperature reduction for therapeutic success. "I am an enemy to all antipyresis," said an eminent Berlin professor to me last year. "Although I was educated in the school of Traube, who was a warm advocate of bathing, I regard antipyresis as a false therapy. Away, therefore, with the bath, because it is an antipyretic." Thus has it come about that hydrotherapy in acute disease is abandoned by many, while in chronic disease it increases its hold on the profession in certain parts of the world.

To-day the best clinical teachers are making an effort to prevent water from sharing the fate of chemical antipyretics. This subject will be more fully referred to in the chapters on Fever Treatment. I must call attention, however, to a new danger which threatens hydrotherapy. The excessive medication, combined with blood-letting, which characterized medicine in the early part of this century and in the previous history, gave way to what was termed therapeutic conservatism. The writings of Bigelow and Flint in this country, and of Wunderlich and others in Europe, developed the expectant method of treatment, which aided the system in its battle against disease instead of fighting the latter at the expense of the former. A therapeutic nihilism resulting from

the abandonment of excessive medication ensued, which endured until very recently, when certain medicinal agents, as salicylic acid, antipyrin, etc., were proved to produce definite therapeutic effects.

To-day the student is no longer tortured by the necessity of mastering needless materia medica, especially botanical details. But the other extreme has ensued; many physicians, especially in Germany, shrug their shoulders when discussing treatment, while they glow with enthusiasm when the bacteriological or pathological aspect of the case is considered.

The quack and semi-quack who haunt the flanks of the medical army, as the guerilla does those of a nation, have picked up some of these nihilistic (conservative?) ideas. The result is the formation of a sect of *natural physicians* (Naturärzte), who propagate their therapeutic ideas by lectures, books, and periodicals, and thus succeed in driving the physician from the field. Men like Father Kneippe use cold water as the chief remedy, while others more or less intelligent—teachers, preachers, and men and women of all conditions—have constructed upon hot and cold, vapor, and hot-air baths, exercise, massage, and diet, a system of Natur-heilkunde, which must very soon bring reproach upon hydrotherapy. The latter is their chief reliance. These men, being uneducated, apply it empirically, and propagate their errors among the people. There is a large institute at Chemnitz, in Saxony, devoted to the treatment of disease by

natural remedies, which I have visited, and there are many smaller ones in other parts of Germany.

It is a singular paradox that the German Government does not protect the people against these uneducated quacks. Whether they shall be allowed to pursue their calling here, remains to be decided. Thus far I know only one such hydrotherapeutic institute in New York, in which the treatment is most crude and unscientific, and under the management of an ordinary masseur. Let not the profession stand idly by and allow again the value of water as a remedial means to be overshadowed by the efforts of these unskilled advocates. If *they* can obtain good therapeutic results, which I do not doubt, how much more may a correct and rational application of the remedy accomplish !

CHAPTER II.

MODE OF ACTION OF WATER.

In the consideration of therapeutic measures it is important to define their mode of action as far as has been ascertained by trustworthy observation. So long as the art of medicine represented only the aggregate of a large mass of empirical observations, our predecessors were content with following the dicta of those to whose teaching they listened or whose writings they consulted. The dawn of the inductive method engrafted a more rational basis upon medical practice. As a result, remedies are now subjected to tests other than merely clinical, either before or after they have come into practical use.

Fortunately, we are able to distinctly trace the remedial effects of water along physiological paths, and to make from these our therapeutic deductions.

It is proposed to show here how water may influence the most important functions of the human body in health, ere the reader will be asked to accept its applications in disease.

The effect of water upon the human body is complex in accordance with the method of its application.

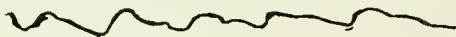
INTERNAL USE OF WATER.

The internal use of water is distinct in effect from the external use, as is the case with any other therapeutic agent.

The importance of water as a constituent of all secretions and excretions, as well as of all tissues, is so trite a physiological fact that it is referred to here only in order to emphasize the effect of changes which may be produced in these by its increased imbibition.

That water received into the stomach or rectum acts upon the *temperature* of the body, has been established by numerous observers. But not only is a direct reduction of temperature produced by the imbibition of cold water; we have here also a milder effect by reflex channels, which, as will be shown later, is observed when water is applied externally, as is most frequently done in practical hydrotherapy.

The reflex effect upon the vaso-motor nerves, the consequent contractions of peripheral vessels, and changes in their tension, were clearly pointed out by Winternitz. As long ago as 1864 he demonstrated the effect of cold-water drinking upon the pulse, by the following sphygmographic tracings:



Before drinking $\frac{1}{3}$ quart water at 43° F.



After drinking the same.

These tracings clearly show that immediately after drinking very cold water the ascension lines are shortened and become less perpendicular, indicating an increased tension in the radial artery.

In order to prove that the effect is entirely due to the temperature of the imbibed water, the above tracings may be compared to the following, taken before and after drinking 0.3 litre of water of about 90° F.:



Before drinking $\frac{1}{3}$ quart water at 90° F.



After drinking the same.

The change in the ascension lines is precisely reversed. That this effect is not due to the simple increase of fluid by absorption, or to direct cooling or warming of the blood, is demonstrated by the fact that it is observed too quickly after imbibition. It must be the result, therefore, of *reflex* action. Excitation of the vagus fibres in the stomach by cold drink is transmitted to the vaso-motor centre, from which slowing of the pulse and change in its curve is probably evolved.

Warm fluid may produce nausea, and thus lower the innervation and result in diminished arterial tension.

The incorporation of large masses of fluid with the blood must produce decided changes in the system. Water is doubtless absorbed chiefly by means of the veins of the stomach, and its rate of absorption is governed, according to Winternitz, by various conditions. A low state of vascular tension; impoverishment of the blood by diarrhœa, hæmorrhages, profuse perspiration, and even copious urinary excretions; a feeble percentage of salts in the water; the presence of free alkali in it; all these accelerate the absorption of water from the stomach or intestines.

High vascular tension and plethoric conditions of the system, on the contrary, inhibit the absorption of water.

It follows from the physiological investigations of Böcker and others that the administration of small quantities of water at intervals of twenty to thirty minutes for a long time, will increase the saturation of the tissues, render the blood column heavier, and increase vascular tension and pressure. The contrary effect may be produced, *i. e.*, absorption of watery exudations, etc., by imbibition of large quantities of fluids after long intervals of abstention (six to eight hours). Clinical observation has substantiated these deductions.

Tissue metamorphosis (regressive and productive)

is enhanced. Indeed, Böcker says: "There is no single substance which so rapidly promotes construction, after inaugurating destruction, and which rejuvenates the system, like water. In the institutions where cold water is used externally and internally we see patients whose digestion has been faulty always ready for the fork exercises, and it is only necessary to drink a few glasses more water in the morning in order to do greater honor to the art of the cook. If the effect of water be compared to that of mercury, the rejuvenating effect of the former becomes clear; they both further elimination in an eminent degree; the prolonged use of mercury, however, increases elimination enormously, and constructive action suffers so much that for years a prolonged feebleness remains. Water acts differently. It interferes with constructive metamorphosis only if its use is too prolonged and combined with starvation. But as a rule, so soon as it is discontinued, reconstruction begins more energetically. That water is a remedy for the rejuvenation of the organism, deserves to be therapeutically considered." This testimony from a physiologist and a clinical observer is entitled to respect, especially as it has been physiologically demonstrated by numerous other observers, among whom are Mosler, Lehman, and Glax. These have shown that the imbibition of cold water acts as a diuretic, and increases the solid constituents of the urine, especially urea. Thus it is evident that a more active change of nitro-

genous material is inaugurated by copious water-drinking. As it has also been shown that the latter is followed by a diminution of uric and oxalic acids, and an increase of CO_2 and of oxygen, we must conclude that oxidation is more active and complete. Again, those inorganic salts of the urine which are products of regressive metamorphosis of the organs and muscles, as potash salt, phosphates, and sulphates, are shown to be increased by drinking large quantities of water.

It is true that this interpretation of these phenomena is not accepted by all authorities, there being still some doubt whether the increase of urea after copious imbibition of water is the result of increased utilization and destruction of albumen, or simply the effect of a more thorough flushing of the vessels by which the urea is more rapidly swept out. Be this as it may, it cannot be denied that a decided increase of water imbibition gives rise to a fluctuation in the formation of urea, and thus a change is produced in the system which must produce therapeutic results. Water that is drank is not simply excreted, but some of the tissue becomes more saturated with it, especially the glands. The latter are forced to secrete more abundantly, and the heart is called upon to propel a larger quantity of fluid; the kidneys and skin are stimulated to increased activity. And all this is accomplished in the very innermost parts of the body, far away from reflex influences, which are

the chief agencies by which the *external* use of water acts.

Peristalsis is increased by imbibition of cold water. This may be observed readily in emaciated persons and in the expulsion of gases from the rectum.

Increased biliary secretion has also been noted by Lehman and others. Horvath has proved by passing streams of water of various temperatures (from 66° to 106° F.) that peristalsis is stimulated, and Roehrig has demonstrated by actual experiment that intestinal irrigation increases bile secretion more than the injection of water into the veins. Thus is the treatment introduced by Krull in catarrhal jaundice established upon physiological principles.

We may conclude from the results of many experiments, whose details space does not admit of recounting, that, inasmuch as an increased absorption of water into the veins must give the heart and glands more work to do, we have in the administration of large quantities of water, especially of cold water, a valuable remedy for stimulating various functions, which may be utilized clinically if the rationale of its action is not lost sight of.

If it is remembered that the stimulus is felt by the organs themselves, and does not depend, when the secretions are involved, so much upon reflex nerve activity, the internal use of water will be preferably applied in many cases in which its external use, which demands considerable power of reaction, would fail.

The temperature-reducing and gland-stimulating effect of copious water imbibition has been utilized in disease recently by Meigs, Cantani, Dujardin-Beaumont, Debove, and Sahli, as will be shown in the clinical part of this work. Suffice it here to maintain the connection between the physiological and therapeutic lines, by citing the practice of Cantani, who reduces temperature slowly but surely by copious enemata and drinking of cold water; and the practice of Beaumont, who promotes diuresis and elimination of the products of organic disintegration by copious libations of water; and the practice of Debove, who administers, instead of drugs in typhoid fever, six ounces of cold water every two hours for the purpose of washing out the poison. In this method of hydrotherapy, as in the external method, the empirics have done much to bring its use into disrepute by the swilling to which they have subjected their patients. It must be evident to any unprejudiced observer who understands the rationale of water-drinking, that its excessive use must overburden the system, and, if the latter be already enfeebled, must tend to cripple the organs it is intended to relieve.

EXTERNAL USE OF WATER.

This being the most important mode of application in hydrotherapy, a thorough study of its physiological effect is of great importance.

Aside from certain minor effects, such as the

antiseptic and cleansing, we may divide the essential action of water into: 1st, that evolved by its temperature effects; and, 2d, by its mechanical impact.

As a vehicle for the absorption and transmission of temperature variation to the periphery, and thence by direct or reflex action to the centres of the body, water is a phenomenally useful agent.

That it possesses an enormous capacity of absorbing heat without being itself much elevated, and of giving off heat without itself losing it very materially, has been frequently demonstrated by experiments. The quantity of heat required to raise the temperature of 1 lb. of water 34° suffices to elevate to the same temperature 2 lbs. of oil of turpentine, 8 lbs. of iron, or 33 lbs. of mercury. Again, one gramme of iron at 32° may be elevated to 130° F. by the same quantity of water at 140° , the latter only losing 43° ; while one gramme of iron at 140° F. will elevate one gramme of water at 32° only to 43° , with a loss of 130° .

The enormous physical change to which water may be subjected at different temperatures enhances its value as a flexible therapeutic agent, whose effects must be carefully studied. At 32° F. water solidifies, while at 212° under ordinary atmospheric pressure it becomes elastic, attaining a volume 1,700 times greater.

When it is considered how easily the temperature of water can be varied by the judicious applicaiton of ice or heat, how its application may be limited to the

most minute portion of the body or be made to the entire periphery, and how its local temperature effects may be varied in different parts of the body at the same time or at different times, its immense value as a therapeutic agent must be appreciated, after these effects are carefully studied, as we propose now to do.

By means of low and high temperatures we may produce positive irritation, and by means of moderate temperatures we may neutralize irritation already existing; thus we have a scale of stimulating or soothing effects, for which we look in vain among medicinal agents.

As Kroeger has aptly put it, just as the eye perceives certain waves of ethereal atoms as impressions of light, so do the organs of temperature perception, the peripheral endings of the sensory nerves, experience definite waves of body atoms as perceptions of heat and cold. This conception renders intelligible all empirically established facts which are observed in the effect of various temperatures upon the organism.

EFFECTS OF TEMPERATURES.

That temperature exercises a potent influence upon living matter, is a trite physiological fact. That cold diminishes vital activity, and heat enhances it, needs but a simple reference to emphasize the application of these well recognized principles to therapeutics. Smooth muscular fibres are positively made to contract under cold and expand under heat, within

certain limits. This physiological fact alone renders it evident how powerfully we may influence heat production, which depends upon muscular activity, and consequently tissue change, which is interwoven with heat production, and indirectly by these means all other functions, by any measure which, like water, gives us complete control over muscular activity.

Although it is difficult to separate the thermic from the mechanical effect, it is useful to study each separately as far as it will admit. Cold and heat may be regarded as nerve irritants whose intensity is in proportion to the difference of temperature between the part receiving the impression and the agent conveying it.

There is, however, a limit to the therapeutic application of thermic agents. Both extremes of temperature become painful, and, as is well known, may destroy sensibility and eventually vitality also.

Recent investigations by Donath (*Archiv für Psychiatrie*, 1884, xv) have placed the painful cold impressions in different parts of the body of healthy persons as varying from 12° to 37° F. In different individuals the painful impression from cold varies between 29° and 73° F. Painful heat impressions also vary, according to the parts applied to, between 98° and 126° F.; the variations in individuals being between 36° and 88° F. The upper and lower limits of heat impression for various points in the skin are 147° and 95° F., respectively.

There exists great latitude in the sensibility to cold and heat impressions in different parts of the body, and even in the same parts at different times, due to the condition of the nervous system and the circulation at the time of observation.

It has been ascertained by Blix and Goldscheider that there are special terminal nerves in the skin, devoted to the perception of heat and cold and of pressure, and that the perception of cold is rapid and lightning-like, while that of heat is more deliberate and diffused. Warming and cooling of the skin reduce its response to heat and cold, respectively, but each enhances cutaneous response to opposite temperature effects.

Thermic irritants induce changes of innervation not only at the point of contact, but also in sensory tracts, in the nerve centres, and in all motor and trophic fibres connected with them whenever they fall within the sphere of irritation, either by transmitted or reflex action. The effect upon motor fibres is not to be regarded only as reflex, for even at the point of application there are everywhere numerous networks of ganglia, which may perform the function of nerve centres within the immediate sphere without depending upon impulses from the brain or spinal cord. This makes plain many local effects which seem to arise independently of the higher nerve centres. There can be no doubt that thermic irritants, conveyed by water or otherwise, exert their effect upon

the innervation. The rapidity of their action alone would prove this. But clinical experience demonstrates it in the most forcible manner.

Whoever has witnessed the revivification of a fainting person by a dash of cold water, how the color returns to the pallid cheek, how the glazed eyes brighten and consciousness returns, must be convinced that only through impressions upon the sensory nerve endings, conveyed to the nerve centres, could such rapid and positive effects be initiated. That cold, though the most familiar, is not alone in this powerful influence, I have demonstrated to my satisfaction.

In a case of carbolic acid poisoning, with suicidal intent, in which I had the assistance of Dr. Dillon Brown, hot water proved more efficient than cold in arousing flagging vitality.

That extreme heat and cold may destroy sensation, even to complete death of the part, is an undisputed fact. But it is not so generally known that cold applied to a nerve trunk may produce anæsthesia, and even paresis of its peripheral fibres.

Waller applied ice to the ulnar nerve in its superficial position at the elbow joint, and obtained at first hyperæsthesia, later complete anæsthesia of its branches and abolition of response in the muscles supplied by them. We are indebted to our own Weir Mitchell for some valuable investigations upon the subject. He demonstrated (quoted by Winternitz)

that anatomical changes may be produced by intense cold applied to the nerves, such as congestion with or without sanguineous exudations. Briefly applied, cold produces a rapidly passing congestion, without leaving traces behind; but if prolonged, the nerve increases in volume, chiefly by the dilatation of its blood-vessels. There may be actual apoplectic effusions in the structure of the nerve, producing more or less paralysis in the parts supplied by it, but they usually disappear, although some of the nerve fibres may degenerate.

Thus we may account for some cases of acute neuralgia, myelitis, and acute spinal paralysis, following great temperature effects.

Upon one point all observers are agreed, viz., that the effect of the thermal impact is in proportion to its duration, *i. e.*, that an *evanescent application excites, while a prolonged one depresses.*

This is of immense importance in clinical hydrotherapy, as will be shown.

Another element of great clinical importance has been justly emphasized by Winternitz. The suddenness or deliberateness of the excitation influences the susceptibility of the part to which it is applied; the former produces tumultuous, the latter more calm results, just as in the case of the sudden or gradual application of a bright light to the eyes. Daily observation confirms the axiom, but there is a difference whether the transition be from warm to cold or *vice versa*. In the former case there is a more energetic

reaction, because the nerves are in a state of heightened excitability. This fact is utilized in the practice of the French hydrotherapeutists, who precede many of their douches by hot-air baths.

It must also be remembered that, as Urbantschitsch has shown, there are physiologically interchanging effects of irritation in various sensory spheres, *i.e.*, excitations in one sphere may produce similar effects in another. That the effect of temperature impressions upon the peripheral nerves may be far-reaching, is thus physiologically demonstrated.

INFLUENCE OF THERMIC APPLICATIONS UPON THE CIRCULATION.

The impact of cold conveyed by any medium to the skin, as is matter of common observation, induces pallor and shriveling of the skin. Many physiologists have demonstrated that this is due to contraction of the circular fibres of the cutaneous vessels, by which the blood is driven out. In accordance with the physiological law that striated muscular fibres contract and dilate slowly, the contraction of the muscular structure of the skin is followed by a deliberate relaxation. The vessels not only resume their normal size, but even are dilated beyond it, so that more blood is received by them.

Following the process more minutely, we find that by intensely low temperatures the circulation in the capillaries is at first accelerated and the number

of blood corpuscles diminished, when the part becomes pale. Quickly following this acceleration, there is a stasis in the capillaries, while in the smaller veins and arteries the slowing of the circulation is followed by brief and rapid oscillations, which become slower and more infrequent. Slowly the vessels become more pale, less transparent, and finally the movements cease, until the vessel is blocked and occluded.

When the cold is less intense and more prolonged, there ensues a retardation of the stream in the smaller capillaries, while it becomes more active in the larger vessels, which now dilate. If, however, the application is continued, the larger vessels are also contracted and blocked. A collateral hyperæmia in neighboring parts is the result, which produces more rapid circulation in them.

It is not difficult to deduce the most important physiological changes as the result of this energetic influence of cold upon the vessels, as will appear farther on.

The return of blood to the previously contracted vessels is probably not due, as is commonly supposed, to a relaxation of the coats of the vessels. When the vessels dilate after a brief application of intense cold, together with decided mechanical impact derived from pressure under which the stream of cold water strikes the part, the dilatation following the latter cannot be a passive process, but is more probably the result of an excitation of the inhibitory nerves, which

overcomes the action of the vaso-constrictors. This is true of all vascular dilatation following the impact of cold.

REACTION.

As has been mentioned above, blanching of the surface is the immediate effect of the application of cold. This is, however, quickly followed by an active congestion, and may eventuate in stagnation of the circulation. The superficial vessels receiving direct impact dilate most quickly after the primary contraction has passed. They become distended with blood, but, since the continued application of cold renders the capillary circulation sluggish in the parts subjected to it, the veins respond less actively to the excitant influence of cold, and, their contraction being more slow, their dilatation is correspondingly slow. Thus it comes about that the blood accumulates at the point of application of the cold, which becomes turgid at first, and later cyanotic. This effect, however, but slowly reaches the deeper-seated vessels, whose contraction would, as is well known, materially influence all vessels to which they are tributary. When this happens, or if cold is applied directly to the large vessels, their branches receive a smaller supply of blood, and they accommodate themselves to the change by diminishing their calibre. The result is an increase of resistance, viz., tone, which can be readily demonstrated by the sphygmograph—a tone in which every part of the arterial circulation participates if

the entire periphery is subjected to the cold. The condition of the pulse indicates clearly that the local hyperæmia resulting from the thermic irritants (within reasonable limits) is not an evidence of exhaustion or paralysis, but points distinctly to a heightened tension in the vascular system. It is scarcely necessary to emphasize the physiological fact that these effects are traceable to the nervous system, and that change of temperature can thus be readily induced by change in the blood supply. But it must be remembered that not alone upon the circulation may we thus energetically act, but also upon the innervation. The effect of the application of cold to the large nerve trunks is well known, and has been referred to above.

Thus it seems clearly established that the most powerful effects may be incited by the application of cold, by reason of its effect on the calibre of the vessels.

EFFECTS UPON DISTANT PARTS.

An important result of thermic applications to the periphery is obtained in their effect upon parts not directly in contact with them. Since the impulse conveyed by the heart to the blood stream continues unabated, the contraction and subsequent dilatation of the parts in immediate contact induces certain changes by which vascular accommodation is accomplished.

If the blood is driven out of the narrowed vessels, it finds entrance into the collateral circulation.

As a result we have collateral hyperæmia, accompanied by increased tension and rise of temperature. The vessels of those parts, again, which receive this increased blood-supply, contract more vigorously, and force the blood which has, by reason of local or general pathological conditions, accumulated within them, to move on and give place to the more active current. This change in the blood current, which has been demonstrated by actual experiment, is capable of depleting congested organs, of restoring their normal tone, and of conveying to the diseased organ material for renovating its function. Moreover, by this increase of the local circulation, *materies morbi*, elements of retrograde metamorphosis, and detritus of various kinds, whose presence has seriously menaced the activity of the suffering organ and the life of the patient, may be removed.

This brief explanation of the possibilities of hydriatic procedures and of their rationale lends color to the claim of such excellent clinicians as Semmola (*Klinische Therapie*, 1890, translated into German, with preface by Prof. Nothnagel), that "in visceral troubles which defy all treatment because they are favored by special alterations of tissue change, the physician may accomplish in many cases a true and real cure by endowing all the functions of the organism with the highest activity, by the aid of hydrotherapy." Medicinal agents are, as every experienced physician knows, utterly impotent in cases such

to endow organs suffering from languid blood-supply with vigor by an increased afflux of blood and heat and nerve force. This may be accomplished readily by the retrostasis which invariably results when blood is driven from one part of the body into another, not by severe local irritants, blisters, cautery, etc., but by processes which imitate the physiological closely, and which are under complete control of the hydrotherapeutist.

Like all agents that are powerful for good, however, this method may produce irreparable damage. George Johnson, of London, has shown that transient albuminuria may thus be produced, and Winternitz cites a case in which transient hæmoglobinuria was due to that cause. Vessels that have become atheromatous may be ruptured and life destroyed in the same way. Due regard must, therefore, be had in elderly people, and in those less mature also, to the condition of the vessels, ere this powerful agency of retrostasis is called into action. The experienced hydrotherapeutist endeavors to tone up threatened parts by preliminary brief or enduring cold applications, and by taking care that all procedures are followed by distinct reaction to the surface.

All applications of cold to the periphery, even if they are followed by dilatation of the peripheral vessels in full, cause an increase of blood pressure. The contraction of the arterial capillaries induces primarily an acceleration of the blood stream from the arteries

to the veins by way of the capillaries. The return of the blood into the nervous system must be accelerated by this increased *vis a tergo*. The deepening of the respiration which also results, and which will be referred to below, increases the rapidity of the circulation of the small vessels, and induces an increased and accelerated return flow of blood in the left auricle, a slower and more vigorous systole, and more active filling of the arterial system—hence a heightened blood pressure in it.

The sphygmograph demonstrates that the dilatation of the peripheral vessels which ensues upon reaction is not accompanied by a loss of tone, and is not passive, but is probably due to an excitation of the inhibitory nerves. This is confirmed by the opposite effect which hot vapor baths produce upon sphygmographic tracings. These show plainly a reduction of tone, diminished tension, and great diastole.

It may be accepted as a demonstrated fact that cold enhances, while heat lowers, the tone of the vessel walls, although both are followed by vascular dilatation of the surface vessels. In the former, however, we have an accelerated and increased passage of blood, with the vessels under high tension; while in the latter we have the vessels under low tension, and the walls relaxed and dilated, owing probably to a diminution in their elasticity. That these last must sooner or later produce a hyperæmia, is evident; hence it is important to distinguish these physio-

logical differences between cold and warm applications, which primarily do not differ materially but which eventually are totally at variance.

PRACTICAL DEDUCTIONS.

The practical deduction from all the investigations on this subject is clear, that, wherever we aim to reduce blood pressure, with passive hyperæmia, warm water should be applied; whenever we desire to produce increased blood-pressure, with active hyperæmia, without loss of that contractility which is so essential to a normal healthful circulation, we should resort to cold water. That the tension of the tissues and vessels exercises the most potent influence upon the local circulation in the blood- and lymph-vessels, has been convincingly demonstrated by Landerer in Volkmann's *Sammlung*, p. 259.

If, then, we may by varying applications of heat and cold powerfully affect the tension of the tissues and vessels, it is but reasonable to deduce that by these applications we may overcome many inflammatory conditions. Clinical evidence of such effect is abundant. The increase of urinary flow, which is commonly observed after the cold bath, both in health and disease, and which I have often seen exemplified in typhoid fever, is another evidence of the increase of blood pressure after cold application. Not alone, however, by direct vascular effect upon the continuity of the vessels may this influence upon the circulation

be produced. Formerly this was regarded as the only channel of action of remedies which produce local external hyperæmia. It was supposed that the accumulation of blood on the surface, after blisters or rubefacients, withdrew blood whose fluxion to internal organs was pathological, and thus proved antiphlogistic. This fallacy was exposed by the investigations of Naumann, which have become classical.

REFLEX EFFECTS.

Naumann demonstrated clearly that the effects of peripheral irritants upon the circulation within the body were really reflex. He separated the head of a frog from the body, leaving them connected by the medulla oblongata only. He next severed one leg, after preventing loss of blood by tying the vessels, so as to leave it connected with the body by the sciatic nerve. Now he applied thermal, chemical, and electric stimuli to the foot of the partially severed leg, while he observed under the microscope the mesentery of the frog. Shortly after gentle irritation of the peripheral endings of the sciatic nerve in the foot, the circulation in the vascular network of the lungs and mesentery was accelerated, and resumed its former condition slowly after the withdrawal of the irritant. A more severe irritation produced retardation of the flow, and even stasis occurred, as if the heart had become temporarily paralyzed. A strong irritant produced dilatation, a feeble one constriction of the vessels. The effect of

these peripheral irritations upon the heart was also noted. A strong irritation of the skin weakened its circulation; a feeble irritant strengthened it. As there was no possible vascular or nerve channel from the part irritated to the part thus visibly affected, and as the phenomena ceased entirely with the subsequent severance of the spinal cord, the conclusion is inevitable that the effect was entirely reflex. Hot water acted precisely in the same manner as other irritants. Naumann continued his investigations upon warm-blooded animals and upon man with the same result, and announced his conclusions as follows:

1. The action of epispastics is essentially produced by means of reflex action through the central organ.

2. These agents exert considerable influence upon the activity of the heart and vessels.

3. In proportion to the irritability of the individual, powerful continuous stimuli lessen the activity of the heart and vessels and weaken contraction, the vessels becoming dilated and the circulation slower.

4. Relatively weak stimulation increases the activity of the heart and vessels, strengthens cardiac contraction, narrows the vessels, and accelerates the circulation.

5. The changes produced in the body by long-continued cutaneous stimulation last a considerable time after the conclusion of the same, as a general rule; the more enduring the stimulation applied, the

longer they will last, and in a healthy person will often still be perceived after the lapse of from half to three-quarters of an hour from the conclusion of the stimulation.

6. The relaxation of the pulse which follows a more powerful cutaneous stimulation often attains its maximum during the stimulation, but frequently only after the conclusion of the same.

7. The excitant action of a relatively weak cutaneous stimulation likewise continues for a considerable time after the stimulus has been removed, but it is finally also followed by a relaxation, only that this appears much later and in a less degree than after more powerful cutaneous stimulation.

8. As a consequence of a stronger cutaneous stimulation, there constantly appears, mostly after a longer or shorter period of warming, a cooling down of the body, which often has not terminated half an hour after the cessation of the stimulus.

9. This period of alteration in temperature is of varying duration; cooling oftentimes takes place during the stimulation, but, as a rule, only after its conclusion.

EXPERIMENTAL DEMONSTRATION BY VIVISECTION.

Prof. Max Schüller's experiments also may be cited as demonstrating with precision the influence of thermic applications to the periphery upon the circulation of the interior of the body. These experiments

are of great importance, since they were made altogether with water. Schüller trephined rabbits, carefully exposing to view the vessels of the pia mater, without disturbing the dura, whose transparency facilitates such observation. He carefully noted the normal circulation of these vessels, and ascertained that even simple pressure upon the belly produced dilatation of the veins, and sometimes also of the arteries, probably through mechanical interruption of the venous return-flow. When he applied pieces of ice upon the dura mater, he observed very energetic contraction of the veins and arteries, which continued half a minute even after removal of the ice. When he had removed the superior ganglion of the sympathetic, the ice had no effect upon the vessels. The most interesting observation, however, was that, when he placed cold wet compresses upon the belly of the rabbit, the vessels of the pia mater invariably dilated, cerebral pulsation became more pronounced and slower, and respiration was deepened and slowed. These phenomena continued a short time after removal of the compresses, and they were followed by transient narrowing and a return to the normal calibre. When warm compresses were applied, the arteries and veins of the pia mater contracted, the pulsations became less pronounced and more frequent, and respiration more shallow and rapid.

By changing the temperature of the compresses these changes were more or less rapidly produced. A

very hot compress produced the same effect as a cold compress. The manifestations were also observed, but with more pronounced effect, after immersion of the entire body into cold or hot water; then the effect was exactly in proportion to the extent of surface immersed. After prolonged immersion in cold water a narrowing of the vessels and sinking of the brain substance ensued, due, doubtless, to the reduction of temperature in the circulating blood, which approximated in effect to that produced by local ice application. The vessels of the ear also participated in the reflex effect. Immersion in warm water produced a transient dilatation, which was followed by a vigorous narrowing of the vessels and sinking of the brain substance. The cerebral movements became at first accelerated, afterward slower and more shallow, finally becoming more rapid, when the temperature was elevated. Immersion into very hot baths produced effects similar to hot compresses, but of greater intensity and duration. Under the cold and warm douche the cerebral circulation did not vary greatly. Cold rectal enemata always produced a moderate dilatation of the cerebral vessels. Schüller has placed hydrotherapy under lasting obligations by the pains taken in his observations.

Winternitz and others have confirmed on the human subject the findings of Schüller in the rabbit. By means of the plethysmograph Winternitz was enabled to measure the volume of various parts,

chiefly the arms, of individuals who were subjected to cold applications in a sitz bath. He ascertained that the cold affusion produced excitation of the peripheral nerve terminals, which in turn acts by reflex upon the vaso-motors. Contraction of the vessels in the vicinity of the application ensues; the blood is driven from them, thus providing other vascular areas with more blood, which increases their volume. A warm sitz bath produced the opposite effect.

PRACTICAL DEDUCTIONS.

These valuable researches enable us to reason upon the various and somewhat paradoxical effects of cold and hot applications. Upon the heart, as the chief agent in the circulation, thermic applications act more powerfully, not only, as Naumann has observed, by reflex action, but also, as Winternitz, Delmas, and others have so often demonstrated, by narrowing or dilating the peripheral arteries, and thus increasing or diminishing the vigor of the cardiac contraction by increasing or diminishing the resistance to it at the periphery.

The first impression of cold upon the sensory peripheral nerve endings is rapidly conveyed to the nerve centre, whose response is manifested by the induction of more rapid contraction, which is followed by an increase of vascular tension. Immediately following acceleration of the cardiac action, we observe diminution of the pulse rate, even below that

existing prior to the application, but the heightened tension remains. The duration of this effect depends, however, upon whether the individuals subjected to the application remain quiet or not. If absolute rest follows it, the heart's action slowly becomes less rapid; if muscular exercise follows it, the pulse sinks at first, and afterwards becomes accelerated, but does not lose its tension. If muscular exercise quickly follows the application of cold, the effect upon the circulation will be more manifest.

Even the empirical hydropaths have long insisted upon the value of sending the patients out in the open air; and in Professor Winternitz's institute at Kaltenleutgeben it is a rule to give most of the treatment immediately after rising, when the reactive capacity of the patients is at its height, and then send them out to walk or ride before breakfast. Thus physiological experiment confirms empirical results, and enables us to adapt our procedures to each individual case in a manner far excelling that of drug treatment.

It is a well ascertained law in physiology that the functional activity of an organ is always accompanied by an increased flow of blood through it. The quantity of blood circulating in the organ being increased, a proportionate diminution must take place in other parts and organs, diminishing their functional activity for the time being.

Although much additional proof could be fur-

nished, we have dwelt upon the manner in which the influence of thermic application is exercised upon the circulation with sufficient detail to convince the reader that a rational basis exists for it.

INFLUENCE OF THERMIC APPLICATIONS UPON THE
RESPIRATION.

Having shown clearly how thermic applications may influence the nervous system and the circulation, it is not difficult to demonstrate the effect produced by them upon the respiration. This function depends so entirely and completely upon impulses received from the central nervous system, that any decided impressions made upon the latter must affect the former. Common observation quite accords with this proposition. The deepened respiration inducted by cold affusion, or even by a simple dash of cold water into the face or upon any other sensitive part, is a patent illustration of how energetically this influence may be exerted, even when the reflexes are dormant, as in a fainting person. In the cold bath administered for typhoid fever, there is so deep an inspiratory effort that the respiratory muscles are unable at the first moment to respond to the stimulus. The patient gasps for breath and becomes frightened. And the same thing occurs in health when the water is too cold. This spasmodic effort soon passes away; the muscles make more rapid effort, and then settle down to slower action. When reaction ensues, the respiration

is found to be deepened, but approximating the normal rhythm.

Warm applications, on the contrary, increase the number of respirations. The warm bath renders them more shallow and frequent. In the hot-air boxes at the Montefiore Home the respirations are increased 20 to 30 per cent., and sometimes become so shallow that the patient is panting.

INFLUENCE OF THERMIC APPLICATIONS UPON TISSUE CHANGE.

Carl Voit, Finkler, Duke Carl Theodore, Liebermeister, and others have demonstrated by actual experiment that in the only reliable test, the excretion of CO_2 and absorption of oxygen, oxidation is certainly enhanced by cold and diminished by warmth, so long as the temperature is approximately constant. The sinking of temperature even slightly below the normal is at once followed by retardation of the processes of combustion; and a similar rise of temperature produces the reverse effect. The seemingly paradoxical effects of thermic applications are thus explained: Cold may exercise the same influence upon tissue change as warmth, *according to the degree* of temperature applied. An increase of tissue change under cold, as Pflüger and others have shown, occurs as the result of the excitation of the sensory nerves by it, the degree of tissue change accelerated depending upon the degree of muscular contraction by it as

a reflex effect. This is very important, and may be regarded as axiomatic.

The increased metabolism resulting as a reflex effect from the influence of cold, is chiefly manifested in non-nitrogenous material; there is no increased consumption of albumen. The tissue metamorphosis following the direct influence of cold, on the contrary, is similar to that produced by raising the body temperature, either artificially or in fever. Heat abstraction, as produced by hydriatic procedures, induces an increase of nitrogenous tissue change in the course of the temperature-elevation incidental to the period of reaction. These procedures may be graded according to the degree of reaction, which is often dependent upon the heat abstraction producing it.

All experiments have demonstrated again and again that an increase of urine and diminution of its specific gravity result from cold baths. This would only indicate a more complete excretion of the products of retrograde metamorphosis of nitrogenous matters, not an increased formation. The increased elimination of urine is probably chargeable to the change in the circulation and perspiration. This is not the case in the changes produced in the urine by the *elevation* of temperature incidental to the period of reaction following applications of cold. Juergensen and others have shown in their studies of body heat that in six to eight hours after a cold bath the urine presents a higher specific gravity and contains

more urea than it does immediately after the application.

These investigations lend a certain amount of probability to the assertion that low temperatures acting upon the body produce an increase of oxygen absorption and CO₂ excretion. If the bodily temperature is reduced by the application of cold, oxygen absorption is diminished, as well as carbonic oxide excretion. While warmth also diminishes the elevation of bodily temperature, external heat increases the respiratory function, as I have shown above from experiments in the Montefiore Home. With this an increased excretion of nitrogen ensues.

PRACTICAL DEDUCTIONS.

Winternitz justly cites, as an evidence of the influence of the hydriatic procedures upon tissue change, the fact that among 2,400 patients treated at his institute, 56 per cent. gained in flesh, 30 per cent. lost weight, and 14 per cent. remain unchanged.

This is especially demonstrable in the improvement of the appetite and increase of flesh in cases previously very much depreciated by loss of blood owing to diseased condition of digestive organs, in phthisis and carcinoma even, and in many persons whose age (over 50) would render the weight somewhat stable. Those hydriatic procedures which stimulate diaphoresis are especially calculated to aid tissue metamorphosis and changes in the blood. Profuse

perspiration involves losses of water and salts. Inasmuch as there is a constant effort of the system to maintain the integrity and constancy of the blood, the removal of these salts by any means involves a compensatory effort on the part of the tissues and organs, which must impress certain changes upon them.

From these briefly stated experimental deductions and facts it would seem that more or less intense impressions are made upon tissue metamorphosis by different degrees of cold and heat, and that the latter may be adapted with more or less precision to the effect aimed at. How these changes may be made more to the benefit of the patient, will be shown in the clinical portion of the work. Suffice it to state here that even the composition of the blood has been definitely changed by various hydriatic procedures. These changes are not only evidenced by the improved rudeness of the previously anæmic patient, but they have been determined by the hæmometer of Fleishl and Hayem.

INFLUENCE OF THERMIC APPLICATIONS UPON THE BODY TEMPERATURE.

Without entering upon the physiology of heat production and elimination, many of whose points are still *sub judice*, we propose to show clearly how the temperature of the human body may most surely be modified by thermic influence from without. This must suffice for our purposes, inasmuch as it is the

aim of this work to demonstrate only by accepted facts the potent influence of hydiatic measures, which are but the conveyors of thermic impressions upon the human economy.

One physiological fact stands undisputed above all others, viz., that the temperature of a living part or organ depends upon the amount of arterial blood circulating within its tissue. The fact that venous blood returning from an organ in a high state of functional activity is warmer than the arterial blood passing into it, is alone sufficient evidence of the proposition that the arterial circulation is an important element in the equalization of the body temperature, aside from heat production. Add the physiological fact that all tissue change, all organic action, depends upon vascular activity, by means of which excretory and secretory elements are carried to and from the tissues, and that the accumulated heat in the organs is equalized by the great streams of blood which constantly pass through them, and we have a combination of elements which almost controls temperature variations.

We have shown in a preceding chapter how hydiatic procedures influence the circulation. It remains now to demonstrate how, by utilizing this powerful influence, we may reduce or elevate the temperature in the human economy. That the application of baths of various kinds is potent in this direction, has been recognized since the primitive days of

medical investigation. Indeed, the idea that the reduction of temperature is the chief, if not the sole, attribute of the baths, has so strongly rooted itself in the professional mind that it is difficult to dislodge it to-day, when we have come to realize that this is only one of its valuable manifestations.

There is no evidence to prove that the influence exerted by external thermal agents is traceable to the heat-producing centres. There is abundant evidence, however, to prove that this influence is directly exerted upon the most important heat-regulating element, the peripheral cutaneous circulation. The mode of action in this direction is twofold. It is a well known fact in physical science that two bodies of different temperatures, on coming in contact, will at once make an effort to equalize their respective temperatures. This law applies to inanimate bodies, however, and is only applicable to the living body up to a certain point, because the latter is endowed with compensatory powers which enable it to resist dangerous encroachments from external temperature agencies.

COMPENSATORY ACTION.

The utilization of these very compensatory powers enables us, as will be shown, to influence the temperature of the body powerfully in health and disease—more powerfully in the latter than in the former.

The temperature of any portion of the body surface may be reduced or elevated by its contact with

media of different temperatures, until death of the part by freezing or scalding occurs. But so soon as this occurs, the inner parts are protected against further destructive invasion by the intervention of the dead part. On the other hand, temperature whose effect falls short of destroying the parts in contact with it cannot be conveyed to the deeper parts to any extent, because the collateral circulation is enhanced in the muscular structure, endowing the parts invaded with more vitality; because the muscular tissue is a bad conductor; and because the tonic contractions of the muscle which ensue upon the application of cold, for instance, create more heat. Thus the internal parts are well defended against the invasion of thermic agencies by direct action, and *our means of reducing or elevating the temperature of the body by this means are very meagre.*

FALLACIES EXPOSED.

The sooner this important point is thoroughly mastered by the profession, the better. For the fallacious idea that cold baths, for instance, reduce temperature by the direct effect of the cold, is still so firmly fixed in the minds of many that it is regarded as axiomatic. *The fact is that the colder the bath the less intense its power of reducing internal temperature.* The mouth temperature being so commonly accepted as correct, is the cause of this fact not being appreciated. I have often seen the mouth temperature,

after a bath of 65° F., in typhoid fever, reduced to normal, when the rectal temperature was two degrees higher, although both were carefully taken for five minutes, or even longer in the mouth.

This point has never been published, but as it is a clinical fact I must insist upon it here, as I shall elsewhere also in order that the unreasoning prejudice against the cold bath, which has its origin in the idea that its antithermic effect is in proportion to the low temperature of the bath, may be removed. The fact is, as shown by Liebermeister (*Handbuch der Pathologie und Therapie des Fiebers*, page 102), that, during the action of extraordinary heat abstraction from the external surface, if its intensity does not exceed certain limits, the inner temperature of the body does not fall, but even rises a little.

The second and most important temperature effect of thermic agencies externally applied, lies in their immense power over the cutaneous circulation. We know from the investigations of several physiologists that, when a portion of the skin is moderately heated, the temperature of neighboring portions is cooled, and that when cutaneous surfaces are moderately cooled the neighboring structures present a proportionally higher temperature. These effects are traceable to the collateral anæmia produced by withdrawal of blood to the surface to which warmth is applied, and to the local hyperæmia produced by the driving of blood from the surface to the inner structure when cold is applied.

REACTION AIMED AT.

Reaction follows both of these conditions, either restoring the equilibrium or disturbing it in an opposite direction. Fleury, who has done so much in France toward explaining hydriatic procedures upon physiological principles, offers the following results deduced from careful experiment: Dipping the body into moderately cool water (48° to 58° F.) for thirty minutes reduced the temperature of the surface, while the inner temperature did not change at all. The more brief the application, the colder it was made, and the higher the surrounding temperature the more rapid and complete was the reaction. The reaction entailing the re-establishment, and even the increase, of the previous temperature, depends upon the conduct of the patient after the applications, it being more rapid and complete under active and passive exercise of the parts, especially in a warmer surrounding medium.

Another important deduction made by Fleury is the fact that reaction depends upon the individuality of the patient and the condition of the circulation and innervation at the time. These simple facts have again and again been verified by numerous authentic authorities, and may, if properly grasped, lead to a correct understanding of many seeming paradoxes in hydrotherapy.

WINTERNITZ'S LAW.

They confirm the law long ago enunciated by

Winternitz, that the amount of temperature reduction depends more upon the intensity of the thermic irritation of the cutaneous sensory nerves than upon any other element.

The commonly observed fact that a drunken man may have his toes frost-bitten, while one in a less depressed condition of the nervous system may present a ruddy, healthful glow from the same exposure, is but an illustration of the last of Fleury's laws.

PRACTICAL DEDUCTIONS.

In typhoid and other infectious fevers it is important to bear this law in mind, for the same bath which may stimulate and refresh a patient in the first week may in the third, when his nervous system is depreciated by disease, prove a fatal depressant. For the same reason patients treated from the beginning with cold baths have their nervous system and all functions depending thereon so perfectly sustained that they can bear baths later in the disease which in neglected cases it would be homicidal to apply. Disregard of these patent facts is the reason why hydrotherapy has failed so frequently in the hands of otherwise well informed men. Hydrotherapy requires special study, to further which this work is written; but by grasping its well known principles that study will be made comparatively easy.

The chief element, then, in the influence we may exercise upon heat regulation, is derived, so far

as we can determine it positively, from our power to regulate the temperature of the surface of the body. This is accomplished by the change in the general circulation which, as referred to above, follows thermic applications to the periphery.

If, during the abstraction of heat from the surface, friction is resorted to, the effect upon temperature reduction is more intense. This will be exemplified further in the "Rationale of the Cold Bath in Fever."

SUMMARY.

Winternitz sums up the automatically acting agencies which protect the body against serious heat-abstraction, aside from the simultaneous changes in heat production, as follows: "Alteration of the body temperature by the physical law of contact; elevation of temperature in the muscular structure enveloping the entire body; the constancy of temperature of the inner organs, as induced by the reactions which are signs of a changed blood flow and heat distribution; and the acceleration of the circulation, which may be accepted as a manifestation of rising temperature. The automatically acting protective agencies against injurious rise of body temperature are, aside from the change in heat production: Increase of heat dissipation from both the skin and lungs, due to the enlarged blood stream flowing through them; increase of cutaneous secretion, due to reflex excitation, made possible by increased flow of blood through the skin; and change

in the distribution of the blood. The importance of all these processes for the maintenance of a constant temperature is *a priori* obvious. Whenever an energetic contraction of the muscles and vessels of the skin drives the blood within, the giving off of heat from the surface must be diminished. There is less blood circulating in the skin; and, the circulation being the chief medium of heat equalization between the exterior and interior of the body, the refrigerant effect upon the blood-volume as a whole is necessarily small. The loss of heat is diminished in proportion to the diminution of the difference of temperature between the surface of the body and the medium in contact with it, and the diminished area of the peripheral blood stream. The cooling of the body takes place, aside from the loss of heat in respiration, ingesta and excreta, only in proportion to the direct heat conduction through the single tissue layers, each of which presents a different resistance to conduction. Hence, by contraction of the muscular vessels of the skin and the forcing out of better conducting fluid from the cutaneous and subcutaneous tissues, the heat loss from the periphery is diminished and the heat conduction through the tissues impeded. Cooling (almost to complete stoppage of the circulation) is diminished somewhat in the manner in which it may be done in a cooling-coil apparatus when the stream is interrupted."

Opposite conditions ensue in case the skin is irri-

tated by heat, when its vessels dilate and more blood is forced through it. The surface temperature is raised, the difference between it and the surrounding atmosphere is increased, and heat dissipation is therefore also increased. It is to the credit of Winternitz to have first demonstrated by actual mathematical calculations the correctness of these propositions. His assistant, Pospischl, has, by actual demonstration in fifty observations, established the following propositions:

1. Driving of the blood from and stoppage of the circulation in a part, diminishes the loss of heat up to 70.6 per cent.

2. The interruption of the circulation by the production of passive hyperæmia diminishes loss of heat up to 46.2 per cent.

3. Mechanical irritants may produce an increase of heat loss up to 95 per cent.

4. Weaker chemical irritants produce an increase of heat loss to 40 per cent.; intense irritants, on the contrary, only to 8 per cent.

5. Thermic influences which produce cutis anserina diminish heat loss up to 44.5 per cent.

6. A warm rain-bath may by this means induce a reduction of heat loss up to 38.7 per cent.

7. Partial cold, wet rubbing may increase heat loss up to 80 per cent.

8. Cold rain-baths, with subsequent rest, produce, after a transitory diminution of temperature, an increase of 23 per cent.

9. Cold rain-baths, with subsequent exercise, increase heat loss up to 66.6 per cent.

10. Warm rain-baths, with cold fanning and subsequent rest, increase heat loss 16 per cent.

11. In two cases of fever the heat loss during the rising of the temperature was diminished 25.4 per cent.

If we accept as the result of these exact investigations the deduction that the heat dissipation may be decreased 70 per cent., or increased 90 per cent., thus enabling us to induce compensatory fluctuations that may be three times the normal, we have a ready explanation why these compensatory agencies serve to maintain the constancy of the body heat. We must also accept the deduction that in this manner may be explained the rise of temperature in fevers and its reduction by hydriatic procedures, as will be shown further on.

VALUABLE AID OF MECHANICAL ACTION UPON THE SKIN DURING BATH.

The utilization of this flexible cutaneous agency for heat maintenance enables us in disease powerfully to influence temperature. To Winternitz belongs the credit of having first demonstrated how active mechanical action on the skin, combined with the application of cold water, enhances the temperature-reducing effect. He has shown that by friction or other active stimulation of the surface circulation during the bath, as by the wet sheet, half-bath, etc.,

the cutaneous vessels may be made to dilate quickly and in tonic action, so that a larger area for cooling off the blood which circulates in near proximity to the cooling medium (the water) is created. The cooler blood, passing inward, is exchanged for hot blood coming from within. A simple yet effective method of reducing the temperature is now created, which explains many inconsistencies. It is now clear that the amount of compensatory heat increase is not dependent upon the absolute amount of heat abstraction, but upon the intensity of the thermic nerve-irritation, and the degree of actual cooling of the peripheral terminal nerve fibres, which govern by reflex action the increase of heat production. This will also explain why two baths of the same temperature and duration may produce quite different effects in the same individual, if in the one case he lies quiet and undisturbed, and in the other he is subjected to active friction of the periphery. In the first instance the peripheral circulation is impeded, the surface is cooled down almost to the temperature of the surrounding water, the heat production in the muscular layers is greatly enhanced, and the rectal temperature not much diminished; in the other, peripheral circulation is stimulated, the cutaneous surface is cooled down less, but the blood coming to its related vessels is cooled more, the heat production in the muscles is diminished, especially as tremor is prevented, and, therefore, the rectum temperature is lowered.

Winternitz is convinced of the correctness of this view, which he has long advocated and defended against influential opposition, inasmuch as recent experiments by others have verified it. The exact investigations of Speck on the influence of cooling upon the respiratory process (*D. Archiv für Klin. Med.*, xxxiii) demonstrate that heat abstraction from the surface of the body produces an increase of CO_2 exhalation and oxygen imbibition only when voluntary or involuntary muscular action is not avoided. Loewy (quoted by Winternitz) has shown, from exact observations in Zunz laboratory upon the influence of cooling upon the exchange of gases in the human body (*Pflüger Archiv*, xlvi), that the actually positive fact in the regulation of the body temperature in man is that the first result of cold as an irritant induces contraction of the skin and its vessels, which produces an impediment to heat dissipation. In mild heat-abstraction complete compensation occurs; this is not the case when the heat-abstraction is more intense. After the latter the temperature will sink more or less; in the former it will remain constant.

Changes in heat production may be added to by tonic or clonic muscular contraction, either voluntary or involuntary, which may occur after cold or after other irritants. Their importance as heat-regulating elements stands in man far below that of the skin; they cannot prevent a fall of temperature. Hence it may be regarded as a law that the regulation of the

body temperature depends chiefly upon the changes in heat dissipation, therefore chiefly upon the condition of the peripheral nerves and vessels. Inasmuch as we may influence the latter energetically by hydriatic procedures, as we have shown above, we possess a powerful agent for affecting the temperature of the body in health and disease. Winternitz points with justifiable pride to this confirmation by the most recent investigations of the view he has long promulgated, and he concludes his magnificent chapter on this subject as follows:

“ If you connect the above with what happens in thermic and mechanical procedures, with regard to the blood and heat distribution, the control of heat dissipation—or rather, as I may say now, the control of the degree of heat production—you will find it quite natural that hydrotherapy is the most sovereign remedy, not only in the first stages of febrile diseases, not only in fevers depending upon heat retention, but in all fever processes especially, because no other remedy, if properly applied, is capable of meeting the chief therapeutic indications of the latter.”

That we are fully in accord with Winternitz on this point we shall endeavor to demonstrate in the chapter on the hydriatic treatment of fevers.

We have now, as briefly as the importance of the subject would admit, dilated upon the rationale of the action of water, as a vehicle of thermic agencies, upon those functions of the body upon which physio-

logical integrity depends in health and disease. An agent of such power must be capable of utilization in therapeutics as no other known agent can be shown to be.

CHAPTER III.

TECHNIQUE AND CLINICAL APPLICATION OF HYDROTHERAPY.

Much of the prejudice existing against hydrotherapy is due to the more or less complex methods adopted and insisted upon by certain advocates of this treatment. It is the aim of this work to simplify hydriatic procedures by modifications which the author has found of value in his general practice (private and hospital), and to divest it of mysticism and empiricism.

NECESSITY OF PRECISION.

The first element of success in all hydriatic procedures is precision in executing them, with regard to method, duration, temperature, etc. The absolute necessity of an exact technique in the application of water as a remedial measure is unfortunately not appreciated by the profession, and its neglect is undoubtedly a cause of the failures which have operated in preventing the more general adoption of hydrotherapeutics by the practitioner. Water is so simple, so readily obtainable, and so easily applied, that it would seem an unnecessary refinement of therapeutics to enlarge upon the methods of its application. On the other hand, too, the empirical hydropaths and water-cure doctors have divided and subdivided their

procedures into numerous baths and douches, etc., each one infallibly adapted to certain conditions. It shall be our aim to steer between the Scylla of indifference and the Charybdis of over-activity, to simplify these methods, and to instruct the general practitioner in such hydiatic procedures as his common-sense will enable him to apply under the guidance of physiological and pathological principles.

The first step in this direction is the appreciation of the fact that, while there is no sleight-of-hand or mystery in the hydrotherapeutic methods, there does exist a necessity for *absolute precision* in the application of water, simple and universally applicable though it be. A few illustrations from our clinical experience will impress this lesson more forcibly than the simple statement.

ILLUSTRATIONS.

Some time ago one of the house physicians of one of our metropolitan hospitals informed the writer that the cold-bath treatment of typhoid fever had been inaugurated in his institution. Inquiry regarding the method adopted elicited the fact that the patient was wrapped in a wet sheet, and ice water was poured from a carriage sponge over the entire surface of the sheet, until the temperature was decidedly reduced and a reduction of 5° had been noted. The prognosis made by the writer, that the w. man would die under this unphysiological management, was verified in two days. Failure in this case is attrib-

utable to the fact that refrigeration was the chief aim of the treatment. The success of the hydriatic management of typhoid fever rests, as will be shown, upon the principle that the refreshing influence of cold water upon innervation is the important indication. The latter is fulfilled by promoting reaction during the bath by friction of the entire body. This point has been fully elucidated in the section on the Rationale of the Action of Water. That the necessity for precision is well understood, however, by some of our metropolitan hospital physicians, was made evident to the writer by the receipt of a written request from Dr. Austin Flint, one of the attendants at Bellevue Hospital, to aid him in instructing his house staff of two divisions, which will doubtless ere long bear fruit in the saving of life and in comfort.

Another illustration may be of service. The writer had occasion to suggest intestinal irrigation in two cases of summer diarrhœa of infants. Finding the treatment painful and inefficient in these cases, inquiry elicited the fact that in one case the attendant (who is an accomplished physician) had cut off the lower third of a Nélaton catheter, and converted the upper into a drainage tube by cutting three eye-holes into it. Is it surprising that the introduction of such a tube was painful, and irrigation through it ineffective? One thorough irrigation in accordance with the technique laid down under this heading changed the entire aspect of the case. In the other case referred

to, the attendant had used a No. 4 French rubber catheter, had placed the child in the dorsal position, and attempted to irrigate with a Davidson syringe. The tube doubled up in the rectum, its proximal end was too small to connect with the syringe point, and failure was the inevitable result of this neglect of proper technique. The reverse of this picture is contained in the following extract from a letter received by the writer. Dr. Chas. Schram, New York City, says:

“I have successfully managed a desperate case of summer diarrhœa in a child, 18 months old, by following out implicitly the principles of treatment laid down by you in your monograph on the subject published a year ago (*Medical News*, July 7th, 1888). The case was one of a severe type, with a high fever, muco-purulent and bloody dejections, and vomiting. I feel that I owe you a debt of gratitude for the assistance derived from studying and following the principles laid down in your paper.”

A few days ago a masseur applied to the writer for work, stating that he was quite familiar with hydriatic procedures. Being asked to describe the dripping sheet process, he said that a sheet should be dipped into cold water and thrown over the patient, who should rub himself with it as well as he could, with the aid of the attendant. This specialist had entirely lost sight of the important elements of the technique, which are the use of a linen sheet, a thermometer for

exactly estimating the temperature, and the necessity for the patient remaining entirely passive while the attendant applies the friction outside of the sheet. Recently a letter from one of the most justly eminent neurologists of America was shown to the writer, in which the following directions were given: "Wrap yourself in a cold wet sheet every night, and have some one to rub you down." This would be equivalent to saying to a patient: "Take some quinine once a day." Precision in the temperature of water (which, if cold, may vary from 35° to 80° F.) is as important as is dosage of medicinal agents.

The technique of hydrotherapy may be studied under: (1) Procedures having for their object distinctly local effects; (2) Procedures having for their object general effects.

PROCEDURES FOR LOCAL EFFECTS.

The *mechanical* influence of water as a remedial measure is well illustrated in its simplest form when administered as lukewarm water for the purpose of acting as an emetic in gastric disturbances or as an enema in constipation. Here we have the simple mechanical effect acting by over-distension. For the former purpose the object may be accomplished best by abundant quantities of water at a temperature of about 90° F. A higher or lower temperature would probably fail. As an enema, experience has shown that water at any temperature from 60° to 95° may

be used, a sufficient quantity to produce mechanical distension being the chief requisite. Even in these simple procedures due attention to detail will alone bring success. A small quantity will fail as an enema, while a temperature materially above or below 90° will probably fail to produce emesis, as every tyro knows.

THERAPEUTIC APPLICATION.

As a mechanical agent, we obtain from water important effects in the treatment and diagnosis of gastric and intestinal disturbances. In *chronic gastric catarrh*, for instance, there is no remedy equal to half a pint or a pint of hot water, above 100° F., an hour before each meal, as may be indicated in each case. This measure, which has almost become a popular craze, is now receiving more appreciation from the profession. But, like other hydriatic procedures, its efficacy depends upon attention to details. The originator of the method recommends the administration of a pint of water as hot as can be sipped, one hour before each meal, the object being to remove mucus and fermenting material from the stomach, and thus to enable it to perform its function unhampered. The correctness of the theory is demonstrated by clinical data. A half-pint of hot water slowly and deliberately sipped not less than half an hour before one or all meals, as the severity of the case may indicate, will be sufficient, provided the stomach is occasionally irrigated with lukewarm

water five hours after a meal. If the diagnosis be correct, there is no medicinal treatment or physiological aid by acid or pepsin which can approach this simple cleansing of the mucous lining. That the hot water does remove the mucus in mild cases, I have demonstrated by the experiment of washing the stomach half an hour after it was drunk. When, however, the mucus is tenacious or in large quantity, it fails. It would seem unnecessary to refer to so simple a matter as the *time* for administering hot water, but I have observed failures due to the neglect of this point. A lady at Long Branch, who had been under the care of an eminent hospital physician, sought my advice for an obstinate gastric catarrh. When hot water before breakfast was ordered, she remarked that the treatment had proved inefficacious in her case after trial for several months. Inquiry elicited the fact that she had been drinking the hot water immediately before eating. The slow and gradual sipping of hot water an hour before breakfast produced a favorable change, which, together with proper diet, secured her recovery.

GASTRIC AND INTESTINAL DISTURBANCES OF INFANTS.

The mechanical effect of irrigation is the most valuable remedial measure in these affections, next to the proper attention to diet. For the removal of the ingested and multiplying bacteria from the gastrointestinal canal of an infant with summer diarrhœa,

irrigation by a soft rubber tube, as introduced by Epstein and earnestly advocated by Seibert, offers a valuable resource in obstinate cases, even after failure of the most reliable remedies. The method of introduction is as follows: A No. 8 Nélaton or Jacques catheter is gently but firmly pushed through the pharynx into the stomach of the child, which is held upright in the nurse's arms. In very many infants this is not a difficult procedure, as they will aid it by sucking the tube. In older children it is more difficult, and had better be avoided. The procedure should not be made in the presence of the mother, nor of anxious friends, if it can be avoided, because the occasional anxious and cyanotic appearance of the baby, although evanescent and not denoting harm, will interfere with the procedure in many instances. The catheter being lodged in the stomach, it is connected with a fountain syringe, from which simple boiled water of a temperature of 95° F. is poured. The infant will probably vomit, but it is better to disconnect the catheter from the syringe and allow the water containing products of fermentation, mucus, and undigested curds to escape through the tube. If the tube is not firmly held, it will be vomited.

TECHNIQUE OF LAVAGE FOR DIAGNOSIS AND TREATMENT.

The diagnostic value of water may be referred to in connection with this branch of the subject. Its

value as a diagnostic and therapeutic agent in dyspepsia has so frequently come under my observation that I would here briefly refer to it. There is no disease that perplexes the physician more than the various types of dyspepsia. To diagnose an ordinary gastric catarrh or a neurosis of the stomach from other forms of gastric trouble is not devoid of difficulty. When a case of chronic dyspepsia presents itself, it is my custom to bid the patient eat a full meal at 12.30 P.M., and present himself at 5.30 P.M. for irrigation of the stomach by tepid water. A long, soft, but firm, rubber tube, with open end and one eye near the latter, is introduced into the stomach. The necessary quantity of warm water, usually two to six quarts, being in readiness, a basin is placed upon a chair in front of the patient. It is well to protect the clothing of the latter by a doubled sheet, or what I use in my office, an oil-cloth apron, secured around the neck and reaching over the knees. Artificial teeth, if present, are removed. The patient is requested to sit upright with his head thrown back. The physician, standing on his right, dips the lower end of the tube in warm water (oil is unnecessary and injures the tube eventually); holding it between the thumb and forefinger, he introduces it over the tongue, until it strikes the back of the pharynx. The patient is now told to bend his head forward. In the first effort gagging will ensue, but an abundant mucus is secreted in the throat which lubricates the tube. The

patient should be reassured, if he feels choked or distressed, by informing him that this is the usual effect and that if he will keep his mouth well open he cannot choke, because there is ample room in the pharynx for a larger tube. The physician must refrain from sharing the patient's excitement, and by his calm demeanor reassure him when he (as is often the case) protests that he is utterly unable to do his bidding. I have failed only twice in many hundreds of instances, and I have observed that some patients, who at first declared it impossible to swallow the tube, became so expert that they executed the entire process themselves. Sometimes an obstruction is met with at the cardiac orifice, which contracts upon the tube. If an assistant will pour warm water in at this moment, the spasm will relax and the tube pass steadily down. At times it is necessary to move the introduced portion back and forth. This, however, should be avoided, because it produces gagging. It will be found that each successive introduction is more free from trouble and distress. The tube being introduced as far as the mark usually found upon it (which, however, may be measured in each case by laying the tube along the curve of the proposed course from the mouth to the xiphoid cartilage), the patient, or, better, an assistant, is asked to hold it lightly but securely *near the teeth*, the mouth being held open. Through a funnel connected with the upper end, water is now poured into it. If vomiting ensues, the patient is

quietly asked to lean over the basin and allow the vomit to flow out around the tube. If the irrigation is done too early after a meal, or if undigested food or large quantities of tenacious mucus obstruct the fenestrum and lower opening, the water should be poured from a height by holding the funnel up. Sometimes it may become necessary to remove the tube, clean it, and re-introduce it. This embarrasses the process greatly, if it is the initial effort. Hence it is advisable to make the first irrigation six or seven hours after luncheon, or before breakfast. The water being slowly poured into the funnel, whose lower end is firmly grasped by the physician's left thumb and index finger, flows readily into the stomach. After about a pint has been entered, the funnel, still held firmly, is turned down into the basin. This should be done quickly, *while the water is still flowing*, in order to establish siphonage. A neglect of this simple point defeats the proper emptying of the stomach. If the water does not flow out readily, the tube may be introduced farther or withdrawn a little. During the whole procedure the patient requires reassurance. I have sometimes succeeded in inducing timid patients to make the attempt, after a failure, by allowing them to witness the introduction in a well drilled case. This is rarely necessary, however; patience, calmness, reassurance, gentleness, and skill in manipulation and overcoming obstacles will surely succeed in nearly every case.

I have been somewhat minute in describing the technique, because experience convinces me of the value of details. The stomach should be thoroughly washed, even if several gallons of water be required, but no larger quantity than one pint should be introduced at once. The washings are now carefully inspected, when it will be readily discovered if portions of food have remained undigested. Thus a perfect clue is afforded the physician to the actual digestive powers of the patient, and the latter obtains a valuable guide. If the washings contain mucus, it is important to distinguish between stomach and throat mucus. The former is a thick, tenacious, brown mass which floats upon the surface of the water, like the scum on the surface of a pond; the throat mucus is thin, transparent, stringy, and may be more abundant, being the result of irritation by the tube of the pharynx and œsophagus. The quantity and quality of the stomach mucus indicate with some accuracy the condition of the gastric mucous membrane. Its rapid or slow disappearance under renewed irrigations and treatment indicates the character of the disease affecting the mucous lining. Three cases recently treated in this manner may serve as illustrations of the diagnostic and therapeutic significance of warm-water irrigations in stomach troubles.

J. M., a young college student, complained last winter of severe pain in the epigastric region, without other symptoms of dyspepsia. Various forms

of diet, amounting at times almost to starvation, afforded no relief. Bismuth and magnesia, hydrochloric acid, hot water before meals, and other remedies, only afforded temporary relief in the course of several months. A sojourn in the country completely restored him. On his return he apprenticed himself to a microscope manufacturer. This occupation being sedentary, and his mid-day meal being taken hastily at a restaurant, the old trouble very soon developed. The pain now became so severe that he often refrained from eating to avoid it. He was constipated and suffered from eructations. A full meal, consisting of soup, fish, meat and vegetables, was ordered at 12.30, and his stomach was washed out five hours later. A small quantity of bread, some celery and spinach appeared undigested, *the remainder of his food being disposed of*. Pain was almost unbearable until the stomach was cleansed, when it ceased at once. The entire surface of the water in the basin was covered with a thick, brown mucus. The diagnosis of chronic gastric catarrh, due to prolonged nervous dyspepsia, was made, and the following simple treatment was adopted: He was ordered an aloes-and-mastic pill every night, a meat pulp diet, irrigations of the stomach every second day, and pulv. magnesia for pain. The stomach was washed nine times, the interval being prolonged as the course of treatment progressed. The pain returned but once, the patient remaining entirely free from it until he resumed his

college studies. He was ordered hot water before breakfast, and gradual return to ordinary diet. In this case the same care in diet had been ineffectual until the cleansing of the stomach prepared the way for the more successful dietetic and hygienic management.

When the case is not of long duration nor of secondary origin, and the patient is young, complete recovery may be almost invariably obtained by this simple diagnostic aid. In the more chronic cases other management, to be presently detailed, is indicated. Another case in which the diagnosis by irrigation rendered treatment successful may be of value:

Miss M., an anæmic young lady, presented every symptom of gastric catarrh, with the addition of occasional vomiting of mucus and food, and severe pain in the epigastric region. She had been treated several months without success, but was immediately relieved by an exclusive diet of hot milk and seltzer water, gradually increased to chopped-meat diet preceded by hot water. A cautious return to a more varied diet brought a return of pain, with increased violence; eructations of gas were explosive, and her condition was precarious. Five hours after a test meal, her stomach was irrigated, and it was discovered she had digested her food well. A small quantity of tenacious stomach mucus floated out, portions of which were so deeply tinged with blood that they appeared like pieces of beef pulp. Diagnosis of

ulcus ventriculi was now clear. Stomach irrigation was therefore refrained from. The usual treatment by rest in bed, systematic nutrition by milk, sarcopeptones, and farinaceous food, with alkaliies, completely changed the aspect of the case in a few days. It was continued two months, and now the patient is in perfect health, eating a mixed diet, and gaining flesh rapidly. There had never been the slightest evidence of blood in her ejecta, and she had been treated by several physicians, including myself, for gastric catarrh, until irrigations made the diagnosis clear.

Dr. H. asked me (March 4, 1890), after reading the account of the above cases I had given in a paper before the New York County Medical Society, to wash his stomach for diagnosis. Patient looked haggard; suffered from migraine; had worked hard as a country practitioner for eighteen years; vomited continuously, with headache; had tried everything, including rest for eight months; dieted carefully; no serious gastric distress after eating. An eminent authority had diagnosed gastric catarrh, and had put him on meat diet. He had had section of external rectus of both eyes; thought to be astigmatic; sleeps well. Dr. Carl Koller found no error of refraction. My diagnosis of nervous dyspepsia was confirmed by the entire absence of mucus, and complete digestion of all food taken five hours previously; which surprised the patient greatly. A mixed diet was ordered, which, to-

gether with hydrotherapy externally applied, relieved him very much.

It may be claimed that these cases might have been diagnosed without the aid of stomach irrigation. But I cannot overestimate the assistance which these ocular demonstrations constantly afford me. Moreover, the moral effect upon a hypochondriacal patient, who sees the mucus gradually diminishing, is not an insignificant factor in the treatment of some of these trying cases.

GASTRIC IRRIGATION IN TREATMENT.

In the management of long-standing gastric catarrh, the most unpromising cases that come under my care, the diagnosis may be at once established, but the treatment by irrigation is not so successful as in those of recent origin. As an addition to hygienic and dietetic management, irrigation is useful, however, inasmuch as it frees the stomach thoroughly from accumulations of fermenting material and tenacious mucus, and prevents the over-distension by gases, which paralyzes the motor functions of the gastric walls and forms an almost insurmountable obstacle to recovery.

Much discussion has been caused as to the time at which these irrigations are most useful. Riegel and others insist that at bedtime this lavage is most useful, because it enables the stomach to be restored to a nearly normal condition, free from fermenting

material and particles of undigested matter, during the night. There is doubtless good reason for his preference, but in those parts of this country, especially in cities, where the evening meal is usually about three and a-half or four hours before retiring, much good nutritive material is lost by the practice; hence, as a rule, it is desirable to resort to irrigation in the morning, except in cases which are under constant supervision, in which the interval between the last meal and the irrigation may be made longer, and the meal of less substantial food. Hence the time must depend a good deal upon the individual case. When, for instance, we have a case characterized by accumulation of large quantities of tenacious mucus, which interferes with digestion and demands large quantities of water, I am in the habit of washing the stomach before dinner, directing the patient to take his luncheon of some light broth or hot milk at noon. Five hours suffice for digestion; if the foods have not been disposed of in six, it is probable that they will be propelled into the bowel undigested, and will, therefore, be lost to nutrition. Hence a luncheon at 12 and lavage at 6 is most suitable in business men and women. I have recently had a busy lawyer under my care, in whom the products of decomposition produced an offensive odor in the washings, mingled, as they were, with such enormous quantities of mucus that six to eight quarts of water were required for complete cleansing. He vomited, prior to treatment,

every other day for months, and then, being partly free from the accumulations, managed to attend to his business. There was not a particle of hydrochloric acid in his stomach, according to frequent analyses. The motor power was so far in abeyance that articles of food were recognized in the washings twenty-four hours after he had partaken of them. This case was completely *relieved of his symptoms*, requiring now only bi-weekly washings. It proved to be a case of stricture of malignant character, to which the patient finally succumbed. Lavage served to make life tolerable and to prolong it.

When the motor function of the stomach is impaired without other organic involvements, as in anæmia or other conditions which lower the general muscular and nerve tone, lavage should not be resorted to habitually. A weekly or bi-weekly evacuation suffices for diagnostic, prognostic, and therapeutic purposes, while other appropriate treatment is resorted to for the restoration of the general condition.

LAVAGE COMBINED WITH EXTERNAL HYDROTHERAPY.

Miss W., daughter of an Ohio physician, æt. 23, anæmic, applied for treatment May 15, 1889. She had been ill three years; at first suffered fainting fits at menstrual period; afterwards violent pains in right hand, traversing body and concentrating in epigastrium, for which her father administered morphia for

a month. Her stomach then became irritable, and has continued so until the present time; she vomited and spat up nearly all her food, more frequently solids. Sea-baths did not improve her. She studied hard, and got worse. In the fall of 1888 she lived on milk and farinaceous mush, and her stomach was washed out regularly, but she grew worse. She now became emaciated, took peptonized milk for a month, but vomited it; tried meat with same effect. Last fall she lived on grapes, which agreed with her. Had tonics, pepsin, and all possible medication her father and brother could muster, without avail. She was sent to me by Dr. Francke Bosworth, after being in the city for three weeks without improvement. She then vomited every day, was anæmic and depressed. She traced her ailment to painting-lessons, but I drew from her a history of a potent psychical factor as a cause in the sudden violent insanity of the favored nurse of her childhood.

Diagnosis: Gastric neurasthenia of the pure type. Stomach was washed twice a week to remove mucus and fermenting material. General faradization daily, also the wet sheet. She received a brisk rubbing over the snugly applied dripping sheet (water at 60° F.), while she stood in a tub of warm water. Under this general treatment vomiting ceased entirely. She went to the sea-side improved in July, and on her homeward journey called to tell me that she had grown stout and felt perfectly well. A year

later she writes: "You would not recognize me as the same girl whom you treated."

When retention of undigested matter and production of decomposition are due to pathological dilatation, and thus impair the motor functions, lavage may be practiced with advantage as often as is necessary to cleanse the stomach. It will be useful as an adjunct as well as a curative agent. Life may be prolonged, in malignant cases especially, by this simple hydropic procedure.

DILATATION OF THE STOMACH.

Kussmaul held long ago, and his view has been found correct by myself and many other observers, that the stomach-tube, by completely emptying the stomach, may restore the contractile capacity of the stomach walls, if they have not been entirely exhausted, just as the catheter does in ischuria occasionally.

In all cases of this kind, due to actual stricture or simply to gastric catarrh, with excessive fermentation, aided by mucus, which encourages the formation of butyric acid, gastric irrigation a long time after meals, either before dinner or breakfast, is perhaps the most valuable therapeutic resource we have, if cautiously introduced. In nervous dyspepsia it is advisable not to be urged to too frequent irrigation by the alleged gastric fullness of which the patients complain. An occasional irrigation cleanses the stomach of possible, though rare, accumulations, and

exerts a psychological effect which is of some value. The products of fermentation require occasional removal. The use of small quantities of ice-water by lavage acts as a douche upon the stomach walls, and aids other means, such as electricity, etc., in restoring its tone.

GASTRALGIA.

In this painful malady, even when not dependent upon accumulated fermented material (which, by the way, is its most frequent source), the irrigation with hot water acts as would a poultice to an external sensitive part. A striking case is reported from Kussmaul's clinic. A woman, 22 years of age, teacher, suffered after three years of dyspepsia from agonizing gastralgia, which failed to yield to all remedies, including electricity, wet compresses, blisters, etc., and yielded only to morphia. Becoming habituated to the latter, she gave up work, and entered the clinic in a miserable condition, feeble, emaciated, dirty pale; abdominal wall covered by cicatricial knots from hypodermatics, etc. Diet, rest, etc., were unavailing; morphine was still required. Her stomach was now irrigated with warm water every morning, while empty. The water returned almost clear and a little acid. This was continued with advantage to pain and renewal of appetite. Carbonized water, mixed with plain water at 100°, was now substituted, 2 to 3 liters being used. In three

weeks she could eat beefsteak, etc., and take a walk. Warm baths at night, of ten minutes' duration, were now administered with great benefit. The morphine injection gradually became less necessary. To aid in obtaining spontaneous actions of the bowels, faradization was produced by introducing a wire electrode through the tube into the half-filled stomach, and placing another electrode upon the outside for five minutes. In four weeks she was entirely restored. In cases in which the soothing effect of warm irrigation is desired, it is self-evident that the warm water should be allowed to remain in the stomach for several minutes, and repetition resorted to.

INTESTINAL OBSTRUCTIONS.

Another valuable application of water, discovered by Kussmaul in 1882 and published in 1884, is the treatment of ileus by irrigation of the stomach with a large volume of warm water. We certainly encounter no class of cases which afford us more anxiety. Hitherto their non-surgical treatment consisted of purgatives, enemata of water or air, the injection of large quantities of crude mercury, and, lastly, opiates—remedies to which many cases, even those that are not due to actual stenosis, fail to yield. Hence we welcome any addition to our measures with due appreciation. The first case treated by Kussmaul was admitted into his hospital in March, 1882, having been unsuccessfully treated by all the

usual methods for eight days. The stomach was thoroughly washed out, feculent masses were evacuated, and the irrigation was repeated every three or four hours until the water came away clear. Patient fell asleep for the first time, and on awakening passed a thin, yellow stool. No further treatment was necessary; recovery was complete in five weeks.

A second case occurred a year later. Here, again, all remedies had been exhausted for nine days without result. Laparotomy was determined upon, but Professor Lücke, the surgeon, requested Kussmaul to see the patient before operating. One large irrigation of the stomach removed immense masses of feculent matter, and was followed by sleep, which had been denied the patient even under large doses of morphine.

Other cases have been reported by Senator and others, in some of which stomach-irrigation acted as a curative, in others as a very comforting palliative agent when surgical interference became necessary, the distressing vomiting and great distension being removed. We have in this hydiatic procedure a valuable means, which should never be neglected, ere laparotomy is decided upon, and after its failure we may more promptly decide upon laparotomy than hitherto.

In a case occurring in my own service at the Manhattan Hospital, stercoraceous vomiting and the terrific urgent straining accompanying or succeeding

it in a case of stenosis were so completely allayed as to lull the house staff into a false sense of security, from which the collapsed condition of the patient aroused them. Laparotomy by Dr. Wilkie revealed one intussusception and one constriction by bands. The value of the hot-water irrigation as an anti-emetic is here illustrated in an extreme case.

COLIC FROM GALLSTONES.

In the discussion of Senator's paper, Rosenthal referred to the fact that in two cases of colic from gallstones, irrigation of the stomach not alone relieved the pain and vomiting, but the gallstones were seen in the fæces. Although I have failed to obtain any such result from this treatment, its simplicity commends it for repetition in other cases.

It is well to remember the statements, here reproduced, of such men as Kussmaul, Senator, and Rosenthal, when we are face to face with these distressing cases.

INTESTINAL IRRIGATION — TECHNIQUE IN INFANTILE DIARRHŒA.

This is a remedy in the diarrhœa and dysentery of infants which affords more comfort to the doctor and security to the patient than the whole materia medica. I say this advisedly after an experience of thirty-one years in a large general practice in a country and city clientèle. But it must be borne in mind that

irrigation cannot be accomplished by an *enema* of warm water—this would act as an irritant and create additional disturbance. A rubber horse-catheter or a Nélaton catheter should be used for this purpose, because its walls are firm and yet elastic, and its length admits of its deep introduction. It should be attached to a fountain syringe, containing one quart of water that has been boiled for half an hour, and in which half a drachm of chloride of sodium has been dissolved. The infant is placed upon its abdomen in the lap of the attendant. The tube, anointed with vaselin and firmly held between the thumb and index finger of the right hand, is gently introduced into the anus. The pressure of the fingers is now somewhat relaxed, in order that the water may flow, while the tube is being gently but firmly pushed into the intestinal canal. Whenever it meets an obstruction it should be withdrawn a little and gently persuaded to pass upward. If the water is allowed to flow and distend the bowel, introduction is greatly facilitated. Remembrance of this point has frequently saved me the mortification of abandoning the introduction. Sometimes it is more readily introduced when disconnected from the syringe. When the upper point has reached the transverse colon, or cannot be introduced farther, it is held quietly until about a quart of water has been passed. There will be no distension, because the pressure of the child's body upon the nurse's lap will aid in expelling the water as rapidly as it is intro-

duced. If it does not return, it may be allowed to run out through the catheter. I have sometimes in extreme cases added with advantage one-half grain bichloride of mercury to the quart of water, allowing always an extra pint of plain water to follow the medicated injection to prevent poisoning.

Experience has convinced me that thorough irrigation of the large intestine, administered by the physician, or by a competent nurse under special instruction, every four or five hours, lessens the number and changes the character of the movements, and produces a most soothing effect upon the patient. I have frequently seen infants who had been tossing in pain, purging and vomiting, drop into gentle slumber while the water was still flowing. Almost invariably a quiet slumber follows the irrigation, the purging ceases or is much modified, and the whole aspect of the case is changed. The result of irrigation is the removal of bacteria, mucus, undigested food, and fermenting material.

RATIONALE OF ACTION.

J. L. Smith has found the lesions in summer diarrhoea "in all but one of the cases, in the colon; in thirty-nine, nearly or quite through its entire extent; in fourteen it was confined to the descending colon. The portion of colon most frequently inflamed is just above the sigmoid flexure."

"In the large intestine, the cæcum, sigmoid flex-

ure, and upper part of the rectum were the positions in which the most advanced lesions were met with; in the small intestine the changes were generally limited to the lower part of the ileum," says Holt in the Medical News of June 9, 1888. Hence we may safely assume that the irrigations reach most of the diseased surface, and thus we follow the indications of modern therapeutics, to *treat local troubles by local measures*, as far as possible. The inflamed parts are not only soothed by these warm irrigations, but the *materies morbi*, which maintain the disease, are removed and neutralized.

An incidental advantage, too, is the stimulation of the hepatic function which this imitation of Krull's injections produces. While I have, in severe cases of *dysentery*, resorted to the addition of bichloride of mercury with advantage, I regard the addition of antiseptics to the irrigating fluid as inadvisable, inasmuch as the solutions cannot be made sufficiently concentrated to effect the destruction of germs and spores without endangering the integrity of the mucous membrane, or menacing the system by poisoning from absorption. Further investigations may develop a perfected medicinal irrigation. For instance, Cantani's method of tannin irrigations in cholera may be here imitated. He has succeeded in reaching the stomach with these irrigations. In chronic and subacute cases these may be valuable by their local astringent action.

CATARRHAL JAUNDICE.

About ten years ago Dr. Krull, a German physician, treated eleven cases of catarrhal jaundice by simple cold-water irrigations of the intestines. After failure with other treatments, which almost invariably had included the Carlsbad waters, these irrigations succeeded, first, in relieving the constipation, and later in re-establishing the hepatic norm. Dr. Löwenthal reports (Berl. Klin. Wochenschrift, 1886) forty-one cases of catarrhal jaundice, in which all but one demonstrated good and rapid effects from intestinal (anal) irrigations. Four irrigations of one to two quarts, of a temperature varying from 54° to 64° F., increasing three degrees daily (one quart sufficing for children), were needed, on an average, for each case. In all cases fæcal evacuations followed the irrigations, sometimes diarrhœa; these ceased if the succeeding irrigation was of a somewhat higher temperature. Grey or colorless clay-like masses were evacuated after the first treatment; after the third the fæces became slightly yellowish; and after the fourth, usually brown. Gastric pains and oppression, headache, etc., ceased; appetite returned; icteric hue disappeared in one case after the first, in two after the second irrigation. Pruritus, among seven cases, disappeared after second to fourth treatment. The skin began to clear up, but continued dark for a long time. There were 27 male and 14 female pa-

tients; in most of them the cause lay in disturbances of digestion; two claimed sudden fright as a cause. Other reports of similar results are found in recent literature, confirming the value of this *hydriatic measure*, so that it may be regarded as established. I can testify from personal experience to its beneficial effect in catarrhal jaundice, and to its failure in jaundice from gallstones. Once in twenty-four hours I place the patient in the knee-elbow position, and pour from one to two quarts of water of 54° to 60° F. into the rectum from a fountain syringe. The patient is induced to retain the fluid as long as possible. On the following day the temperature of the water is increased two degrees, and this increase is continued until 70° F. is reached. From two to six irrigations are sufficient to produce the desired result. In my own experience the gastric and hepatic pains ceased after the first injections, appetite soon returned, and jaundice disappeared more or less rapidly, but I failed in subduing the pruritus by this measure.

DYSENTERY.

In acute dysentery of infants, as well as of adults, irrigation with water, about 95° , made thoroughly aseptic by long boiling, has proved in the hands of the best clinical observers a valuable auxiliary by removing pathological products, subduing hyperæmia, relieving tenesmus, and thus enabling the inflamed bowel to obtain that rest which in all inflam-

matory affections is the chief element of restoration. All these effects are due to the mechanical cleansing action of water. They demand careful attention to the details of the procedure, which, though simple, experience has taught me are necessary to be inculcated. How not to do it, is illustrated by the case cited in the opening of this chapter.

Clinical evidence of the value of this simple hydiatic measure is readily obtained. The most recent report on the subject I find in the *Medical Age*, August 25, 1891. Dr. Peter S. Korytin (Russia) details fifteen successive cases of diphtheritic (9) and catarrhal (6) dysentery which he treated daily with warm (30° R. or 100° F.) large enemata of six pints either of filtered water from the tap or of a carbolic solution, 10 to 20 grains to the 6 pints of distilled water, which is practically equivalent to plain water. Only one of the patients died, the remaining fourteen making excellent recoveries. The total number of the injections in individual cases varied from one to six, averaging two and a half. The injected fluid was retained by the patient generally from five to ten minutes, being sometimes expelled in one or two, and in other cases in from fifteen to twenty, minutes. The following effects were commonly observed: Abnormal distension and pain speedily subsided; the frequency of stools diminished and tenesmus decreased; the spirits, appetite, and sleep quickly improved; the stools soon became painless, more solid,

and free from offensive odor, mucus, blood, sloughs, and shreds, while the temperature became normal. No therapeutical difference whatever was noticed between carbolic and simple enemata. It appears, therefore, that the beneficial results of the treatment should be attributed simply to the thorough washing-out of the large intestine. (See Dr. Hiram Corson's views, page 16.)

LEAD COLIC.

Reisland published in the *Berliner Klin. Wochenschrift*, 1875, an obstinate case of this disease in a potter. He had been constipated for five days, despite the most active purgation; he was collapsed, with frequent spasms of the arms and legs and vomiting of bile; face pale and ashen. The teeth presented a plain lead line; abdomen hard and retracted; pulse small (65); temperature normal. Croton oil and opiates were ineffectual, also enemata. Four and a half liters of warm water were now poured into the bowel with a Hegar's irrigator. The water returned in five minutes, colored by fæces and containing some scybala. The patient obtained so much relief that he insisted upon a repetition. Three liters were introduced, and were followed in half an hour by the same quantity, each injection being followed by fæces and relief from pain. The knee-elbow position was practiced during irrigation. The patient became no e nauseated, but after the third irrigation he slept

well for the first time in six days. The pain returned, and three more injections of 3 and 2½ liters brought stools and relief. On the following day the pain and spasms returned, and were again relieved by irrigation. He received one more irrigation of 3 liters, which brought a good fæcal evacuation, and he was assisted to entire recovery by a dose of *Ol. Ricini* and *Ol. Crotoni* and a warm bath. In Kussmaul's clinic at Freiburg this treatment has been used for many years. Whether lead colic be a neurosis of the intestinal muscular coat, or, as Riegel deduces from the effect of amyl and pilocarpine, a spasm of the mesenteric vessels, it is certain that abundant warm injections per anum may avert a colic in its incipiency, and act as a good palliative. It is very interesting to note that this procedure quickly produces fæcal evacuations, irrespective of the rejected enemata, proving that it induces a normal activity of the intestine. The experiments of Horvath, who sent streams of water through portions of the intestines of living animals, demonstrate that the passage of water (66° to 105° progressively) through the intestines excites peristalsis (Malbrane, Berliner Klin. Wochenschrift, 1878).

WATER IN GYNÆCOLOGY.

Another illustration of the distinctly local effects of water is the application of hot water in some diseases of the female pelvic organs. Those who in

former years ordered injections of cold water, in which tannin, sulphate of zinc, alum, or other astringents had been dissolved, for checking leucorrhœa, for healing so-called ulceration, and so forth, are in a position to appreciate the immense advance which the introduction of hot vaginal douches has inaugurated. If Dr. T. A. Emmet had done nothing more for gynæcology, our debt of gratitude would be great indeed. But here, as in all other applications of water as a therapeutic measure, everything depends upon details—the method and the temperature (110° F.). He claims, moreover, that it is impossible for a patient to give these injections to herself so as to derive their full benefit. So different is the corrugating, and therefore tonic, effect of these injections when administered according to his rules, that Dr. Emmet discovered by digital examination those women who, among a series in the Woman's Hospital, had been given injections without their guidance. "We resort," says Dr. Emmet, "to the prolonged use of hot vaginal injections to gradually bring about the required contraction and to tone the pelvic vessels. Whenever inflammation exists, there is essentially a congestion of the arterial capillaries; and when it subsides, there remains, among other results, a condition erroneously termed chronic inflammation—a condition essentially the same as the one just described, attended with a loss of tone in the vessels and an obstructed circulation; but "chronic inflammation" is a misnomer,

since the condition is found where no previous inflammation has existed. The usual seat of the so-called inflammation, and the circumstances under which it is generally found, have already been stated, as well as the fact that what we have chiefly to deal with is the direct results of a loss of tone in the venous circulation throughout the pelvis. The use of hot-water vaginal injections is equally beneficial in all those conditions which constitute the various forms of disease in the female organs of generation, and which are amenable to any treatment other than a surgical procedure—and equally so whether the congestion is venous or arterial. This remedy is not to be considered a cure-all, but one of the most valuable adjuncts, under all circumstances, to other means. Yet so beneficial is it, except in displacements of the uterus, that I believe more can be accomplished in the treatment of the diseases of women by its use and a carefully regulated plan of general treatment than by all other means combined. After a vaginal injection has been properly administered in accordance with the directions given in Chapter V, the mucous membranè will be found blanched in appearance and the usual calibre of the canal lessened, as after the use of a strong astringent injection. As the patient lies on the back, with her hips elevated, the blood will be aided by gravity in its return to the heart, and the veins will be rapidly emptied sufficiently to relieve their over-distension.

In this position, also, the vagina will be kept fully distended by the weight of the water, and only the surplus amount can run off into the bed-pan beneath. The hot water will then be in contact with every portion of the mucous membrane under which the capillaries lie. The vessels going to and from the cervix and body of the uterus pass along the sulcus on each side of the vagina, and their branches enclose the vagina in a complete network. The vessels of the fundus, through the veins of which the blood flows to the liver and back into the general circulation, communicate freely, by anastomosis, with the vessels distributed to the body and cervix below.

“If, then, we are able to cause the vessels of the vagina to contract, through the stimulus of the hot water, we can, directly or indirectly, influence the whole pelvic circulation. It is most important to appreciate the necessity for elevating the hips, by which plan so large a portion of the venous blood becomes drawn off by gravitation. If the stimulus of the hot water is then applied, so as to cause the vessels to contract still more, we shall, for a time at least, have the pelvic circulation reduced almost to its natural state. In order to allow the contraction to be as prolonged as possible, I generally direct the injection to be given at night, in bed, just as the patient is ready to retire. Thus, by constantly causing the vessels to contract, and by resorting to every other means of lessening the supply of blood in the pelvis, we shall

succeed eventually in securing a proper vascular tone. No plan of treatment could be more rational or appeal more forcibly to sound judgment. But, unfortunately, owing to a *neglect of details*, it is rare that the slightest benefit is derived from the use of the injections, although so many years have elapsed since the profession has been fully informed as to their mode of action. For fifteen years at least, I have been experimenting by different methods in the use of hot water, and have had during that time as large a number of cases as would be likely to be at the service of any practitioner, and I have arrived at the conclusion that it is an impossibility for a patient to properly give these injections to herself so as to derive their full benefit. Not the slightest advantage is received from them when administered with the patient in the upright position, or, as is the usual method, while seated over a bidet; for, given thus, the water does not dilate the vagina, but escapes directly along the nozzle of the syringe. I have found that the best mode of all is to have the injections while the patient is placed on her knees and elbows or chest. In this position we have the assistance both of gravity and of the pressure of the atmosphere to empty the pelvic veins, while the water is able to act on a much larger surface of the vagina than it is when the patient is in any other position. But this position is a difficult one to assume, since those who are in the greatest need of hot water have

not the strength to remain in it long enough to secure the full benefit; considerable difficulty is also experienced in keeping the patient dry. This latter, however, can in a measure be overcome by using a funnel-shaped receptacle with an india-rubber tube attached to the smaller end, the two sides being indented sufficiently to enable the patient to retain it in place by keeping the thighs together. I have also used an inclined plane to elevate the hips; it should come between the legs and have a hole large enough for the buttock, so that the water may flow into a receptacle below. These methods, or any other which the ingenuity of the physician may suggest, can be employed, so long as the action of gravity is brought into play and the vagina is fully dilated by the water. But, for the largest number of cases, the position on the back, with the bed-pan to elevate the hips, will be found the most convenient. Few women are so situated as to be unable to get somebody to administer the injection properly, and the inconvenience of soliciting aid is a trifling one considering the benefit to be derived from it. Experience, too, has shown that, *unless details can be carried out fully*, the process only involves a waste of time and a tax on the strength of the patient. The temperature and quantity of water are to be varied according to circumstances. When the early stages of inflammation are under treatment, it is necessary that the temperature should be elevated rapidly from that of blood heat to 110° , or to as high

a degree as can be borne by the patient, and that the injection should be often repeated. For ordinary use a gallon of water, two or three degrees above blood heat, is generally sufficient, but the temperature must be maintained at the highest point by the addition of hot water from time to time. The hour of bed-time is generally the best in which to seek for the beneficial effects of hot water upon the local irritation; for a prolonged vaginal injection, at a high temperature, will often, when given by an experienced hand, act with more promptness than an anodyne in allaying the nervousness and sleeplessness of a hysterical woman. I have frequently known a patient, after being well rubbed and having received an injection, to fall asleep before the nurse had completed the process, and to be so overcome with drowsiness as to be but little disturbed when the bed-pan was removed.

“In rare instances, and from a condition I am unable to explain, cases are met with where a sense of weight and an uncomfortable feeling are experienced about the pelvis after an injection of water at the usual temperature. In some instances so much disturbance has resulted that I have been obliged to discontinue its use. But I have long since ascertained that the injection is well borne in these cases at a lower temperature, generally about 95° F., and that after a week or two the temperature can be gradually increased. This ‘cooking process,’ as it has been slightly termed, is rendered easier by the use of

ivory or some non-conducting material for the nozzle of the syringe, since the patient suffers more discomfort from the heated metal of the ordinary nozzle coming in contact with the vaginal outlet than from any degree of heat in the water which it is advisable to employ."

The originator's own words have been preferably reproduced here because the author can corroborate from personal observation that here, as in all other hydriatic procedures, exact appreciation of the technique and rationale will enable the practitioner to obtain the positive benefits resulting from this valuable measure.

WATER IN SURGERY.

The most important advance of modern times in hydrotherapy, and one which has always been overlooked or not credited to the latter, is the recognition of hot water as the chief means of rendering wounds aseptic. More lives have been and will be saved by appreciation of this fact than by any other connected with this subject. Here, too, an intelligent recognition of the principle involved (cleanliness) will lead to success. It will afford at once a conception of the importance of the method if we briefly compare that now in vogue with that of the past. We need not go very far back for the reason. During the late civil war between the States, water was a prominent element in surgical practice. My personal experi-

ence, as a regimental, field, and hospital surgeon, was as follows: All wounds were cleansed with cold (rarely warm) water, conveyed by sponges; compresses of patent lint, moistened with cold water, were applied, and these were carefully held in position by bandages and moistened from time to time. As soon as suppuration commenced, the wounds were sponged and syringed with warm water, and the dressings were kept moist with cold water. That many wounded recovered under this treatment, is true; but that it was an improper method, the frequent active and exhausting suppuration, the not infrequent accumulation of maggots, the common complications of erysipelas, septicæmia, and gangrene—and the comparative immunity from these undesirable complications under the modern dry treatment of wounds—amply demonstrate. (The modern idea would eliminate water from the treatment of most wounds.) During amputations, resections, and other operations, cold water was freely poured over the field of operation by means of large sponges. How much more gentle is the *modern method of irrigating* the exposed structures; how much more effective in reaching every nook and recess of the wound, which would escape the sponge or require its rude application! But there is still room for improvement in our boasted modern management during operations. It appears to me that the temperature of the irrigating fluid should approximate that of the body, and not be obtained

from a cold bottle. The same principle which demands warm water for laparotomy should apply to the less sensitive, but certainly not callous, parts involved in amputations.

It is one of the triumphs of water in modern surgery that experience has demonstrated the value of boiled water as an antiseptic in laparotomy.

HOT WATER THE BEST ASEPTIC AGENT.

The conviction is slowly gaining upon the surgical mind that the various medications resorted to, to render water aseptic, would become unnecessary if the proper preparation of the water and the proper temperature during its application were scrupulously attended to. Here the temperature of the water is an element of such decided import as to impress the most superficial observer.

HOT WATER AS A STYPTIC, ETC.

The application of hot water as a styptic and to prevent shock is of modern origin, and need only be referred to here to demonstrate the enormous and formerly disregarded value of this purely hydriatic measure. In post-partum hæmorrhage, intra-uterine injections with plain hot water are our chief reliance. They leave the uterus in an aseptic condition, which contrasts favorably with that remaining after the formerly vaunted persulphate-of-iron injection. By the use of hot water the uterus is left clean and free

from coagula, while after the iron injection it is filled with firm clots, whose removal must be accomplished by processes that may produce septic conditions.

The improvement of modern wound treatment is not due so much to the appreciation of certain antiseptics, as to the proper *application of water* as a cleansing agent before and during operations, and, what is equally as important, the abolition of its abuse after operations. The correct appreciation of the true functions of water in surgery, aided by the prolonged rest of the wound from the disturbances hitherto practiced by repeated cleansings and ablutions—a rest which is provided by permanent dry antiseptic dressings—these are the true causes of the enormous reduction of mortality from wounds in recent times. This fact, daily emphasized by clinical experience, cannot be too energetically inculcated into the mind of the profession, especially of its younger members, since the idea seems to dominate many that if corrosive sublimate, carbolic acid, or other antiseptic be applied in proper solution to wounds, all indications have been fulfilled. I hold that thorough cleaning of the field of operation by hot water and soap, and thorough irrigation of the wounded surface—in other words, strict cleanliness enforced by the abundance of hot water used without stint—will be the surgical antiseptic of the future. Then cleanliness will indeed lead to godliness, for it is godly to succor suffering humanity.

CONTRA-INDICATIONS TO THE USE OF WATER.

It is important to point out that water, like every other therapeutic agent of potent action, should be used with caution. Not only, as has been pointed out, is it imperative to adhere closely to a precise technique and to understand its rationale, but even the simple application of water may prove detrimental.

In *Eczema*, for instance, it is now a recognized principle to *abstain* from the use of water altogether. Formerly, bathing an eczematous surface was regarded as a *sine qua non* of the therapy of this disease.

That this is an error, personal experience has again and again demonstrated. I well remember a young colleague who suffered from a chronic eczema of the hands, for which he had been unsuccessfully treated *secundum artem* by zinc, tar, and other ointments, and rubber gloves. The suggestion to refrain from washing the parts led to an early recovery. Many instances of a similar kind have come under my observation. I refer to this apparently trivial point especially because it is a modern observation of which personal cognizance extends only to about six years, and from which I have derived more satisfaction than from all other so-called improvements in treatment of chronic eczema.

In Otitis Media.—In chronic suppurating otitis media the frequent injection of warm water is contra-

indicated. Numbers of observations, made when in charge of the eye and ear classes of two of our dispensaries some years ago, have convinced me that this is a practice which often maintains the supuration, macerating the inflamed and sometimes fungoid edges of the perforation, and proving a serious obstacle to recovery. The simple refraining from injections, and the substitution of the dry boracic acid treatment, has afforded me brilliant results in the most obstinate cases. This was well illustrated in a lady who, in early life, had been a patient of Politzer, but had been later under simultaneous treatment by an eminent laryngologist and an otologist of New York. The discharge was offensive and profuse, and had on this occasion been constant for six years. The syringe had been faithfully used to prevent unpleasant odor and check the suppurative process. Treated with dry boracic acid packing, entire cessation of the ulceration followed, and a complete cure was established in a few days.

In Normal Puerperal Condition.—A third contraindication to the local use of water, which I am glad to have been instrumental in enforcing several years ago, is the injection of warm water, with and without antiseptics, after normal labor. Valuable as this measure is after the comparatively rare abnormal labors when it is probable that septic material has been introduced by the frequent examinations or by instruments, or may have been formed by decom-

position of bruised and decaying tissues or retained secundines, *abstention from these injections after normal labors* should be the first rule of management of the puerpera.

In several papers before our medical societies I have offered practical facts, not theoretical arguments, to demonstrate that vaginal injections after normal labor and in the normal puerperal period are not only devoid of value as a prophylactic measure, but that they may prove a veritable Trojan horse, admitting the enemy, to whom we are energetically striving to deny entrance, into the precincts of the vagina, and thus letting loose the destructive elements among the torn and raw surfaces which expose the lymphatics. That this warning is not out of place, even at the present day, is evidenced by the fact that in the London Lancet of Jan. 21, 1891, an article appeared from the pen of one of the physicians to the Rotunda Hospital, warmly advocating the washing out of the uterine cavity with hot water as a *routine* treatment in private and hospital practice. Coming from the school which first taught that "meddlesome midwifery is bad" with regard to instrumental labors, such dangerous interference is, to say the least, singular at a time when modern obstetrical art applies its precautions not only to instruments, but even goes so far as to eschew digital examinations. (Leopold, of Dresden, forbids these to the students, in order to favor asepsis of the vagina.) Hence the author is warranted in

entering in this treatise upon water in general, a third contra-indication, viz., to abstain from its introduction into the vagina after normal labors.

It is as important to know how and when *not to use* water as how and when to use it, because, as will frequently appear, water is powerful for evil as well as for good.

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