COLLECTANEA JACOBI

COLLECTANEA JACOBI

IN EIGHT VOLUMES

Vols. I, II and III, Pediatrics

Vols. IV and V, General Therapeutics and Pathology

Vols. VI and VII, Important Addresses, Biographical, and Historical Papers, Etc.

Vol. VIII, Miscellaneous Articles, Authors' and Complete Topical Index

DR. JACOBI'S WORKS

COLLECTED ESSAYS, ADDRESSES, SCIENTIFIC PAPERS AND MISCELLANEOUS WRITINGS

OF

A. JACOBI

M. D. UNIVERSITY OF BONN (1851); LL. D. UNIVERSITY OF MICHIGAN (1898), COLUMBIA (1900), YALE (1905), HARVARD (1906).
Professor of Infantile Pathology and Therapeutics New York Medical College (1860-1864); Clinical Professor of Diseases of Children, New York University Medical College (1865-1869); Clinical Professor of Diseases of Children, College of Physicians and Surgeons, Columbia University (1870-1899); Professor of Diseases of Children in the same (1900); Emeritus Professor of Diseases of Children in the same (1903); Consulting Physician to Bellevue, Mount Sinai, The German, The Woman's Infirmary, Babies', Orthopedic, Minturn and Hackensack Hospitals.
Member of the New York Academy of Medicine (1857), Medical Society of the City and County of New York, Medical Society of the State of New York, Deutsche Medizinische Gesellschaft of New York, New York Pathological Society, New York Obstetrical Society, Association of American Physicians, American Pediatric Society, American Climatological Association, Congress of American Physicians and Surgeons, American Medical Association, International Anti-Tuberculosis Association, Association for the Advancement of Science; Associate Fellow of the College of Physicians in Philadelphia, Société de Pédiatrie de Paris, Société d'Obstétrique, de Gynécologie et de Pédiatrie de Paris, American Academy of Arts and Sciences; Foreign Member of the Geselischaft für Geburtshülfe in Berlin; Corresponding Member Physicalisch-Medizinische Gesellschaft of Würzburg, Gynecological Society of Boston, Obstetrical Society of Philadelphia, Gesellschaft für innere Medizin und Kinderheilkunde in Wien.
Honorary Member Yonkers Medical Association, Louisville Obstetrical Society, Abingdon, Va., Academy of Medicine, Brooklyn Medical Society, Medical Society District of Columbia, New York Obstetrical Society, Medical and Chirurgical Faculty of Maryland, American Laryngological Association, Pediatric Society of St. Petersburg, Pediatric Society of Kiev, Royal Academy of Medicine, Rome, Deutsche Gesellschaft für Kinderheilkunde, Verein für Innere Medizin of Berlin, Royal Society of Medicine of Buda Pesth.

IN EIGHT VOLUMES

EDITED BY WILLIAM J. ROBINSON, M. D.

NEW YORK

1909

CONTRIBUTIONS
TO
PEDIATRICS

BY

A. JACOBI, M.D., LL.D.

VOL. II

EDITED BY WILLIAM J. ROBINSON, M.D.

NEW YORK
THE CRITIC AND GUIDE COMPANY
12 MT. MORRIS PARK WEST
1909

CONTENTS

VOLUME II

CONTENTS

CONTENTS

GENERAL THERAPEUTICS OF INFANCY AND CHILDHOOD

Therapeutics of infants and children has gone through its various stages between the era of dull and ignorant prescribing and that of impotent and conceited nihilism and of churlish pessimism. But neither a deluge nor an absence of drugs makes a physician, nor do they contribute, *per se,* to the welfare of a single individual or of the community.

The first indication in therapeutics is a correct diagnosis. The most efficient treatment is local, and the cause, seat and essence of a morbid process should be known, or at least sought for. Many a diagnosis at the present time is still simply symptomatic, though less so than in bygone times. Half a century ago, or less, symptoms like paralysis, convulsions, dropsy, or jaundice were considered full-fledged and sufficiently scientific diagnoses; to-day even chlorosis, pernicious anæmia, diabetes, epilepsy, and many others require etiological differentiation to be understood and appropriately treated. The most promising therapy of the future—serotherapy—owes its origin and importance to nothing but an accurate bacteriological diagnosis.

Much has been said of the difficulty of a diagnosis in the diseases of infancy and childhood, and the consequent difficulty experienced in treating them. I do not believe that the diagnosis in the case of an adult is much easier; in many instances it is more difficult. The latter will often mislead you intentionally, or because he is carried away by prejudices and preconceived notions; the infant may conceal by not being able to talk, but will certainly not tell an untruth. Besides, the ailments of children are rarely complicated, and usually a single diagnosis tells the whole story. If it be not made, it is perhaps best for the practitioner not to attempt much doctor-

ing, beyond the relief of the most urgent symptoms, and for the patient to be let alone. For, happily, most diseases have a tendency to get well, either completely or partially, and many will run a more favorable course when not meddled with.

This does not mean, however, that I discourage treatment even in such ailments as run a typical course extending over a number of days or weeks. On the contrary, I am opposed to the practice—much too common—of those who do not, for instance, wish to interfere with a whooping-cough because it finds its natural termination after several months. This is true, but many of the children also find their natural termination during these months. Every day of whooping-cough is a positive danger. A lobular pneumonia which occurs in the second or third month of the disease, and proves fatal or terminates in tuberculosis, would have been prevented if the original affection had been removed or relieved by treatment. A physician advising no treatment in such cases as terminate unfavorably in this manner ought to be held responsible for his neglect. Nor do I approve of the practice of "meeting symptoms when they turn up." My responsibility is not lessened by my busying myself with subcutaneous injections of brandy, when a collapse has set in which I ought to have foreseen and prevented, or with giving digitalis when on the fifth or sixth day of a pneumonia the pulse is flying up to 160 or 200. Anybody can perform that sort of perfunctory expectant treatment extending from the first call to the writing of a death certificate. What I expect of a physician is to know beforehand whether or not that individual heart will carry its owner through an inflammatory or infectious disease without requiring stimulation. Many a case might be saved by a few grains of digitalis or another cardiac tonic or a few efficient doses of camphor or musk, if administered in time.[1]

[1] "Our platform should be: In order to obtain indications for treatment make a diagnosis. That art is becoming both more accessible and, through honest and hard work, more easy with the aid of modern methods. Remember that most diseases have, indeed, a tendency to spontaneous recovery, but also that

Altogether, it has always appeared to me most satisfactory to treat children, and particularly infants. They are truthful, unsophisticated; they are what they appear, and they appear what they are. In their pathology and therapeutics there is no mysticism, no faith-cure, no spiritism, nor any other diabolism. Their diseases are seldom influenced by mental impressions and emotions, and for that reason "suggestion," hypnotism, or any other confidence game has no power over them, certainly not to the same degree as over adults. But older children may be influenced to a certain extent. Neurasthenia, neuralgias, and hysteria are not unknown among them; like strong irritations of the senses, the incautious causation of emotions and the awakening of autosuggestions may become dangers to psychical life and lead to somnambulism, hysteria, and intellectual and moral perversities of all kinds. Imitation, or emotional contagion, in a schoolroom leads to chorea, in a dormitory to enuresis. Children's nature and that of their ailments are simple enough, but you must know how to understand them. Unfortunately, however, for incompetent practitioners, children are no mere miniature editions of adults, and their ills and whims and peculiarities must be known, patiently studied, and, together with the ignorance and the prejudice and caprices of the parents, endured.

Though pediatrics is no specialty like, for instance, ophthalmology, and the practice prevailing in Europe, mainly in Germany, on the part of those who are in the market for business and reputation, of advertising themselves as children's specialists ("Kinderarzt"), is both ludicrous and reprehensible, there is enough in the physiology and pathology of infancy and early childhood to justify the most careful attention to their peculiarities, mainly on the part of those who have laid a solid foundation of general medical study. This is essential. That is why pediatrics should form the most important branch of the very last year—the fourth with us—of a medical curriculum. In the contemplation of the healthy and of the morbid condition of

recovery is not always complete and that invalidism should not be invited through neglect of treatment." (*Trans. of the Med. Soc. of the State of N. Y.*, 1901.)

the young the first consideration is the imperfection of the tissues. Cell-growth is still or is apt to remain embryonal. That is why hemorrhages are so frequent soon after birth and why most tumors encountered in later life have a fœtal origin. Voluntary and involuntary muscular action at that age is insufficient. Circulation is different from what it is to be, the heart is comparatively large and strong, the arteries in part larger (carotids, renal) compared with the size of the organs they supply, and compared with their own size as attained in later years. Digestion is not competent compared with that in adults. Muscular action is defective, and the gastro-intestinal secretions not equal to those of advancing growth; still, it should be known that the differences are not so great as prejudice or the obstinacy of often refuted impressions will have it. For to this very day there are innumerable men who will simply not submit to what has often been and may easily be proven to be a fact, that the newborn has a diastatic amylum-digesting ferment in his salivary glands. The nervous system of the newborn is but little receptive, is still less apt to exhibit reflex action than later on; in the young infant the inhibitory function is scantily developed. The most characteristic feature of the young is their growth; developmental diseases are very frequent. To this class belong those of the locomotor system, osteitis and epiphysitis of every kind, including spondylitis, rhachitis, and scoliosis; of the nervous system, such as meningitis and encephalitis; of the lymphatic system, such as adenoids, hypertrophies of the tonsils, adenitis, periadenitis, and polypi of the rectum. In close connection with his disorders is the congenital condition of mucous membranes. On the combination of the imperfect or morbid condition of those two rests the condition we call scrofula. The respiratory organs have their own peculiarities; their inflammations have a peculiar type in early years, and the narrowness of the larynx explains many of the imminent dangers connected with even a thin diphtheritic exudation. Infectious fevers generally can be best studied in infancy and childhood. These are only a few instances proving that a large part of general and special

nosology can be studied in infants and children only, and that both hygienic and drug therapeutics cannot be complete by far without the information drawn from the morbid conditions of infancy and early childhood.

The period of puberty requires particular attention on the part of the therapeutist. There are sudden changes. The heart grows suddenly, the blood-vessels, formerly wide, are relatively narrower; the body grows, with it the head; metabolism is very active, the muscles gain strength, the sexual organs develop and send to, and derive from, the central nervous system new sensations and impulses. Hereditary taints show themselves at that period, epilepsy and insanity reveal the neurotic taints of parents or grandparents; so marked are such outbreaks of developmental origin that, when intermitting, they may return during the climacteric period. Growth may stop, however, at that time; small stature, deformity of the genitals (with or without hernia), absence of beard may explain and detect the previous criminal. In milder cases there are general feebleness, neurosis, headaches, chlorosis, menstrual irregularities, changes of character, with or without onanism, or the onset of constitutional diseases. No new diseases need appear about this period, but the impressibility and vulnerability of the nervous system, the tendency to anæmia occasioned by the sudden growth, and the frequent lack of harmony in the development of the different organs are able to start hidden diseases and tendencies, and require the most painstaking care of the judicious practitioner in regard to diet, hygiene, and medicinal therapeutics.

There is one all-important principle in treating infants and children which cannot be repeated too often. They are very liable to become anæmic, to submit to general inanition, and to suffer from failure of the heart in spite of its anatomical and physiological vigor. These facts render it urgent that the physician never lose sight of the general condition of the patient while attending to a local disorder.

Good treatment is always preventive; it should save strength, if any be left, and provide at once for such comfort as will facilitate physiological functions. Do not in-

sist, at the cost of a patient's life, upon having a very accurate local diagnosis when a pleuritic baby with a pulse of 180 and agony imprinted on its pinched, flushed face, appeals for mercy. It may die while and because you are satisfying your "scientific" interest. Or when a patient, old or young, gets into a hospital ward after a tedious ambulance trip that exhausted whatever vitality was left, let there be no routine bathing and no close examination until the patient has been rested and a stimulant and probably food have been administered. To act differently may kill him.

Then, attention must be paid to the way the sick are placed or kept in bed. As long as they are conscious they will aid the doctor in determining their posture; but grave infectious fevers, such as meningitis, influenza, typhoid, etc., impair consciousness and the self-protection it affords. A patient must not be allowed to rest on the same side always. Hypostatic congestion of a lung may be prevented or even cured by proper alternation. Gangrene may thus be prevented. Other suggestions which should force themselves on the attentive physician, and might be multiplied, are as follows:

Congestion of the cranial cavity and meningitis require a rather erect or at least semi-recumbent posture. Convulsions thus originating may be relieved by changing the horizontal position into one more vertical. Care should be taken, however, not to raise the head alone and thus interfere with the circulation of the neck. The trunk must be raised with the head at the same time. Be also sure that no feather pillow or mattress add to the internal heat. Anæmia of the brain requires a horizontal or nearly horizontal position; temporary syncope, a temporary lowering of the head and upper part of the trunk even below the horizontal level.

Spondylitis, no matter whether tuberculous or traumatic, requires absolute rest on a mattress; the former is more frequent, and in its incipient stage may heal with rest and general proper treatment. The latter will, however, never suffice without the former. Marked rhachitis requires rest. Bending limbs should be discouraged from walking, soft-

cned cranial spots protected by a hollow air or hair pillow, and bending ribs and spine demand carrying in a well-lined brace (pasteboard, leather, wood, felt, wire) until after months the bones are sufficiently hardened. A rhachitic child should never be carried on the arm before the bones are hardened, and surely not persistently on the same (right) arm. Scoliosis is the invariable result.

Children suffering from retropharyngeal abscess, pharyngeal phlegmon, or laryngeal obstruction bend their heads back to facilitate respiration. Until fully relieved, their heads should be supported in the position voluntarily assumed. In incipient pleurisy they will try to lie on the healthy side; when effusion has taken place, however, on that of the effusion, to give fairer play to the healthy side. In local pneumonia, mainly of the upper lobe, a rather erect position is preferred; in a total pneumonia of a whole side or an extensive lower lobe affection most patients prefer a nearly horizontal position, with slightly raised head only, to permit extensive excursion of the diaphragm and the cooperation of abdominal respiration. Heart diseases with dilatation and hypertrophy and pericardial effusion require semi-recumbent position in bed or erect posture out of bed. Dilatation of a bronchus and abscess or gangrene of a lung demand posture on the healthy side; thus expectoration of the putrefying or putrid mass is facilitated. Moreover, in that position the inhalation of disinfectants is rendered easier. During pulmonary hemorrhage the patient should, if possible, lie on the affected side to prevent to some extent the blood from running into the healthy lung.

Proper feeding and nursing of the infant prevent the numerous gastric and intestinal diseases of the earliest period, which either destroy life at once or lay the foundation of continued ill health. For that reason a rather large part of my literary labors has been dedicated to the questions of diet and hygiene. These and medication belong together. That is why the first chapter of this work necessarily contained some remarks on medication, and this one, dedicated to therapeutics, cannot abstain from referring to diet. Those who still object to drug medication on

the "principle" of ignorance, or worse, are requested to kindly determine the boundary line between medicinal and hygienic agents or products. Attention to respiration and circulation and to the functions of the skin are of similar moment. Their requirements will be discussed in special chapters. The subjects of climate, massage, electricity, orthopædics, and gymnastics will find their places with the diseases of the lungs, muscles, nerves, joints, etc. Bathing, cold washing, exercise, and sufficiently long interruptions of school hours to avoid exhaustion are subjects of vital importance. Physicians and humanitarians have declaimed against premature schooling, too long hours, too short recesses, and objected to the overcrowding of the curriculum and to the vanity of incompetent school-masters and mistresses who utilize the poor victims in behalf of exhibitions; mostly in vain thus far. A child of seven or nine years should not have more than two or three hours daily, one of which should be spared for intermediate recesses; from nine to twelve years the school hours should be three or four, after that age not more than five hours, with frequent and ample recesses. If the mentally slow were taught separately, bodies and minds of all classes of children would be benefited beyond the possibilities of a hot-house instruction. The best exercise of the child is play in open air. Compulsory gymnastics in badly ventilated localities cannot take its place successfully, and may add to exhaustion and ill health. It is an unfortunate fact that when the claims of physical development were urged upon school authorities, gymnastics were added to the overcrowded curriculum as a matter of business necessity, or of conviction, not always willingly or intelligently. The summer vacations of public school children ought to be four weeks longer than they are. The public schools ought to be closed about the middle of June and reopened in October. Many years ago the Harlem Medical Association and the Medical Society of the County of New York requested the Board of Education of the city to open the public schools on the third, in place of the first, Monday in September. The soundness of the principle was appreciated, and the necessity for such a change was acknowl-

edged by the authorities, and *therefore* (!) the second Monday of September was selected for the beginning of the school season, so as to afford the children an extra week's broiling in the city sun and an opportunity to lose, as they did formerly, the benefit derived from the summer vacation. The sanitary reason for this loss of a beneficent opportunity was said to be the virtuous anachronism of an eighteenth-century school superintendent, still in office in this twentieth century until a few months ago, who said he preferred the influence of the school-room to that of the New York streets for the New York boy. The good effects of the excursions of the St. John's Guild and the air funds and of the Sanitaria of the Guild and the Children's Aid Society, and many other sensible charities, are steps in the right direction.

The beneficent influence of fresh air is enhanced by that of light. Rooms situated toward the north exhibit a musty odor compared with those directed toward the south. Sunlight oxidizes organic substances and destroys bacteria. Light without warmth has been recommended against bacilli, syphilis, furunculosis, and lupus. Others recommend against the latter light and warmth, as also against rheumatism where it is said to cause perspiration without urea, and against neuralgias; the same is recommended for the increase of erythrocytes and hæmoglobin. Old clinicians and physiologists appreciated the influence of light. Winslow charged insufficient light in the houses with being the cause of retarded mental and physical development and of rhachitis. Moleschott knew the slowness of metabolism in children when not exposed to light. In light the elimination of carbonic acid and the assimilation of oxygen are increased. In open air the temperature of the body is higher by 0.5° C. than in dwellings. It is true, however, there is the additional influence of air (and exercise?).

The subject of *bathing,* or rather of *hydrotherapeutics* in general, deserves some preliminary remarks in connection with a future discussion on "bathing." There is hardly a topic which deservedly has attracted the attention of the profession (and of the public) in the last decade or two to a greater degree than that of water and of its

uses as a remedy. As I am writing no history, I mention but two (modern) names that merit most credit in outlining both the indications and the methods of its uses, Winternitz, in Europe, and S. Baruch, in America. Cold water was long believed to have an antipyretic action only. Now the indication to reduce the temperature of the body arises when an excessive frequency of the pulse, degeneration of the tissues of the heart and other muscles, of the kidneys and of the brain, dryness of the mucous membranes, and impairment of absorption appear to result from it, but from it alone. Cerebral symptoms, such as delirium and convulsions, are then not uncommon. Particularly is that so in the onset of a disease, while the same temperature may be readily endured at a later stage. That is why the elevation of temperature alone, without the above dangers either present or feared, should yield no indication for antipyretic treatment; indeed, many a child bears easily a temperature which carries danger to another; and there are high temperatures in some diseases, such as many forms of typhoid fever or of intestinal auto-infection, which do not seem to interfere much, for a while at least, with the ease and comfort of the patient. Unfortunately, however, the thermometer, ranging 103° F. or more, is often permitted to establish indications, and the reduction of temperatures appears to become a fad and the only acknowledged duty of many practitioners.

To reduce temperatures we have drugs and water. Of the former, quinine should not be relied on except in malaria, also in some septic fevers, when it may be used by itself or in combinations during remissions. The coal-tar preparations, antipyrin, salipyrin, lactophenin, phenacetin, etc., will all reduce temperatures, and have their occasional indications, but are known to depress, one more, the other less, the action of the nervous system and the functions of the heart, and even to destroy blood-corpuscles. Acetanilid has the latter effect more than any of the rest and should be discarded altogether. Their administration requires the utmost care, and frequently demands the combination with stimulants to guard against detrimental effects.

The temperature of the young body is easily influenced by apparently slight causes; it may rise and fall almost suddenly. A sudden rise and a continuous heat may prove dangerous; remissions and intermissions are loopholes for escape from dangers. These dangers are not so much the direct result of a high temperature as of the toxic effect of circulating microbes or their products. A moderate degree of temperature is well tolerated and should not be interfered with. In many cases it should be looked upon as a reaction of the organism only and in others should be considered welcome by its effect on the destruction of microbes and toxins and its favoring the formation of antitoxins in the infected blood and cells. Not infrequently the very worst and most unmanageable cases of sepsis, diphtheritic, scarlatinous, or puerperal, run their bad or fatal course with low temperatures, while those with high temperatures will recover.

Water, when properly employed, lowers the temperature, but has none of the depressing effects of the coal-tar antipyretics. On the contrary, it stimulates the nerves of the skin and by reflex those of the whole system, particularly of the heart; it increases heart and arterial pressure, thereby aids oxidation of tissues and diuresis, and appears even to increase the amount of hæmoglobin and of red cells. In this respect there can be no longer a difference of opinion; but in regard to the use of cold washing, with or without friction or affusion, of packing, of ice applications, of hot, warm, or cold baths, of the duration of an application or of a bath, and of the degree of temperature requiring or permitting their employment in an individual case, no iron-clad rule will ever hold good.

A cold bath (from 60° to 75° F.) is seldom, if ever, appropriate for a baby of less than eight months or a year, and never in congenital heart disease. If given at all, it ought to be interrupted when the child begins to shiver or the lips become bluish; it cannot be expected to have a good effect unless the feet share immediately in the reaction which should take place after the bath. A cold bath should, according to circumstances, sometimes

be preceded or followed by the administration of a stimulant, and usually not be extended beyond four or five minutes and be accompanied by friction of the surface, mainly of the extremities. A warm bath (from 85° to 98° F.) differs so much from the temperature of a feverish child (from 101° to 107° F.) that a reduction will also be readily accomplished by it. Besides, the patient submits to it more readily. The temperature of the bath decreases from minute to minute, or, if necessary, may be lowered by adding cold water. A warm bath, when given for the purpose of reducing *temperatures,* should last longer,—from five to fifteen minutes,—and may be given a number of times daily. After a cold bath the child should be covered warmly, particularly the feet, at least until the cutaneous circulation is fully restored; after a warm bath the covers should not be too heavy, in order not to lose the benefit of copious radiation from the surface. Packs of cold water, iced or not, need not, in most cases ought not, to cover the whole body of the child; arms, feet, and legs should be left out. A single thickness of a common towel or napkin is wrapped around the body, exclusive of the arms, either the chest alone, or the abdomen alone, or both, and the thighs, according to the more local or more general effect which is to be attained; and a layer of oil-silk or rubber cloth, and over it a flannel sheet or blanket should cover the pack. To reduce local congestion or inflammation (conjunctivitis, peritonitis, arthritis, meningitis) cold water, ice-water, or ice-bags may be used. *Small children do not tolerate ice applications to the head for any length of time, collapse resulting the more readily the thinner the skull.* Applications should not be too wet; small pieces of cloth cooled on a lump of ice should be frequently changed in cases of conjunctivitis. Extensive meningitis requires at least two ice-bags, the effect of which should be carefully watched.

Cold compresses, well wrung out and covered with flannel and oil-silk, to small or large surfaces, and allowed to remain from twenty to fifty minutes until the skin is hot, are efficient stimulants. Hot baths (from 96° to 105° F.) act as stimulants, but should be given sparingly and be of

short duration, as too exciting or exhausting, when lasting long, for most patients. The head must be cooled while the body is immersed. Short hot baths, with or without mustard and with or without cold applications to the head, dilate the superficial blood-vessels, and will be found useful in an occasional case of pneumonia, in collapse, or to favor the cutaneous eruptions of scarlatina and of measles. After removal from the bath, the patient should be covered with hot blankets, and a hot drink, such as water, an aromatic tea, or milk, should be given freely to promote perspiration.

When bathing is resorted to as a means to lower or to increase blood-pressure, the effect of medicines given at the same time should be taken into consideration. Morphine lowers it, digitalis increases it; a bath to counteract the effect of morphine should have a lower temperature; to relieve that of a dose of digitalis, a higher temperature.[2] That is why the dose of a bath—that means its temperature and its duration—should be adapted to the normal and the morbid conditions of the individual patient.

Because of its grave importance, I repeat here that milk and drinking-water are safest when boiled. It is to be hoped that, whenever fresh and fairly sterile milk cannot be obtained, the method of sterilizing milk devised by Soxhlet, of Munich, and introduced in New York by Caillé, and systematically employed by Rotch, of Boston, and his followers, will prove successful. Mental and physical labor ought to be easy and pleasant. Factory work for children is an abomination, and not only a cruelty committed against the individual helpless child, but a danger to the future of the republic, which cannot be expected to thrive while the physical and intellectual development of the future citizen is crippled by the greed of the manufacturer and the recklessness or the partiality of legislatures.

It is evident, therefore, that *preventive medicine* is coming to the front as the main reliance of the future, in which

[2] Karl Lewin, Phys. Diät. Therapie, Wiener Klinik, No. 8, 1901.

the public-spirited and well-informed general practitioner will again be recognized as superior in breadth of horizon and good citizenship to the merely dexterous specialist. Besides preventive medicine, drug therapeutics has not been left behind in the evolution of practical medicine. Since the times of Magendie, who supplied us with the first alkaloids, the laboratories of the pharmacologists, both in professional chairs and in factories, have added to our exact knowledge of drugs and their effects. At the same time physical therapeutics has developed simultaneously with drug therapeutics. The claim of some of the most modern writers, however, that physical therapeutics, such as hydrotherapy, electricity and galvanism, and the study of climate, is an accomplishment of the last few years, is not justified by the history of therapeutics. Only the books get bigger and sometimes out of proportion to our increased knowledge. Physical therapeutics has been extolled as " merely aids to natural processes," and " not medicines in the usual meaning " of the word. On that score superiority has been claimed for it. What that expression means I am at a loss to explain. I do not take a medicine to be a bullet that kills a disease from afar, nor a rope that strangles it. The enthusiasm of " physical therapeutists has sometimes grown into fanaticism. Does physical therapeutics militate against drugs? make them unnecessary, useless, or injurious? If water and massage and electricity are " natural " aids, are iron, digitalis, mercury, arsenic, alcoholics, or acids " unnatural "? The narrowness of some minds cannot be better demonstrated than by the angry shopkeeper rivalry of doctrines or teachings or therapeutical aids meant to work for the same legitimate and humane ends.

In the *administration* of medicines excitement on the part of the patient must be avoided; the nervous system of infants and children loses its equilibrium very easily. Fear, pain, screaming, and struggling lead to disturbances of the circulation and to waste of strength. Preparations for local treatment or for the administration of a drug must be made out of sight, and the latter ought not to have an unnecessarily offensive taste. Naphtalin, iodoform, beta-

napthol, rhubarb, and such like should be shunned. The absence of proper attention to this requirement has been one of the principal commendations of "homœopathy," whatever that may have been the last twenty or thirty years. Still, the final termination of the case and the welfare of the patient are the main objects in view, and the choice between a badly tasting medicine and a fine-looking funeral ought not to be difficult. In every case the digestive organs must be treated with proper respect; inanition is easily produced, and vomiting and diarrhœa must be avoided, unless there be a strict and urgent indication for either an emetic or a purgative. The most correct indications and most appropriate medicines fail when they disturb digestion; it is useless to lose the patient while his disease is being cured.

The administration of a medicament is not always easily accomplished. Indeed, it is a difficult task sometimes, but one in which the tact or clumsiness of the attendants has ample opportunity to become manifest. For "when two do the same thing, it is by no means the same thing." Always teach a nurse that a child cannot swallow as long as the spoon is between the teeth; that it is advisable to depress the tongue for a moment and withdraw the spoon at once, and that now and then a momentary compression of the nose is a good adjuvant. That it is necessary to improve the taste as much as possible need not be repeated. Syrups turn sour in warm weather, glycerin and saccharin keep; the taste of quinine is corrected by coffee (infusion or syrup), chocolate, and "elixir adjuvans," a teaspoonful of which, when mixed each time before use, suffices to disguise one decigramme = one and a half grains of quinine sulphate. Powders must be thoroughly moistened; unless they be so, their adherence to the fauces is apt to produce vomiting. On the other hand, their prescription and preparation require care; for instance, many powders absorb moisture, such as potassium citrate, sodium bromide, calcium chloride, piperazin, lysidin, chloral hydrate, dry vegetable extracts, extracts of animal organs, citrate of iron and ammonium; others form a fluid when in combination, for instance, antipyrin and sodium salicylate; others,

like resorcin, change their color. Air-tight bottles or the addition of licorice powder correct some of these changes. Capsules and wafers are out of the question because of their size; pills, when gelatin-coated or otherwise pleasant and small, are taken by many. The rectum and the nose may be utilized for the purpose of administering medicines in cases of trismus, cicatricial contraction, or obstreperousness. Both of these ways it may become necessary to resort to for weeks in succession.

The rule not to prescribe incompatible medicines is valid at every period of life. For the treatment of children the following facts should be remembered. Corrosive sublimate should be dissolved in alcohol or in distilled water with the addition of sodium chloride. Calomel and iodides should not be given together or in close succession; calomel cannot be mixed with calcined magnesia; potassium permanganate not with syrup, or with tannin, sulphur, glycerin, alcohol, or sweet spirit of nitre; potassium chlorate not with carbon or with sulphur; alkalies not with alkaloids; tannic acid should not be prescribed with alkaloids or albumin.

The *effect* of a medicine depends on its dose and the readiness with which absorption and elimination take place. Medication, when its effect is wanted speedily, should be continued during the night; mainly in such patients as have healthy kidneys. In infants and children sodium salicylate, for instance, is readily eliminated, much more rapidly than in advanced age. Both absorption and elimination are very active in infancy and childhood; but they vary. Curare, for instance, is eliminated speedily, and must be repeated quite frequently; potassium iodide soon after its administration, but there are traces in the urine after some days; phosphate of lime appears in the urine and fæces directly; potassium chlorate is excreted through the kidneys within a few hours; silver and mercury may take a long time in exceptional cases. Absorption takes place the more readily the more the solution in which the medicinal substance is held is diluted; but it depends greatly on the condition of the surface or tissue which is selected for the introduction of the drug. A horny

skin absorbs but little; inunctions require a clean surface, and are best made where the epidermis is thin and the net of lymph-ducts very extensive, on the inner aspect of the forearm and the thigh. A congested stomach, a catarrhal or ulcerated rectum, are more or less indolent and disappoint our expectations quite frequently. High temperatures of the body exert their influence on mucous membranes and their secretions and absorbing powers, so that absorption and efficacy are diminished or annihilated. That the doses must be adapted to the ages of the patients is self-understood; but to establish fixed rules is more than merely difficult. To give as many twentieths of the dose of an adult as the child has years is a fair average; but this rule suffers from very numerous exceptions, like all the other rules that have been decided upon not at the bedside but at the writing-table. Like foods which are tolerated by the adult, but are not tolerated by the young, though the amounts be diminished in proportion to their years, so there are medicines which are not borne by the infant. Nor are the doses the same for every adult. As healthy persons thrive on different quantities of food, so there is a variableness in the amount of medicines required for full effect. Besides, there are idiosyncrasies which in some forbid the use of a medicine apparently indicated and borne with success by others. There are those who respond quickly, and sometimes too quickly, to very small doses of opium; others in whom a minute trifle of mercury produces salivation. It is this class of cases which gives rise to much disappointment and requires all the tact and foresight of a good physician. In some the system gets used to a drug after a short time. Babies, after having taken opiates for some time, demand larger, and sometimes quite large, doses to yield a sufficient effect. Excessive doses continued a long time have produced morphinism in children as in adults. Some drugs are required in proportionately large doses. Febrifuges and cardiac tonics, such as quinine, antipyrin, digitalis, strophanthus, sparteine, and convallaria, are tolerated and demanded by infants and children in larger doses than the ages of the patients would appear to justify. Potassium iodide may

be given in doses of one or two drachms (four or eight grammes) daily in meningeal affections, while in the same one of the heart tonics, caffeine, must be shunned because of its—under these circumstances—exciting and irritating effects. The same may be said of alcohol, which must not be administered in cerebral congestions unless they be of septic origin. Mercurials affect the gums very much less in the young than in advanced age. Corrosive sublimate, in watery solutions of one to eight or twelve thousand, may be given to a baby of two years with membranous croup in doses of a fiftieth of a grain every hour or two hours for five or six days in succession, with rarely as much as the most trifling irritation of the gums or of the stomach and intestines. In urgent cases of hereditary syphilis it can and should be administered on a similar plan for weeks, and, somewhat modified, for many months, to be resumed after an interruption of weeks, and later on of months.

If it be the object of medication to accomplish an end and to fulfil an indication with the least expense to the organic economy, and within the briefest possible time, we do not score a success in very many instances. Indeed, not every aim is reached directly and not all indications can be fulfilled at a moment's notice. As the object of eating and drinking is the reproduction and the growth of the body, as many a meal is required to produce a lasting and visible effect, and as every one of the meals is necessary for the sum total of the final results, so the administration of numerous small doses of medicines extending over weeks, months, and even years may be demanded for a certain purpose. Particularly is this so when chronic ailments of the blood, the nervous system, or tissue anomalies are concerned. To affect rhachitis, phosphorus requires weeks. The faulty sanguification of chlorosis is mended by iron, if at all, after weeks or months. Pernicious anæmia, sarcomatosis, even chorea require the persistent and protracted use of gradually increasing doses of arsenic. Syphilis and chronic conditions of hyperplasia require mercury or the iodides, or both, to accomplish the desired end, through months and even years. The organotherapy of

myxœdema or of cretinism has to be continued for months and years and resumed after interruptions. Even the effect of digitalis, as a heart stimulant and, by its effect on the smallest blood-vessels of the heart muscle, a nutrient of the heart itself, is obtained solely through the persevering administration of small doses in many chronic cases.

The dose of a medicine depends no less on the *mode* and *locality* of its administration. Modern therapeutics favors as much as possible local medication, like modern pathology, which requires local diagnoses. Subcutaneous administration demands smaller doses, the rectum sometimes a slight increase. There are some medicines which are absorbed and act as well in the rectum as through the mouth; this is a subject, however, to which we shall return. The manner of application results also in different effects. The inunction of the official ointment of potassium iodide is well-nigh inert; its effect is almost exclusively that of massage, for iodine makes its appearance in the urine after days only. Potassium iodide in glycerin, rubbed into the skin a number of times, may eliminate iodine after a day, in lanolin after a very few hours.

At this place it is well to remember the great additions to our therapeutical possibilities, though in a few words only. Our materia medica has been enriched with alkaloids and enabled us to give invariable and exact doses and to render medicines palatable,—advantages much greater than those derived from electrotherapy, Röntgentherapy, or even hydrotherapy. The gigantic strides of chemistry have furnished a large number of synthetic drugs, many of them of great efficacy for good and evil, and some very creditable to both the learning and enterprise of manufacturers. Serotherapy and the medication supplied by the thorough study of the ductless glands are in part due to them. But, after all, the weapons our ancestors had in the shape of mercury, iodine, opium, digitalis, and others have not become dull; indeed, modernized medicine has nothing like them, just as not one of the later or latest modern means of diagnosis excels or equals percussion and auscultation as taught eighty years ago.

Of serotherapy I shall speak again; *organotherapy* may be mentioned here. It was introduced to meet the dangers of the absence of "internal secretion." This is a term extensively employed, at first in regard to the adrenals (*Brit. Med. Jour.*, August 10, 1895), by Schaefer and Oliver, and generally admitted to be descriptive and telling. It is applied to some of the processes, partly physiological and partly chemical, of the formation and disintegration of material in different parts of the organism. Saliva, gastric and pancreatic juice, and bile are external secretions, and carried off by efferent ducts. Internal secretion, however, requires no efferent ducts, indeed, no glandular stricture, for it occurs also in muscle and in brain substance. Internal secretion is carried off into the lymph and blood directly. Liver and pancreas appear to have both external and internal secretions; but the thyroid, thymus, spleen, and adrenals appear to have internal secretion only. Their absence or removal or destruction by disease causes death with the symptoms of a chronic infection. This may result from one of two sources, or from both. Either those organs have the function of forming certain materials required in the organic economy, or that of destroying poisonous effete results of metamorphosis. Thus the absence or destruction or extirpation of the thyroid causes cachexia, that of the pancreas diabetes, that of the adrenals often Addison's disease. In regard to the thyroid, we are now certain that myxœdema and some forms of cretinism are favorably influenced, or even cured, by the administration of the thyroid glands of animals.

At best, organotherapy requires patience and time. Some of its effects cannot be obtained except by administering the substitute for the absent or defective organ persistently. Myxœdema and semicretinism are liable to relapse when medication ceases or is unduly interrupted. This will not be corrected, it is to be feared, until a normal organ is implanted into the suffering organism and made to perform its physiological functions. Thus far surgery has not succeeded in yielding the coveted results.

The *rectum* of the infant and child has been rising in

the estimation of the practitioner since the times of thermometry; for it is certainly the safest and easiest place to take the temperature. For therapeutic measures it is also invaluable.

The rectum of the young is straight, the sacrum but little concave, the sphincter ani feeble, and self-control is attained only gradually. Thus a rectal injection is easily either allowed to flow out or vehemently expelled. Therefore one which is expected to be retained must not irritate. The blandest and mildest is a solution of six or seven parts of sodium chloride in a thousand parts of water ("saline solution"). This may be made to serve as a vehicle of medicine, unless incompatible with the latter, which it will be but rarely. A medicated enema which is to be retained should be tepid and small in quantity, half an ounce or little more or less, and carried up well into the rectum, for the immediate contact with the sphincter may cause its expulsion. Care must be taken to exclude air from the syringe, which, for small quantities, must be a well-fitting piston syringe of hard rubber, with a long nozzle. This must be well oiled, and introduced, not straight, but with a gentle turn, so as to avoid folds in the anal mucous membrane (in the same way a thermometer *ought* to be introduced). The nozzle must not be too thin, as it is liable to be caught; the smallest nozzles of fountain syringes are therefore in most cases improper; the larger size is more appropriate for any age. The injection must be made while the patient is lying on his side, not on his belly over the lap of the nurse, for in this position the space inside the narrow infantile pelvis is reduced to almost nothing.

When medicines are to be injected, the rectum ought to be empty, as in infants it mostly is. When it is not, an evacuating injection ought to precede the medicinal one by half an hour. It ought to be of the mildest possible nature, for any irritation of the rectum, from the local effect of an enema to a catarrhal or dysenteric process, reduces its faculty of absorption. The medicinal solution must not be saturated; indeed, very soluble medica-

ments only are to be selected for medicinal enemata. Nor must they be acid or contain anything irritating. Alcoholic tinctures require relatively large quantities of water; quinine salts must not be selected unless very soluble, such as the muriate, the bromide, the carbamide (bimuriate with urea), or the bisulphate. The addition of a small amount of antipyrin renders quinine very soluble. No acids must be used for the purpose of keeping it in solution. Sodium salicylate, also antipyrin, exhibit their full power through the rectum, and permit of full doses. Frequently, however, the rectal doses are a little larger than those given by the mouth.

Larger enemata are not retained, and are therefore utilized for the purpose of emptying the bowels. This effect is easily obtained in infants and children, for their fæces are soft and movable, with the exception of those cases in which improper medicines (large and continued doses of calcium salts and bismuth or astringents), or badly selected food (casein and starch in undue quantities), or an excess of the normal great length of the colon descendens and sigmoid flexure have given rise to large accumulations of hardened fæces. Small quantities are seldom sufficient for the purpose of relieving the bowels, unless they act as irritants; in this manner glycerin, pure or with equal parts of water, may produce an evacuation readily. Irritants, however, should not often be used, for obvious reasons. An evacuant injection may weigh from a fluid-ounce to a quart, in some. It ought to be given while the child is lying down; the liquid must not enter the bowels quickly or vehemently, the fountain syringe not hang more than ten or twelve inches above the anus. If that precaution be observed, occasional pain or faintness or vomiting can be avoided. If water, or water with two-thirds of one per cent. of salt, be insufficient now and then, more salt or soap may be added for the purpose of enforcing the evacuation. Half a tablespoonful of oil of turpentine, with a pint of soap and water, often acts charmingly; so does the addition of a few drachms of tincture of assafœtida, in conditions of constipation, flatulency, and nervous excitability, also in convulsions; or glycerin in ob-

stinate constipation. A few ounces of olive oil is often preferable, as an evacuant, to anything else.

Large injections will have other indications besides that of evacuation of the bowels. In many cases of intense intestinal catarrh large and hot (from 104° to 108° F.) enemata will relieve the irritability of the bowels and contribute to recovery. They should be repeated several times daily. When such evacuations contain a great deal of sticky, viscid mucus, the addition of one per cent. of sodium carbonate will liquefy the tough secretion. When there are many stools, and these complicated with tenesmus, an injection, tepid or hot, must or may be made after every defecation, and will speedily relieve the tenesmus. In such cases flaxseed tea or thin mucilage may be substituted for water.

When the bowels are in a state of chronic catarrh or ulceration, the injections ought to be particularly large and contain astringent or alterant medicines. Though they be expelled immediately, enough of the dissolved or suspended remedy will remain upon the mucous membrane. Zinc sulphate, alum, lead acetate, tannic acid, silver nitrate, salicylic acid, carbolic acid, and creosote have been used in such medicated injections. One-per-cent. solutions will suffice. Salicylic and carbolic acids may prove uncomfortable or dangerous because of their effect on the kidneys, and ought to be dispensed with. Silver nitrate requires some precaution. From half a grain to five grains or more in an ounce of distilled water may safely be injected; but this enema must be preceded by an evacuant consisting of water only, and followed by one containing some sodium chloride for the purpose of neutralizing the nitrate and protecting the anus and external parts from local irritation. It will also be found advantageous to wash the anus and perineum with salt water before injecting the silver solution. In many cases where one of the above-mentioned agents appeared to be tolerated badly or proved inefficient, bismuth subnitrate (or subcarbonate), mixed with water or with gum-acacia water in different proportions, proved very acceptable and successful.

Suppositories are useful both for evacuating and medic-

inal purposes. Soap is utilized for the former purpose by the public at large, and the same material differently mixed, with or without medicinal additions, such as atropine, by the irregular trade. Local medicinal applications to the rectum are best made by means of injections, but a general effect is also obtained through a suppository. Opiates, and narcotics generally, exhibit their full power when the suppository is retained. Extract of hyoscyamus, from half a grain to a grain in a suppository, to be repeated from two to five times daily, shows its effect in relieving vesical spasm nearly as well as when taken internally. Quinine is gradually dissolved and absorbed. Extract of nux, both in ointments and in suppositories, acts well in prolapse of the rectum and debility of the sphincter.

Subcutaneous injections of remedial agents ought to be made more frequently than appears to be customary. The extremities, particularly their lower halves, should be avoided, for their constant motion and the relative absence of fat in their subcutaneous tissues are liable to give rise to local irritation, swelling, or suppuration. The abdominal wall or the lumbar region is preferable. The recommendation to use the interscapular space was made by famous men who worked in the laboratory and did not know what inconvenience there may be in a back, punctured and often sensitive, on which a patient is to seek his rest. A sharp and aseptic needle and gentle friction of the injected part is all that is required. The solutions used must be clear and without any solid ingredients. When they have been preserved for some time they ought to be filtered before being used, particularly when fungous growths have begun to make their appearance in the liquid. The latter may be preserved best by adding a small quantity of alcohol, salicylic acid, or boric acid. The doses must be as small as possible, and the medicine diluted more than in the case of adults. This is mainly required when a caustic effect is to be feared. While, for instance, Lewin advised for adults a solution of four grains of hydrargyri bichloridum in an ounce of water, one or one and a half grains give a more appropriate solution for infants. One or two

daily doses of eight or ten drops continued for weeks will prove very useful in those urgent cases of hereditary syphilis which are characterized by pemphigus on the soles of the feet and the palms of the hands in the first days after birth. Brandy and ether may be used undiluted as in adults, but the latter is particularly painful and the greatest care must be taken as to the locality injected. The subcutaneous tissue must be reached and the cutis penetrated by inserting the needle at a nearly right angle from the surface. Chloral hydrate dissolves readily in two parts of water, but a solution of one in four or six is better tolerated. For the ready symptomatic treatment of convulsions it renders good service. Antipyrin is well borne in solutions of one in six or eight parts of water, camphor in from four to six parts of sweet almond oil. The fluid extracts of digitalis and ergot are very apt to give rise to indurations and, perhaps, abscesses. As a rule, the most convenient medicaments for hypodermic administration are the very soluble alkaloids. One or three drops of Magendie's solution of morphine or the corresponding solution of morphine muriate is vastly preferable to the internal use of narcotics for bad pain in pleuritis or pleuropneumonia, or in peritonitis of advanced childhood. It may be mixed with atropine sulphate for the reasons regulating its use in the adult. The latter by itself has been found quite effective in the case of an epileptic boy, who had taken the same drug internally without any success. If possible, it ought to be injected during the aura; if not, twice a day. Apomorphine muriate is a ready emetic in doses of a thirtieth or a fifteenth of a grain. Pilocarpine muriate can be injected in doses of from one-twentieth to one-eighth of a grain. Its reckless use, both hypodermically and internally, has led to occasional mishaps, but the drug is a powerful agent for good when carefully applied, and has saved for me several cases of meningeal hyperæmia and cerebral œdema, mostly of nephritic origin. Strychnine sulphate, while in the same affections it has mostly proved inefficient when taken internally, has rendered efficient services in enuresis depending on paralysis or weakness of the sphincter of the bladder and in pro-

lapse of the rectum and fecal incontinence resulting from paralysis of the anus which depended either on disease or congenital incompetency. In these cases a daily dose of a fortieth or a twenty-fifth of a grain—according to the age of the patient or the severity of the case—is sufficient. More frequent doses, however, are required in the diphtheritic paralysis of the respiratory muscles, which is dangerous and apt to become fatal unless speedily relieved. A daily dose hypod. will yield fair results, when long continued, in the later stages of spinal or cerebral paralysis, where its internal administration is entirely or well-nigh useless. Quinine salts must be neutral when injected; I prefer the bromide, the muriate or the carbamide. They, particularly the last, are among the most soluble. The carbamide dissolves readily in from four to six parts of warm water; the latter temperature ought to be preferred in every case of subcutaneous injections. Quite saturated solutions ought to be avoided, because it has happened to me that the water of the solution was speedily absorbed, and the quinine remained as a foreign body in the subcutaneous tissue. Caffeine, in combination with sodium and salicylic or benzoic acid, is an excellent heart stimulant, and has rendered splendid service in urgent cases of heart-failure or pulmonary œdema depending on cardiac disease. Sodio-caffeine salicylate and benzoate are soluble in two parts of water, and are readily absorbed. Both should be avoided in those cases which are complicated with cerebral irritation or sleeplessness. Fowler's solution, carefully filtered and diluted with at least twice its quantity of distilled water, may be injected into healthy or morbid tissues without often risking irritation and abscess. Still, I have seen a splenic abscess after such an injection in a case of sarcoma of the spleen. Undoubtedly, the continued use of arsenic renders very efficient services in sarcoma; but as it has to be used quite a long time, it is almost impossible, except in hospital practice, to resort to hypodermic medication. There is no harm in this, however; for a slow, gradual increase of the drug is tolerated by the stomach to such an extent that very large doses (amounting to half a drachm = two cubic centimeters) of Fowler's solution

daily, well diluted, may finally be administered after meals to children of six or eight years.

Subcutaneous injections have reached an extensive field of usefulness in *serotherapy*. After it was proved that animals could be immunized against certain virulent bacteria, it was found that the blood-serums of previously immunized animals [3] could be utilized as powerful remedies in infectious diseases of man. In the article on diphtheria more has been said of the effect of its antitoxin, the preparation and knowledge of which is due to Aronson, Roux, and Behring. Tetanus and diphtheria are certainly influenced by their proper antitoxins to a remarkable degree. Asiatic cholera is likely to be the next great scourge of mankind to be stripped by its antitoxin (Haffkin) of part of its fury. Neither Marmorek nor others, however, have thus far succeeded in producing an antitoxin which is as effective as those of (tetanus and of) diphtheria in such infectious diseases as appear to be connected with, or dependent on, streptococci (puerperal diseases, erysipelas, scarlatina, and some forms of abscesses, of angina, and of mixed diphtheria). Nor are the claims of Coley, who, with antitoxin procured from the coccus of erysipelas and from bacillus prodigiosus, exhibits interesting results in sarcomatosis (not in carcinosis), generally accepted by all. In many more diseases antitoxins have been recommended; prematurely it appears, for neither croupous pneumonia nor typhoid fever nor syphilis has been benefited thus far. Nor have the attempts at obtaining an antitoxin to take the place of calf vaccinia in the immunization against variola been successful. Not infrequently the lymph usually employed is mixed with bac-

[3] Not to be mistaken for the congenital protection afforded by the presence of "alexins" in the blood-serum of the newborn. Certain infectious diseases leave in the circulation an immunizing substance which protects its bearer against relapses. This, at least, is the only possible explanation of their protection. This fact suggested the possibility of a successful treatment of measles, pneumonia, and scarlatina with the blood-serum of such persons as had just passed through one of those maladies. Good results are reported. Personal experience I have none.

teria and other impurities. The cases of tetanus appearing after vaccination should not shake the faith in vaccination nor relax the efforts to make vaccination compulsory, but should be a warning against careless preparation of vaccine. Thus far, however, a sterile blood-serum of the vaccinated calf cannot be obtained in sufficient condensation and efficacy.

In organotherapeutics the hypodermic method is no longer employed extensively, since the internal administration of the different tissues, or their extracts, or other modes of preparations is both efficient and (mostly) palatable. Many of the secretions and tissues of the body of man and beast were used in olden times under the reign of crude empiricism or bestiality,—blood, bile, urine, fæces, hair, bones, etc. Of the modern organ extracts, cerebrin, hepatin, lienin, renin, pulmonin, oophorin, spermin, didymin, the reports on which are not all dictated by an unpolluted scientific spirit, not much can be said as yet. Those which have been proven to be valuable, particularly to children, will be discussed later.

The subcutaneous injections of cocaine, according to Schleich's method of "anæsthesia by infiltration," will prove a great gain to the practitioner, inasmuch as, with or without the previous use of ethyl chloride, it will facilitate many operations. Maybe its principal advantage will lie in this, that many abscesses and furuncles will be dealt with before they are permitted to get larger. Their antineuralgic action will not be required frequently, because of the relative scarcity of neuralgias in childhood. In almost every case the solution is to consist of cocaine muriate 0.1, morphine sulphate 0.02, sodium chloride 0.2, distilled water 100.0.

Inhalation is resorted to in two different ways. Either the air of the room or of a tent is impregnated with the substances to be introduced into the air-passages, or these substances are introduced through sprays or atomizers of different shapes and patterns. Some of the latter have always appeared to me very faulty and not to the purpose at all. Tubes introduced into the mouth, through which

substances are to be carried down, will land them in the mouth; it takes all the self-control and intelligence of an adult patient to allow the object in view to be accomplished. The oral cavity of the infant or child is small, the tongue is coiled up, and the faucial muscles will not relax. Nose and mouth must coöperate to allow inhalations to enter the larynx, or the former alone must be relied on. A spray calculated to reach the larynx of infants or children is always best introduced into and through the nose. In this way, at all events, the posterior part of the pharynx and the respiratory tract are reached to best advantage. The manner in which the spray is employed in diseases of the nose and pharynx is quite often too perfunctory, with no other result but to make the patients wakeful and restive; and it should not be forgotten that no access to the trachea and bronchi is possible except during a deep inspiration. The difficulty of accomplishing that in children is obvious.

Real inhalation, however, means filling the lungs with a gas or vapor. Warm steam will do good service in bronchitis and pneumonia, when the bronchial secretion is viscid and expectoration difficult, and in diphtheria, for the purpose of softening membranes and increasing the secretion of a thin and normal mucus. Cases of fibrinous bronchitis I have seen getting well in bath-rooms, the hot water being turned on for days in succession and the air thick with steam. An excellent inhalation in the inflammatory conditions of the respiratory organs is that of ammonium muriate. Every hour, or at longer intervals, a gramme or more of the salt—the quantity depending in part on the size of the room—is burned on the stove or over a live coal or an alcohol-lamp. The heavy white cloud fills the room, is easily borne by both sick and well, and improves expectoration. Oil of turpentine can be utilized in a similar way. Its action is both expectorant and disinfectant. In the latter stages of pneumonia, when the bronchial secretion is thick, viscid, or deficient, and expectoration and cough are wanting, the room may be filled with turpentine vapor. This can be accomplished in different ways. A large soft sponge may be soaked with turpentine, with or without the addition of some oil of sassafras,

and suspended at the bedside. Or a kettle of water may be kept boiling day and night on the fireplace or over an alcohol-lamp (this is preferable to a gas-stove, which consumes too much oxygen), and a tablespoonful of turpentine, more or less, poured on the boiling water every hour or two hours. The same may be done to advantage in diphtheria, with or without a teaspoonful of carbolic acid in addition to the turpentine, and in gangrene of the lungs. The inhalation of benzine, cresolin, and similar substances, and of the coal-gas of gas-works, has often been recommended in whooping-cough. In its worst forms, particularly when it is complicated with convulsions, the frequent inhalation of chloroform is sometimes life-saving. A baby of six months, with hourly attacks of convulsions, I kept alive by putting him under the influence of chloroform at the beginning of every attack, and continuing that treatment for several days. Asthmatic attacks will do well sometimes with inhalations of chloroform, ether, and spirits of turpentine in different proportions, mostly 1 to 2 to 4. Chloroform is well tolerated by the young, but should be avoided in the cases of lymphatic patients. Sudden deaths may be (and appear to have been) encountered in them, and may occur after weeks as a result of the parenchymatous changes in the heart caused or increased by the drugs. Amyl nitrite also will influence them favorably; as a preventive of epileptic attacks I have experienced occasional success with its administration. But in collapse, with paralysis of peripheral blood-vessels, it certainly renders good service. With the inhalation of oxygen for the purpose of bridging over the most dangerous period of a suffocating pneumonia and of improving tissue-change in general anæmia and ill-nutrition, the profession is well acquainted. It is no use to deny that effect on theoretical grounds afforded by the alleged law of the diffusion of gases. If those who write books for practitioners would but study disease at the bedside! With the inhalation of ether as an antidote to poisoning with santonin I have no personal experience. Ozone inhalations have been highly recommended in anæmia, whooping-cough, and septic fevers. We shall have to learn more of its effects, and particu-

larly in regard to a ready and reliable method of its preparation. A. Caillé, while regretting the clumsiness and expensiveness of apparatuses, uses it in chlorosis, secondary anæmia, and whooping-cough. A personal communication of his speaks also of a case of tuberculosis in an adult successfully treated with ozone inhalations extending over several years.

In pulmonary tuberculosis the inhalation of disinfectant vapors is employed less than the necessity of the cases would appear to indicate. Carbolic acid, turpentine, eucalyptol have been utilized for that purpose. The object is to supply the lungs with those substances in thin dilutions constantly. Prudden has proved that carbolic acid in twelve hundred parts of water stops the emigration of leucocytes in inflammatory disorders. Thus high dilutions, though they be hardly perceptible to the senses, and certainly not to a disagreeable extent, may be amply sufficient. It is for this reason that Feldbausch invented small apparatuses filled with a disinfectant substance to be persistently worn in a nostril.

The inhalation of chloroform, which is, on account of the average vigor and healthiness of their hearts, preferable to ether for the purpose of producing anæsthesia in the cases of infants and children, is rather unsatisfactory at the earliest age because of the superficial character of respiration. So is that of ether, which, moreover, may become contraindicated in every period of life because of its detrimental effect on the kidneys and on the respiratory organs. It frequently begets nephritis, which anyway is frequent in infancy and childhood, bronchitis, and pneumonia. The effect of the anæsthetic is very temporary, and the administration must be repeated and closely watched during a convulsion or an operation. The difficulty in obtaining a complete narcosis is particularly great in the new-born. The stage of excitement is brief, the pulse becomes frequent, and the pupils contract. After a short time, however, the pulse becomes slow and the pupils dilate. The after-effects are not so inconvenient as they often prove in the adult; infants and young children vomit less frequently and less profusely, and certainly with

greater facility and ease than adults. They are liable to remain under the influence of the anæsthetic a long time after an operation has been completed. After tracheotomies, which I never performed without chloroform unless the children were asphyxiated by carbonic acid poisoning, the patients are apt to sleep long and undisturbed. Thus they require ceaseless watching until the effect has surely passed away. Through the opened trachea the children will get under the influence of chloroform very easily. Five or six drops on a sponge or on some absorbent cotton, held in the mouth of the tube by means of a pair of pincers, have an almost instantaneous effect, and came near destroying—when I undertook to change the tracheal tube on the third day—a successful case of mine forty years ago, before I had the experience detailed in the previous remark. Further care is also required in regard to patients in ill health. Chronic pulmonary and heart diseases do not tolerate chloroform very well, but the diagnosis of these conditions is more readily and quickly made in children than in adults. Adipose children are liable to faint. The usual operations in the mouth, such as resection of tonsils, incisions of abscesses, and evulsion of adenoids, it is best to perform without an anæsthetic, for the amount required to overcome the resistance of the masseter and buccinator is so large, generally, as to possibly endanger the life of the patients, besides the impossibility of obviating successfully the entrance of blood into the digestive organs, where it is inconvenient, or into the respiratory organs, where it is a positive danger.

Of the two anæsthetics, ether and chloroform, the latter should, as a rule, be preferred in infancy and childhood, except in a case complicated with heart disease. It is the heart that runs its risk during the use of chloroform. The average vigorous young heart is less exposed to its dangers, but still its power of resistance should not be relied on too long. For several reasons operations should be performed quickly, though children are anæsthetized more readily than adults. For, after all, chloroform and ether are not indifferent agents, and may prove destructive;

the loss of a few ounces of blood is a serious matter, so long as a baby of thirty pounds has not over one and a half pounds at best; and blood-pressure is diminished so long as the operation requires the uncovering of a large part of the surface. For every operation requiring an anæsthetic a saline solution should be kept ready for subcutaneous injection. Among the disinfectants carbolic acid should not be used at all; even iodoform has occasionally proved dangerous.

Gargles of any description require a certain degree of training and self-control, and are therefore rarely available for children of less than seven or eight years. The liquids thus employed do not reach any farther than to the uvula, the pillars of the soft palate, and the anterior part of the tonsils. Whatever succeeds in passing them is swallowed. Thus the alleged efficacy of gargles is greatly overestimated. Astringents, however, have a certain influence in reaching beyond the area of contact, but through their secondary effect on contiguous tissue only. When a thorough effect is aimed at, it is better to rely on sprays, which may affect the whole pharyngeal cavity, or on insufflations of powders; this latter plan is rather unpleasant, and should be followed in children in exceptional cases only. As, however, in most cases where a local effect on the pharynx is desirable the local affection spreads over the posterior nares as well, spraying or (much better) irrigating the nose is preferable. The liquids thus employed reach the pharynx, and are either swallowed—which is often an indifferent matter—or expelled through the mouth. When these methods are undesirable,—for instance, when the liquids injected enter the Eustachian tube,—they may be poured into the nasal cavities from a teaspoon or a pipette. A common medicine-dropper will seldom suffice; one of the nasal cups for sale everywhere will do better. There is many a case of diphtheria in which the very gentlest method of cleansing and disinfecting the surface of the naso-pharyngeal cavity ought to be selected.

When no liquids are tolerated, medicated ointments may be introduced into the nostrils by means of a camel's-hair

brush, or poured in. Ointments prepared with vaseline, glycerin, or cold cream are good vehicles for that purpose. Sponges and brushes ought to be avoided whenever the young patient objects to them strenuously. No violence must be used for several reasons. The child's strength must not be exhausted by his attempts at self-defence, and most local affections of the throat get worse by any injury done to the epithelia. Even galvano-cauterization can and must be applied without much violence. Persuasion, patience, and cocaine will render its employment possible in many instances.

The *skin* in infancy and childhood participates in the anatomical structure of all the tissues at that early period, inasmuch as it contains more water than in advanced age. Besides, it is thinner, and its lymphatics are more numerous, larger, and more superficial. This explains some peculiarities in regard to the effects of many medicaments. Hot air in apparatuses, as used by Tallerman and others, of 140° C. and more, should be watched, and lower temperatures tried first. It is employed more in chronic than in acute ailments, arthritis of all forms, deformans and gonorrhœal included, muscular and other chronic rheumatisms, and the intense chronic muscular spasms of talipes valgus (very rare in children), also the progressive ossifying myositis, and chronic osteitis and periostitis. Electricity in all its forms is sometimes efficient, and a relatively mild current may suffice. This fact is of particular importance, as, moreover, the bones also are thinner and more succulent. To act upon the brain, very mild currents only must be used. The spinal cord is less accessible, and appears to require rather large doses from large electrodes. The galvano-caustic effect resembles very much that obtained in the adult. In most cases it should be closely watched while being employed; thus, for instance, in the operation on angiomata, or diseases of the tonsils or nose, it readily destroys more than was intended.

Sinapisms, when not mixed with flour, must not be permitted to remain more than a few minutes. As soon as the skin begins to be discolored they should be removed.

When that is done, they may be repeated every few hours, and they are active derivants in many cases of deep-seated congestive processes. The same remark is due in reference to the use of *mustard-baths*. A hot mustard-bath renders good services in suppressed or insufficient cutaneous eruptions of an acute character, internal hemorrhages, meningitis, and pneumonia; but it must not be continued beyond reddening the skin; if so managed it may be repeated.

Vesicatories have lost much of the esteem in which they were held in former times. I remember the time when many a case of pleurisy, articular inflammation, herpes zoster, was not permitted to get well without a Spanish-fly blister. Nor am I of the opinion to-day that it will do no good in some such cases, provided it be not used during the feverish stages. But their drawbacks are many. A plaster will not stick to an emaciated and uneven surface, and is even apt to give rise to gangrene when the surface circulation is very defective. In these cases the wound will heal badly. The skin of the infant being very vulnerable, eczema and impetigo will easily arise on ever so slight a provocation. The local pain of the application produces irritation, nervousness, and sleeplessness. This is particularly so if the application be made on the extremities or on the posterior surface of the body. The kidneys are frequently affected by cantharides, dysuria being the result in many cases, which then require energetic camphor treatment for the relief of the torturing symptoms.

There are some absolute contraindications to the external use of cantharides: the presence of diphtheria in any shape or manner, and such diseases as are liable, during the prevalence of an epidemic, to become complicated with diphtheria. Therefore, no vesicatory must be used during nasal, pharyngeal, or laryngeal diphtheria (croup), or in the different forms of pharyngitis, or in laryngeal catarrh, or in erysipelas, or in diabetes.

When a plaster cannot be expected to remain on the surface and to have its full effect, cantharidal collodion may take its place. The application will prove more effective when the surface is first washed with vinegar or

irritated by a sinapism, which, however, is allowed to remain a few minutes only. Then a flaxseed poultice or warm-water applications may be applied over the vesicatory to diminish the pain and accelerate the effect. Very young infants ought not to carry a vesicatory more than an hour, at least not on the same spot. That is why to them the cantharidal collodion is less adapted. The plaster may be shifted from place to place.

After the epidermis has been raised, the serum must be allowed to escape through small punctures, but not so as to moisten the adjoining parts, for the cantharidin contained in the serum may exert a disagreeable local effect. The epidermis ought not to be removed, and no irritating ointment used to keep up a secretion. To cover the sore surface, vaseline or cold cream is preferable to common fats, which may be, or become, rancid. The best final dressing is borated cotton and a bandage. Vaseline ointments with opium, lead, or zinc, and powders of zinc, bismuth subgallate, iodoform and amylum in equal parts, or salicylic acid one part, with from thirty-five to fifty of starch, will find their occasional indications.

In many affections of the skin, powders, solutions, liniments, ointments, and baths are employed. The skin is thin and irritable. Erythema will follow the contact with water quite often; thus many forms of dermatitis contraindicate its frequent use. Acute and chronic eczema get on better without than with it. Therefore astringent solutions are less advisable than astringent ointments. For superficial effect these must be prepared with vaseline or cold cream, either of which may readily be combined with lead, tannin, zinc, bismuth, salicylic acid, or iodoform. In not a few cases, on a very sore surface, denuded of its epithelium and oozing, the powders alone, or combined with starch or talcum in different proportions, will prove very effective. Oleates ought to be avoided; they irritate the skin and produce eruptions.

As the skin is thin and succulent, and the lymph-ducts of the young quite superficial, large and numerous, substances will penetrate the skin quite readily. Ointments with that object in view must be prepared with animal fats, particularly with adeps lanæ hydrosus of the United States

Pharmacopœia (lanolin), to which, when rather tenacious and dry, ten per cent. of water may be added. Still, much friction may by itself irritate the surface and give rise to suffering.

In the very young, *ice* and *ice-water* applications are not tolerated a long time. Ice to the cranium, the bones of which are but thin, is liable to produce collapse; about the neck and occiput it is better borne and often beneficial. Warm *fomentations* and hot poultices are very beneficial in many morbid conditions of the trunk and extremities, but dangerous when applied to the head and not carefully watched. General *baths* are frequently required, local baths but seldom; foot-baths may be given while the patient is lying down, but hot fomentations are more readily made, and do not require the same amount of watching, nor are they equally objectionable to the young patient.

Depletions were frequently resorted to scores of years ago. Modern practice has learned how to do without them, though we should be willing to assume that they were more frequently indicated than many of us believe at present. At all events, it ought to be taken into consideration that there is but a single pound of blood in a baby of twenty pounds, and that a patient rapidly reduced by sickness is least able to stand a loss of blood ever so small. Thus a venesection will hardly ever be thought of in the case of a baby; at all events, I hope never to repeat the opening of a jugular vein, practised by me on an infant taken with convulsions depending on, and adding to, cerebral congestion, forty years ago. But there are cases of older children that bear, or rather demand, a venesection. Its indications are over-extension and insufficiency of the (mostly the right) heart with impeded pulmonary circulation, with intense dyspnœa and cyanosis, in which the largest doses of digitalis have been given in vain. In one of his cases Baginsky opened the radial artery when he did not succeed in getting blood from a vein. Such cases are occasionally pulmonary œdema during the incipiency of the crisis in a croupous pneumonia, or, principally, old mitral incompetencies with immense dilatation and failing compensation. The objects to be accomplished are the

relief of the feeble heart muscle and the restoration of its contractility. A further indication for a venesection may be afforded in occasional cases of uræmia or eclampsia, similarly to its employment in the adult. Local depletions were once more frequent, though the liability of the skin to inflammation and furuncle was well understood, and the excitement of the little patient was such, now and then, as to lead to an increase of the symptoms and even to convulsions. Among the occasional drawbacks was also the possible loss of blood after the leeches had fallen off. In such a case the local use of tannic acid, alum, perchloride or subsulphate of iron, digital pressure, or in bad cases the ligature underneath a harelip needle, which was inserted through the wound, were resorted to. A solution of from twenty to fifty per cent. of antipyrin in water, which may be immediately followed by a solution of tannic acid (mostly not required), is a powerful styptic. The indications for depletion were bad and painful cases of pleurisy and peritonitis, and cerebral inflammatory diseases. In the two former, the indication to relieve pain is more readily fulfilled by ice or the subcutaneous use of morphine or cocaine. In the latter, the mastoid process and the septum narium are the points on which the leech or leeches ought to be applied. It is the latter spot which I prefer, when I have the choice, in those rare cases of brain diseases of infants and children in which I still feel justified in recommending a depletion. Altogether, however, many of the olden-times indications for blood-letting have proved deceptive. It does not serve as an antiphlogistic in all sorts of fevers and inflammations, or as an evacuant of an alleged plethora, or as a sedative and anæsthetic, but it certainly may be employed to divert a local stasis, even in cases in which apoplexy is feared. In toxic conditions, particularly in intense sepsis, it should be carefully avoided, though acute poisoning may be relieved by it. Uræmia, or carbon oxide poisoning may, as I said, be benefited by a venesection, and the diminished circulating medium replaced by a saline solution administered either subcutaneously or injected in the rectum or directly into a vein.

DISEASES OF THE ORGANS OF CIRCULATION

I. THE HEART

Both in *acute* and in *chronic diseases of the heart* the amount as well as the quality of food requires some modification. In many cases the loss or diminution of appetite will regulate the former. As a rule, however, the amount taken ought to be much less than the same person would take when in health. Not only ought the total quantity to be less, but also that consumed at each meal should be comparatively small. It is best, therefore, to divide the meals into halves and even thirds, so as to cause the patient to eat every two or three hours. Digestibility must be improved by slow eating. The diaphragm should not be annoyed by large quantities of food or by the evolution of gases. Therefore but few carbohydrates (very little fat) are to be given at one time, and the digestion of nitrogenous foods, such as meats (eggs) and milk, with or without cereals, ought to be aided by pepsin and dilute hydrochloric acid. The latter is an excellent adjuvant to the digestion of milk prepared according to J. Rudisch's formula (25 min. of dil. HCl., one pint of water, 1 quart of milk; boil for a few moments; keeps well; quite palatable; digestible). At all events, milk is the main food to be given in cardiac ailments. Its digestion has a further advantage in this, that it does not result in the physiological congestion of the stomach, liver, and spleen, which becomes irksome after large and heavy meals by disturbing circulation and thereby adding to the labor of the heart, and that it does not contain the large mass of fat-forming elements present in the mixed food of healthy advanced childhood or adult age. Altogether, it is best to slightly underfeed the patient; thereby the action of the heart is

facilitated,—an object which must never be lost sight of. For the same reason fast drinking, even of water, must be avoided, for its sudden absorption fills the blood-vessels too suddenly for comfort, and its speedy elimination does not diminish the momentary overwork. This warning is of particular importance as regards iced liquids, which act both by their bulk and by reflex. This advice is by no means superfluous, either to medical men or to the sick. It was urged by Williams more than fifty years ago. Stokes prohibited the use of large quantities of soups or milk. And it has been again introduced by Oertel with such impressive emphasis that thirsting has become almost fashionable and a craze among the fanatics.

That stimulants, such as coffee, tea, and alcoholic beverages, must not form part of the regular diet in cardiac disease is self-understood. They may be required as medicinal agents, however, upon positive indications.

In every form of cardiac disease absolute rest both of body and mind is among the very first indications. The latter is just as important—perhaps more so—here as in diseases of the nerves and nerve-centres. Fretting, worrying, crying are detrimental, and must be avoided. Thus, it may become necessary to take a child out of bed temporarily, to gratify and quiet him; or to change his position, for the recumbent position of an hypertrophied heart may cause dragging of the phrenic nerve or of the sympathetic plexus; or to raise the trunk and head to relieve intracranial hyperæmia and the consecutive irritation of the pneumogastric nerve; or to give a mild opiate or a dose of potassium bromide to insure quietude or sleep. The child must be permitted to select his own position; he knows best where he is most comfortable; but rest he must. The diseased heart is in its most favorable condition when working least; the number of heart-beats is reduced by ten or twenty-five in the recumbent position. Rest is not only a curative, but a preventive agent. Many a life-long cardiac affection could be warded off if care were taken in time. We are becoming more and more aware of the frequency of affections of the heart muscle. Myocarditis in a chronic, subacute, and acute form is of very frequent

occurrence. In or after every case of typhoid fever, scarlatina, diphtheria, or small-pox we should be prepared to be overtaken by some cardiac disease, either interstitial myocarditis or parenchymatous degeneration. Rest in bed or on the lounge (the former is better) will act as a preventive. It ought to be continued for weeks in almost every case. Like the paralysis consequent upon infectious diseases, which develops after weeks, heart disease may occur from the same cause, partly as a consequence of actual primary alterations, partly of nerve exhaustion. So long as the pulse becomes more rapid on exertion, or on getting out of bed, absolute rest is the best remedy and safeguard. In these cases it is not always possible to distinguish between functional debility and actual disease. Autopsies too frequently tell us of our mistakes. Trifling changes in size cannot be measured by percussion, feeble murmurs cannot always be estimated according to their exact value. Functional murmurs are not so frequent in the child as in the adolescent or the adult, and exceptional only in the infant. On the other hand, organic cardiac diseases have a better chance to be cured—really cured—in the young than later. So much the greater is the responsibility of the medical man in cases of preventable or remediable cardiac disorder. Even patients suffering from the very worst forms are apt to feel better within a very few (hours or) days after being confined to bed, with strict diet and loose and comfortable clothing. These cases teach us the lesson of what can be accomplished through the same *régime* in milder or incipient forms, by reducing the labor of the heart and at the same time of the voluntary muscles, with their influence on circulation and blood-pressure, and by diminishing the over-activity as well of the general innervation as of the cardiac nerves, both exciting and inhibiting.

It is difficult to decide to what extent exercise should take the place of rest in individual chronic cases. The hearts of patients are as little alike as are their noses and finger-tips, and their treatment ought to be as individual as the size and shape of their gloves. Neither fit everybody. Nor is the rule adopted to-day that which

will accomplish the best end in a month or a year for the same patient. The heart is neither in health nor in disease a uniform body. Its innervation may change from minute to minute, its nutrition is dependent on sudden or gradual alterations. A heart muscle is influenced in its arterial supply, venous discharge, and lymph circulation not only by its own health or disease, but by the ever-changing conditions of the other organs. Thus, many of the rules given one day may not remain valid another. Still, after a fair time has elapsed since the occurrence of an acute myocarditis or endocarditis, exercise should be recommended. The child may get up and have his quiet play sitting at the table, may begin to walk on the level floor, and may indulge in mild gymnastic exercise. More must not be permitted until the mucous membranes become a little more tinged, the arteries fuller, the heart quite regular. The systematic rules recommended by Stokes and by Oertel refer more to adults, with their incipient fatty degeneration and chronic myocarditis, than to children. In these, while they bear the imprint of cardiac changes, no iron-clad rules hold good. Gentle exercise and long rest should alternate.

Gentle exercise may be replaced or complemented by massage of the skin and the muscles, both of which are so essential for circulation and metabolism. The blood circulating in a resting muscle during one minute amounts to 17.5 per cent. of its weight; in a contracting muscle to five times as much. It is easily seen to what extent massage, hydrotherapeutic irritation of the whole surface, and excitation of the muscles by the interrupted current must do good without an exertion of the heart muscle. The avoidance of the latter, while the muscles are gently exercised by "resistance movements," is the peculiarity of the Schott treatment at Nauheim. It is indicated in a great many cases; in others it is Oertel's climbing exercises. In all it is the judicious mind and common sense of the physician in charge of the individual case.

The skin requires judicious attention. Exposure to cold, with its consecutive contraction of the cutaneous blood-vessels, overloads the viscera, retards circulation, and

increases the labor of the heart muscle. A cold general bath, therefore, is dangerous (as also in the atheromatous degeneration of the old) in acute carditis (where *local* application of cold to the heart region acts quite favorably) or in extreme muscular weakness of the heart. On the other hand, a brief cold sponge-bath or wash, with thorough friction, is an intense stimulant and may be used to advantage for a weak heart, unless the extremities be cold and the mucous membrane cyanotic. In these latter conditions, hot washes and frictions, with or without alcohol, should take its place. In the average condition of the diseased heart general hot bathing must be avoided. It overstimulates and paralyzes, and proves an actual danger in both acute and chronic cases. Newspaper readers will remember the reports of people who go to the hot or " Turkish " bath with their heads erect and full of their own therapeutical wisdom, and leave it with their feet forward. A warm bath, the temperature of which ought not to be over 90° or 92° F., is often relished. In fact, both the talking child and the infant will soon tell you the exact temperature best adapted to their wants. In these cases actual want and comfort are identical. The baths, particularly the first, must be limited to a few minutes; at all events, they should never be continued after the slightest weakness of the pulse is noted. The debilitating or fatiguing effect of the bath must be avoided.

The mineral springs which have obtained a reputation in the treatment of chronic heart disease, like the German Nauheim and Oeynhausen, owe their effect to the stimulating action of the salts and of the carbonic acid contained in them. It should be remembered, however, that not infrequently carbonic acid, both internally and externally, may cause tachycardia and arrhythmia.

Like hot water, hot air is contraindicated in heart disease. The wilted forms of the little ones soon show the effects of summer heat. A temperature of from 65° to 70° F. and fairly dry air are best for them. High altitudes do not agree with cardiac disease, particularly when no compensation has facilitated the heart's action. Compensation is not complete until the hypertrophied left ventricle,

having become so by mitral incompetency, transmits as much blood into the aorta as the pulmonary artery does into the lungs. Until that stage has been reached, the lungs are comparatively hyperæmic and subject to catarrh, œdema, or bleeding. In this condition, therefore, the influence of the rarefied air of high altitudes should be avoided; as a rule, I recommend an altitude of not more than from one thousand to fifteen hundred feet to children affected with chronic endocarditis.

In the therapeutics of the heart it is most important not to mistake a functional disturbance of the heart's action for the immediate result of heart disease. The contractions of the heart (the pulse), as to number and rhythm, are more frequently influenced by disorders of other organs or of the organic economy in general. The pulse may become arrhythmic from cardiac (mainly myocardial) disease, but also from meningitis, from neuroses (chorea, hysteria, epilepsy), from anæmia in convalescence after grave diseases, in chlorosis, in universal obesity, even in the apparently healthy; from the autoinfection caused by constipation or by jaundice; or from the effects of medicines. It is self-evident that all these different causes, and not their common symptom, should be treated.

The functions of the heart and blood-vessels are best considered together, from a clinical point of view. Together they control the normal blood-pressure and circulation; when these are disturbed, it is mostly (not always) the same remedies or drugs that influence at the same time the heart and the arteries. Such disturbances are either an increase or a lowering of blood-pressure, and alterations in the circulation which are characterized by slowness or frequency of the pulse. In the diseases of the young it is mostly cardiac stimulation that is required with a view of contracting both heart and arteries. Its indication is furnished by primary feebleness of the heart muscle, or by that which is secondary to acute or chronic inflammatory or infectious diseases, or meningitis; sometimes by congenital undersize; by impaired brain function after hemorrhages, in syncope, or in chronic cerebral anæmia; in tedious convalescence; by insufficient diuresis; by pulmonary

œdema; by reflexly lowered blood-pressure in shock, in colic, or after extensive burns; by hemorrhages; or by toxic dilatation of blood-vessels caused by chloral hydrate, nitrites, pilocarpine, or muscarine. Angina is, fortunately, very rare, for acute or chronic aortitis is very uncommon. Whenever it occurs it may cause a neuritis of the cardiac plexus near the coronary artery and under the influence of peri- or (and) myocarditis.

Blood-pressure and circulation are improved by physical means, such as transfusion, salt-water infusion, lowering the head and raising the feet, ligature of the extremities, manual compression of the abdominal aorta, and hydrotherapy in different forms. The centres of the medulla and of the spinal cord are influenced by strychnine and ergot; the vasomotor centres and the heart by caffeine, camphor, ammonium, and musk; the vasomotor centres and the peripheric vasomotor nerves by hydrastis; the heart by alcohol, atropine, and sparteine; the heart and arteries by digitalis, strophanthus, adonis, convallaria, hellebore, and apocynum.

Among the principal remedies employed for the purpose of reducing blood-pressure and dilating peripheric vessels are warm baths, or foot-baths with or without mustard, warm clothing, rest in bed, narcotics, such as morphine and chloral hydrate, acids and alkalies, and the nitrites.

At the head of the list of heart and blood-vessel stimulants stands digitalis. It increases the action of the heart muscle and thereby increases cardiac pressure. It is indicated in all conditions of weakness of the heart muscle so long as the latter is not decomposed and the arteries are in their usual structural condition. Primary changes of the heart muscle hardly ever occur in childhood, for uncomplicated fatty degeneration, in which digitalis is contraindicated, is almost unknown at an early age. Secondary parenchymatous degeneration is, however, a frequent occurrence in and after infectious diseases, such as typhoid fever, dysentery, rheumatism, scarlatina, diphtheria, and others. Digitalis is useless and sometimes worse than useless in nervous affections, such as the palpitations of Graves's disease, or neurasthenia, or of hysteria. In all

probability the effect of digitalis is mostly felt at first in the left ventricle, which is more muscular, but in the right ventricle almost as soon. By acting on the left ventricle is regulates the general circulation and facilitates aspiration of the venous blood and the circulation in the lungs and in the right heart. It strengthens the systole and lengthens the diastole. During its administration the contractions of the heart become more vigorous and less frequent, the arterial pulse slower and fuller, the urine increases in quantity, cyanosis and dyspnœa diminish, and dropsical symptoms gradually disappear. When large doses have been given for some time, accumulation of the effect takes place. The pulse becomes quite slow and irregular, and vomiting sets in. If possible, this effect should be avoided.

For how long a time may digitalis be administered when given in moderate doses? This question has often been asked and as often answered. Unfortunately, the preparations sold in the markets are of different strengths and vary too often; so it is best to rely on preparations which are not liable to spoil on one's hands. With that proviso, I can say, from an experience of several dozens of years, that I cannot agree with those who stop the administration of digitalis after a few days, to begin again after an intermission. Moderate doses may be given day after day for months without any ill effect and with great benefit. Nor is it necessary to alternate between cardiac stimulants so long as no uncomfortable effect of digitalis makes its appearance. Only when the patient cannot be seen for many weeks in succession, the practitioner may feel like alternating digitalis and strophanthus weekly.

In practice we are often disappointed. The preparations are as various as are the firms of wholesale, or sometimes retail, manufacturers or tradesmen. The United States Pharmacopœia is, after all, the best stand-by of the practitioner, and its list of drugs and that of the National Formulary of the Pharmaceutical Association are sufficiently large to suit any taste. The infusion of digitalis, when reliable, may be given to a six-year-old child in doses of a teaspoonful two or four or five times a day, the

fluid extract (I have often expressed my predilection for "Squibb's") two or three minims daily, the solid extract from one-half to one grain daily (0.03 to 0.06). They are not equivalent, the infusion being weaker by containing the digitonin, which is highly soluble in water and acts rather as an antidote to digitalin and digitoxin. The tincture of digitalis, when reliable (not fixed up by mixing a poor "fluid extract" with alcohol), ought to be a competent equivalent of the fluid extract, if both be made of the English leaf gathered in July. It has been found that when digitalis, though English and gathered in midsummer, is kept, the preparations made of it later lose in strength, so that those made nine months afterwards display only one-third or one-fourth of their original power. The main constituent is digitoxin; of it there is less in sunless summers, to such an extent that it varies from 0.1 to 0.62 per cent. of the herb. Görges (*Berl. klin. Woch.*, August 13, 1902), for that reason, recommends a dialysate (made by Golaz in Saxon Switzerland) of digitalis purpurea and grandiflora, of which children of two or three years are given from two to six drops three times a day. Indeed, children bear digitalis and cardiac stimulants generally better than adults, and in comparatively larger doses. Digitalin I have used a great deal. Unfortunately, the wares sold by that name are very unequal: they are resinoids, not alkaloids. I have used ten or twenty times the doses recommended in books and price-lists without any effect whatsoever that could be relied on. For many years I have given it up. In urgent cases a six-year-old child must take from one to five minims of the fluid extract at once. That dose may be repeated after a few hours, and perhaps again, until the effect is perceptible. Then it is time to slacken off or stop altogether. It is particularly in those cases in which the pulmonary circulation is obstructed, either by local pulmonary inflammatory processes or by cardiac incompetency, that this mode of proceeding is advisable.

The effect of digitalis is not limited to the heart; the arteries are also affected by it. On this account digitalis is often contraindicated in senile affections of the whole

vascular system. As they (atheromatous conditions) are not found (except in a few cases of the literature) in infancy and childhood, this contraindication is rare in early age. There is a single exception, however, to this rule,—viz., in abnormal congenital smallness of the arteries, which is not so excessively rare as may be presumed, and is a frequent cause of life-long migraine, neurasthenia, hysteria, and chlorosis. In these conditions, thus caused, digitalis is not so well tolerated when given by itself. It acts better when combined with a nitrite.

In those cases in which the effect of digitalis appears to be retarded, or the practitioner has "reason to doubt the qualities of his drug," another one may be substituted for it or combined with it. I plead for occasional combinations of drugs. The "simple prescription" flag of the "one drug only" fanatics waves over a childish affectation. They forget that they are prescribing half a dozen different constituents in their "one drug" digitalis. Moreover, when the heart requires stimulation, we should remember that it is a composite organ; the muscle, the ganglia, the pneumogastric, sympathetic, and vasomotor nerves are suffering simultaneously. The tincture of strophanthus may be taken by the same child to the daily amount of from six to twenty-five minims; the fluid extract of convallaria majalis in the same or somewhat larger doses. Again I suggest that in most cases it is best to ascertain the moderate dose to be administered a long time in succession by giving a good dose from the very beginning and watching its effect. Of sparteine sulphate (better than other preparations of scoparius) eight or ten doses are required daily, altogether amounting to from one-half to two and a half grains (0.03 to 0.15). Caffeine from two to ten grains, or sodio-caffeine salicylate (or benzoate) from four to fifteen grains a day, are fair doses, the effect of which will be pleasant in most cases. The sodio-caffeine salicylate (or benzoate) is well adapted for subcutaneous use; it dissolves readily in twice its weight of water and is not a local irritant; it is therefore easily employed. The effect of these injections is often marked. Nearly twenty years ago I published a case of cardiac pulmonary œdema,

among others, in which recovery was the undoubted result of their use. There is, however, a positive contraindication to the use of caffeine (and coffee),—viz., cerebral hyperæmia, either active or passive, or a tendency to convulsions. The same contraindication holds good for strychnine sulphate, which has conquered a trusted place as a cardiac stimulant. If there be time, it may be given internally, daily, to the amount of from one-sixtieth to one-twentieth of a grain (0.001 to 0.003) for many days or weeks in succession. Urgent cases require its subcutaneous administration. Large doses, up to one-fourth or one-third grain (fifteen or twenty milligrammes), may be given to a child of ten years, in emergencies of collapse and sepsis, in a day, but such doses must not be continued, except in thorough sepsis. Sodio-theobromine salicylate has been introduced (as " diuretin ") by G. Sée. It is a diuretic rather than a cardiac stimulant, and, unlike the former, is often found wanting. It appears to act principally on the epithelia of the uriniferous tubes. Calomel in small doses is certainly a cardiac sedative, and, as it is surely a diuretic, it is entitled to the many praises bestowed on it by the older rather than by modern physicians. Salines owe their effect upon the heart mainly to their action on the digestive and the urinary organs, with the exception of the bromides and iodides, the former of which act as sedatives, and thus save labor and soothe irritation. Potassium iodide has a more direct effect. It dilates arteries, diminishes arterial tension, and aids elimination through the bronchial mucous membranes and the kidneys. Obstructions of the pulmonary circulation depending on the heart are its appropriate indication. Sclerosis of the coronary arteries is not, or hardly ever, found in the young; therefore this is an indication exclusively belonging to advanced age. A child of six years may readily take from five to twenty grains (0.3 to 1.25) a day, in three or four doses, in plenty of water, after meals. It need not often be interrupted because of the gastric symptoms produced. The nitrites and their preparations play an important part in lowering blood-pressure. They dilate blood-vessels by paralyzing the vasomotor centres

(not the central nervous system), mainly the peripheric vessels. Large doses transform hæmoglobin into methæmoglobin and thereby cause cyanosis, dyspnœa, and sometimes methæmoglobinuria. Amyl nitrite may be inhaled in drop doses; nitroglycerin (trinitrin, glonoin) is given in doses of from one-five-hundredth to one-two-hundred-and-fiftieth grain (one-eighth to one-fourth milligramme) in solution. The spiritus glonoini of the United States Pharmacopœia contains one-one-hundredth grain in one drop. The effect of sodium nitrite, from one to four grains (0.06 to 0.25) a day, in solution or in powder, is milder but more permanent. Sweet spirit of nitre is of an unequal composition; its action on the kidneys is more pronounced than that one the circulation in general.

There are occasional cases in which the secondary compensation required by mitral incompetency is not fully established, and serious disturbances of the circulation arise therefrom. The dangerous symptoms may be cyanosis and pulmonary (or) and cerebral œdema. There are, besides, stupor or convulsions, dyspnœa, dilated veins, cold extremities, and a small and intermitting pulse. It is in these cases that a few of the above-mentioned large doses of digitalis may do good; here it is that wavering and indecision become criminal. Whenever digitalis does not have any effect, a venesection may. Our ancestors were less pusillanimous. Maybe they overdid bleeding, but in an urgent case they did not fail to open a vein. I know that I have several times saved the lives of children (and adults) by opening a vein quickly.

Chronic (and sometimes the final termination of acute) cardiac diseases may lead to heart-failure. In such cases stimulants are indicated. Alcohol must not be given by itself and in large doses in cerebral hyperæmia of any kind. A child of six years may take from three to twenty grains ((0.2 to 1.25) of camphor internally; subcutaneously, a solution of one part in five of sweet almond oil should be used, and from five to fifteen drops injected repeatedly. Ether may be given, in doses of from three to ten drops, in alcohol and water, and ammonium carbonate, in frequently repeated doses of from one-half to

two grains (0.03 to 0.125), in anise-seed water or in milk. Musk internally, strychnine subcutaneously, may be required. The more urgent the case appears to be the greater is the indication for combining several of these remedies.

Myocarditis.—Though myocarditis, both acute and chronic, is far from being so common in the child as in the adult, it is nevertheless not infrequent; it is, indeed, remarkable how often it is not diagnosticated, or how little its occurrence is appreciated. Its symptoms are, it is true, sometimes very few. The disease is met with either in connection with endocarditis, pericarditis, very often with rheumatism, etc., or is quite frequently uncomplicated. Then it is parenchymatous, and the result of the toxic influence of infectious fevers (diphtheria, influenza, dysentery, etc.).

In its treatment muscle stimulants must not be given. Digitalis is contraindicated. The recommendation of Heffen, to administer ergot, I cannot approve of, for by its action on the muscular fibres it increases vascular pressure, and thereby secondarily the labor of the inflamed heart muscle. Whatever relieves this temporarily is welcome. Therefore, potassium or sodium iodide combined with a bromide will act favorably. Here is also the place for morphine, either in large doses at long intervals or in small doses more frequently administered, together with ice to the chest. During attacks of collapse, or during weakness or prostration, ether, camphor, and alcohol should be given, either internally or in an urgent case subcutaneously. A dose of calomel will relieve the bowels. Enemata for the same purpose daily, for regular evacuations are the best regulators of intra-abdominal circulation. In chronic cases iron may safely be given with the iodide; not in acute ones, which are injured by it through the increase of vascular irritation. Absolute rest, both physical and mental, is essential. That is why Oertel's and Schott's teaching of systematic exercise should be followed with great care only, even in chronic cases. The extremities should be kept warm (stockings) and ice-bags or wet cloths applied to the heart. Derivation by extensive mustard-plasters and

by hot foot-baths taken in a semi-recumbent position should be tried. A very small pulse demands nitrites. The usual cardiac stimulants, such as digitalis, strychnine, etc., are contraindicated, particularly in cases of arrhythmia or gallop rhythm when referable to myocardial weakness.

Acute dilatation of the heart is now and then encountered after the parenchymatous changes of the heart muscle following infectious diseases. Forchheimer (Festschrift)* studied it in connection with influenza and its etiology as myocardial and nervous, both the muscle and the nerve degenerating under the influence of a toxin. In children the myocardial insufficiency is the cause of the dilatation, rarely *vice versa,* and the latter should be met with absolute rest extending over weeks or months, warm bathing, iodides, and nitrites, and opiates.[1] Recovery is much impeded by concomitant pericardial adhesion.

Endocarditis.—That it is "never primary" is a mistake shown by Henry Hun in Festschrift. "Our forefathers knew that rheumatism might begin in the heart." On the other hand, heart diseases are rarely uncomplicated; endo-myo-pericarditis, this complex of varieties, is often found in combination, and the "carditis" of our predecessors was a good diagnosis based on truth. The treatment of this disease is more promising in the child than in the adult, for entire recovery is more frequent in early life than later; but it is important that the diagnosis should be made early. In order not to be taken unawares, we ought to remember that many a systolic murmur that is mistaken for endocardial is myocardial, and that endo-

* "Festschrift" refers to the volume of scientific papers presented to Dr. Jacobi by his admirers in America and Europe on the occasion of his seventieth birthday.—Ed.

[1] F. Forchheimer quotes Charles West, who observed, forty years ago, in influenza a combination of symptoms, of which dyspnœa was the principal one, disappearing in two or three days, followed by "extreme depression, cool, moist skin, a very feeble pulse, and labored respiration. . . . In this condition the children, though quite conscious when roused, lay generally dozing, while, though the somewhat livid hue of the lips and surface seemed to imply the existence of some serious mischief in the lungs, there was nothing to be heard but a large moist râle."

carditis may be present without, at least for some time, exhibiting a murmur; there are, indeed, cases which run their full course without a murmur. This is eminently so in ulcerous endocarditis: (fever irregular, murmur changing, sometimes quite absent, symptoms [sometimes fulminant]—Henry L. Elsner in Festschrift—of malaria, tendency to emboli not infrequent after gonorrhœa, and then not quite so bad prognostically as is suggested by S. S. Adams in Festschrift). On the other hand, it is also necessary to remember that functional murmurs are not so common in the child, particularly in the infant, as they are in the adult. Thus, every murmur—though there be no hypertrophy developed as yet—should be suspected of being dependent on organic disease. This may also be surmised in most cases of acute chorea, which sometimes precedes and ushers in, instead of following, endocarditis; and in every case of articular rheumatism, the symptoms of which may be sometimes so slight as easily to be overlooked. Acute endocarditis is also common as a sequela of the chronic form and as part of septico-pyæmia. It is not uncommon as the result of acute and chronic nephritis, and of infectious diseases, such as scarlatina, measles, typhoid fever, variola, tuberculosis, and carcinosis, and is frequently complicated—mostly through the intercession of pericarditis—with pneumonia and pleurisy, also with perihepatitis, perisplenitis, and generalized erythema. Frequent and careful examination, therefore, during the existence of such ailments, while it facilitates an exact and complete diagnosis, suggests the best method of prophylaxis. Most of the cases of endocarditis we meet with in children being due to acute rheumatism, every case of the latter, though ever so slight, must be watched, put to bed, and treated with sodium salicylate, which may be given a long time after apparent recovery, or resumed with every new attack. Almost every form of "growing pain" ought to be so treated, and in no case of infectious disease must the patient be permitted to leave the bed before much of his previous strength has been restored.

The special treatment of acute endocarditis requires absolute rest in bed, a dose of calomel sufficient to open the bowels, and regular discharges through the course of the

disease by means of enemata rather than of purgatives. Frequent but small meals, and articles of food as suggested above. If thirst be great, drinking should be permitted often rather than much at a time. No alcohol in the beginning. Depletion by leeches is rarely indicated, and then only when there is a serious complication with painful pleurisy. In rheumatic endocarditis depletion is not tolerated. For severe pain which depends on pleural complication the subcutaneous injection of a few drops of Magendie's solution of morphine is preferable. Dry or wet cupping will sometimes relieve in such cases; other derivants, such as sinapisms, will often suffice. Vesicatories I do not advise in an acute case, the patient having enough to suffer from nature's infliction. Ice applied in a bag, which must not be too heavy, or ice-water cloths, well wrung out, are beneficial in most cases, rheumatic or other. The head and trunk must be raised so as to make the patient as comfortable as possible. Blue ointment has been recommended over the heart and other places, but I cannot say that I have reason to advise it. Strong diuretics, such as act by increasing blood-pressure, must not be given; mild salines will answer best; a small dose of calomel may be given from time to time. According to the indications noted above, potassium iodide, with or without an opiate, will answer best, in doses of from fifteen to twenty-five grains (1.0 to 1.75) daily, for a child of six years. An opiate at night secures rest; potassium bromide may be given through the day. If the case be rheumatic, as it mostly is, sodium salicylate, from fifteen to thirty grains (1.0 to 2.0) daily, will be tolerated and found serviceable. Phenacetin may take its place sometimes, in daily doses, all told, of from five to ten grains (0.3 to 0.6). It acts as a febrifuge, an antirheumatic, and a sedative at the same time, better than quinine, a dose of which may, however, answer well now and then, particularly during remission. Antipyrin rarely, acetanilid never. Aspirin (soluble in alkalies, therefore not affected by the stomach) may be given in endocarditis when it is, as usual, rheumatic, in three daily doses of from eight to fifteen grains (0.5 to 1.0) each. Serious attacks of dyspnœa are best relieved

by morphine, either internally or subcutaneously, or by lead and opium. Drastics will seldom be required and seldom answer the purpose. The nitrites may be tried, though they have not served me so well, or so often, as I formerly thought I had reason to expect; they act best when the pulse is dangerously small. When cachexia and debility are prominent symptoms, tonics and stimulants are indicated early. In bad septic cases chloride of iron may be given at an earlier period. When streptococci are found in the blood, the antistreptococcus serum (Marmorek) may be injected in repeated doses of from five to ten cubic centimetres daily. Credé's ointment should be used at the same time, fifteen grains once or twice a day; subcutaneous injections of yeast and of nuclein have been recommended. Among the stimulants, I think highly of camphor and ammonia. Among the direct cardiac stimulants enumerated above, digitalis ought to be given only after the acute changes in the muscular tissue of the heart have been repaired. (There is hardly a case of endocarditis unaccompanied by myocarditis.)

It is here that the experience and tact of the practitioner must decide an important point. In the further evolution of the case, digitalis with quinine, digitalis with belladonna, digitalis with strychnine, or with bromide, or with iodide, together with stimulation of the peripheric circulation by friction, either dry or with alcohol or hot or cold water, find their own indications.

The hygienic treatment of chronic endocarditis has been disposed of in former remarks. The medicinal agents of most importance are digitalis and iron. Constipation and over-exertion must be avoided. In connection with the latter, the education and training of the child should be so guided as to prepare him for his future trade, business, or vocation. As endocarditis terminates so often in valvular disorders with consecutive hypertrophy, his future life ought not to be exposed, if avoidable, to great excitements or hard physical labor. A child so affected must not take coffee, tea, or alcohol in any shape as an article of diet. He must not be trained to become a military man, a pugilist, or a medical practitioner.

The management of valvular changes resulting from endocarditis is more successful in childhood than in the adult. Compensation is brought about by consecutive hypertrophy; thus it is facilitated, about puberty, by the rapid growth of the heart at that period of life, and particularly by the increase in size of the aorta and also of the arteries in general, thereby easing the circulation. Besides, purely vascular disease, which is so common in the adult, is a rare exception in the child. Moderate exercise contributes its share in increasing the growth of muscular tissue of all kinds, and should be recommended, according to Beneke,[2] as also in undersize of the heart.

Pericarditis.—The pericardium is more accessible to the influence of cold applications than the heart. They generally act well; but we must be prepared to meet with doubtful or no success in many cases, for pericarditis is but rarely a primary or uncomplicated disease; indeed, it is more frequently fatal on account of its complications than of effusion. Myocardial changes (fatty degeneration mostly in the adult), acute œdema or acute inflammation of the myocardium in acute articular rheumatism, chronic interstitial myocarditis, or tubercle, or syphilitic gumma, or complications with purulent mediastinitis or pleuritis, are not uncommon. In pneumonia, pleuritis, and scarlatina, pericarditis is not unusual; in rheumatism frequent. The internal treatment of pericarditis is, therefore, in part directed by the complications. Digitalis is indicated mainly

[2] From birth to the seventh year the volume of the heart increases from twenty-three to one hundred cubic centimeters, by no means in proportion to the weight of the body. Still, this increase is very much greater than that of the lumen of the arteries when compared with the length of the body. The pulmonary artery is wider than the aorta until puberty; afterwards they are equal or the aorta becomes larger. The subclavian arteries and the common carotids are very wide compared with the length of the body (thereby causing physiological and pathological congestions of the cranium and its contents). Between seven and fifteen years the volume of the heart is from one hundred and thirty to one hundred and forty cubic centimetres; at that time the large arteries increase in absolute width.

in cases which are rather complicated; strophanthus, convallaria, and potassium iodide may take its place or be combined with it, according to the suggestions made above. Morphine is demanded in most cases, if only to give rest for the night. The fever may require phenacetin, aspirin, sodium salicylate, or (during a remission) quinine. After the fever has disappeared, or while it is waning, absorption of the effusion may be promoted by caffeine, sparteine, diuretin, iodides, and a vesicatory over the heart. Effusion into the pericardium is not often so copious as to produce suffocation, but I am afraid that puncture of the pericardium to relieve the fatal pressure is not made so often as it ought to be. Fortunately, errors in the diagnosis are not very easily made; still, they do occur, for I have been called to perform paracentesis of the pericardium where there was some pericarditis, more hypertrophy of the heart, and much pleuritis. The operation is not difficult, the liquid being so copious as to give the heart ample space to recede in a semi-recumbent position. The aspiration should be made in the left mammillary line, in the sixth intercostal space. In the same neighborhood, at the upper margin of the fifth or sixth rib, the incision is made to remove pus, and irrigations may be made afterwards. Drainage has also been established in such cases. If at the same time there be pus in the pleural cavity, it may become necessary to select another spot for the pericardial operation. A. Fraenkel recommended it on the right side of the sternum. The heart has been punctured during the aspiration without evil result; but I am not prepared to say, even with Biedert, that "the puncturing of the heart is not connected with any danger."

Hydropericardium, no matter from what cause, must be treated on the same principles as those which are valid in hydrothorax.

Syphilis of the pericardium and of the heart, if diagnosticated or suspected, require their own specific treatment.

Neuroses of the heart are not so frequent in the child as in the adult. The diaphragm, on account of its higher location, may annoy the heart in tympanites; undue motility

(ptosis) of the heart may be congenital; solidification of a lung may render posture on the opposite side difficult and cause tachycardia or arrhythmia; early chlorosis or Graves's disease, alcoholism, the use of coffee or tea, masturbation, and early neurasthenia, often on an hereditary basis, may cause—mostly about the time of puberty—all the symptoms of slow, fast, or irregular heart's action. The treatment should meet the causes: cold water washing and bathing, cold applications to the heart, moderate gymnastics, no sedentary life, little schooling in the usual meaning of the word, codeine one dose for the night, sodium bromide or monobromated camphor in a few doses daily, enema daily, a purgative occasionally, physical and mental hygiene.

Congenital anomalies of the heart claim attention from the moment of birth. The newly-born candidate for cyanosis is liable to suffer from asphyxia, the rules for the treatment of which need no repetition here. When the troubles, being the result either of embryonic arrests of development or of fœtal inflammations, prove incurable, almost the only thing to be done for the little sufferers is to protect them as much as possible. If they be so unfortunate as to grow up, exercise should be avoided,—indeed, is avoided. Alcohol is indicated in conditions of collapse only; no blood must ever be taken; laxatives should be sparingly given, if at all. The temperature in which the little waifs are to live ought to be equable, moderately warm, their wearing apparel warm and comfortable. Congestive disorders which would require the use of cold in otherwise healthy children must mostly do without it, as the patients seldom bear it. Mild vegetable acids are coveted by many. Only those who appear to develop hypertrophy of the heart should take digitalis or strophanthus, provided their effect on the arteries need not be feared. Small doses of an opiate will often relieve their discomfort and dyspnœa. The combination of digitalis with iodides, administered for months in succession, gave relief in a number of cases in which the patients lived four years or more.

There are anomalies of the infant heart which are congenital, or nearly so, and still not comparable in dig-

nity to arrests of development. Rheumatism, scarlatina (rarely), or inflammations of some intrathoracic viscus, when contracted in early life, may result in cardiac complications. They are on the left side of the heart (while fœtal endocarditis affects the right half pre-eminently). *Hæmatoma* at the free margin of the mitral valve is formed immediately, or soon after birth, below the endocardium. It is liable to disappear, and with it, by recovery, or by compensation, or by increased frequency of the cardiac movements (by which the blood-wave becomes smaller and the valve excursion shorter), the systolic mitral murmur caused by it (like that which is caused by rheumatic endocarditis); but excrescences, hard noduli (Cruveilhier), cicatrization, and insufficiency of the mitral valve may persist (Luschka, *Virch. Arch.*, vol. xi.). The latter is easily diagnosticated and requires the usual treatment of acquired chronic endocarditis. As *blood-nodules* on the cardiac valves, Berti (last in *Arch. f. Kinderheilk.*, vol. xxxi., 1901) describes what he takes to be, not hemorrhages, but ectasias and cysts and evolution processes of the valvular tissue with disappearance of the vascular net. Treatment as above, if any.

The *ductus arteriosus Botalli* becomes nearly obliterated within two weeks, entirely within three months, by the aspiration of its blood into the newly opened lungs, by its being bent by the traction of the lungs, by the proliferation of the spindle-shaped cells of the tunica media, and finally by thrombosis. Theo. Escherich (Festschrift) describes, in cases of patency of the duct, sudden attacks of shallow or absent respiration, cyanosis, bulging eyes, swelled lips, slow heart action, and tonic contractions of the extremities. His treatment consists in B. Schultze's method of treating asphyxia. It is to be repeated many times daily, without much exertion, just enough to keep the lungs acting.

Ptosis of the heart (dislocation downward) has been observed with epigastric pulsation as the result of weakness of the connective tissue of the great vessels which sustain the heart. Varicosities and sclerosis were noticed as consequences. Possibly a proper epigastric support may have

a good effect. Four cases of Feranini (*Centralbl. f. inn. Med.*, January 6, 1899) were complicated with mitral stenosis, small size and asymmetry of the cranium, feeble bones, stunted growth, and deformed chest and extremities; once with mental weakness.

Congenital undersize of the heart does not appear to be so frequent as that of the arteries. Indeed, in many cases of undersized arteries it was found of normal size, or somewhat larger. In the latter case the heart was not always hypertrophic; on the contrary, in most instances there was some fatty degeneration of the flabby muscle. Like every small organ, the small heart may be built up by moderate and persistent gymnastic exercise, a small dose of strychnine given three times a day for weeks or months in succession, cold washing and friction, and an altitude of from one thousand to fifteen hundred feet. A certain amount of muscular growth will probably result from it; it is quite welcome, for the labor of the heart requires either an organ of sufficient size or one of unusual strength.

Neoplasms of the heart (carcinoma, sarcoma, fibroma, myoma, lipoma, myxoma, tubercle, echinococcus, cysticercus, and syphiloma) are rare in early life, the last named more frequent than the rest, and the only one that so far can be reached by (antisyphilitic) treatment.

II. THE BLOOD-VESSELS

The structure of the blood-vessels is sometimes very defective, the walls being thin, fragile, and pervious. In such cases hemorrhage, small or copious, is a frequent symptom. The frequency of hemorrhages in the newly-born, leading, when in the cranial cavity, to asphyxia, convulsions, idiocy, or early death, is, among other reasons, caused by the thinness of the vessel-walls, whose tissue has not yet quite evolved from its embryonal condition. This, or a similar condition, may continue for life. This *hypoplastic state,* however, is not, of necessity, general: it may be local. The early nose-bleedings of some, though they have no heart disease, and the congenital tendency to aneurism, mostly in places where the elastic

tissue, either from arrest of local development or by microbic destruction, is either scanty or absent (usually at the origin of branches, Eppinger), prove the occasional occurrence of these circumscribed and local defects.[3] A *uniform thinness* of many or all of the arteries, however, is most likely to be complicated with narrowness, which has been studied by Virchow, Sée, and others in its relation to incurable chlorosis, palpitation, and cardiac asthma. That thinness which predisposes to fatty degeneration of the intima and media, to sclerosis of the adventitia, to atheromatous endarteritis, and to the formation of aneurism at an early age has not been made the subject of active treatment, so far as I know, except by myself. I feel convinced that the administration of phosphorus,—not phosphates of any kind,—with its stimulant effect on the growth of connective tissue in general, has rendered me good service in habitual tendency to cutaneous, mucous, and internal hemorrhages. *Hæmophilia* of moderate degrees appeared to improve under its use, and the children to be safer and better developed. The dose for a child of three years should be from one-fiftieth to one-thirtieth of a grain (0.001 to 0.002) daily; that means from two to three minims of the oleum phosphoratum, or from one to one and a half teaspoonfuls daily of the elixir phosphori (United States Pharmacopœia of 1890).[4]

Atheromatous degeneration of arteries, large and small,

[3] A. Jacobi, Extracranial Aneurism in Early Life. See Index.

[4] The unreliability of the percentage of phosphorus when dissolved in oil, and particularly in cod-liver oil, is the cause of the ill success in the hands of observers and of the clouds of European magazine articles that rain down on the profession. If they would only use, now and then, the preparations of the U. S. Pharmacopœia! Binz, who favors phosphorus therapeutics (mainly in rhachitis), recommends a method to determine the percentage of phosphorus in oil solutions (Centralbl. f. inn. Med., November 14, 1902). A phosphorus solution which is invisible in the dark becomes visible when warmed. Such solutions as contain little phosphorus require a relatively high temperature for that end.

in babies, children, and adolescents is rare, but cases are from time to time reported. In another part of these volumes I have spoken of the recommendation of lactic acid in these conditions. *Syphilitic* vascular changes require their specific treatment. *Tuberculosis* of blood-vessels, mainly small arteries, has been known a long time. Bacilli enter through the lymph and the blood circulation, are frequently perivascular first, and find their way into the intima.

Thrombosis of veins in general, and of the sinuses of the dura mater in particular, is the result of retardation of the (general or) local circulation and of coagulation of blood by marasmus from whatever cause: rapid elimination of water (cholera infantum), debility of the heart, pressure on veins, or inflammation in the neighborhood (for instance, caries of the petrous bone). In the same way thrombosis of the femoral vein may be caused by peritonitis or by a pelvic tumor (or by fractures not set). In the cranium the right transverse sinus is most frequently affected, but quite often also the inferior petrous, cavernous, and longitudinal sinuses. Such thromboses cause hyperæmia, œdema, or extravasations; it is by their symptoms that the diagnosis is made. The treatment must be preventive in order to be successful. Early attention to the ear and mastoid process, treatment of diarrhœa before inspissation of the blood and heart-failure take place, timely stimulating and roborant treatment, and not *pro re nata*,—that is, when it is just a little too late,—are the best preventives. The subcutaneous injection of large quantities of warm sterilized water, with sodium chloride (7 to 1000), is capable of preventing the inspissation of the blood resulting from acute and copious diarrhœa, and often proves life-saving.

Welch refers a number of venous thromboses to cardiac diseases (Festschrift), mainly to advanced mitral affection with failing compensation, tricuspid insufficiency, and pulmonary infarctions. Flexner asserts the frequency of terminal bacterial infections in heart diseases. All this preaches the sermon of preventive treatment (and curative so far as possible) of cardiac and of infectious disorders.

Congenital local dilatations of blood-vessels, capillaries, smallest veins, and smallest arteries, together with an increase of their number, and mostly with incompetent structure, are known by the names *nævus, telangiectasia, angioma.* Their color depends on the nature of the blood-vessels composing the anomaly, also on their distance from the surface, their size on the extension of the morbid process, and their size and consistency on the admixture of connective tissue. They are found in all sorts of tissues and organs, mostly on or below the surface of the body. In the subcutaneous tissue, when mixed with much connective tissue, they are liable, after having remained unchanged for many years, to undergo sarcomatous degeneration. Therefore, and because of their tendency to rapid growth in every direction, with increasing deformity and possible danger from hemorrhage, the early removal of all those which do not exhibit from the beginning a tendency to fade and finally disappear is indicated. The methods followed to obtain that end are very numerous. Vaccination over a nævus will generally destroy it, but may do so but partially, and will leave a bad scar. Plasters of tartar emetic and of Vienna paste cannot be controlled to such an extent as to destroy the growth only. Injections of perchloride or subsulphate of iron are known to have given rise to extensive thrombosis, gangrene, and death; injections of alcohol have been tried, but have not, I think, reached farther than the ear of the medical public. Corrosive sublimate in collodion (1 to 8) is an excellent caustic where the nævus is not extensive, particularly on the head; it rarely requires more than a single application. Fuming nitric acid is perhaps the best of all local applications; the pain is but temporary, and the effect circumscribed and fairly thorough. But it ought to be used for superficial nævi only, and even then requires repetition in a number of instances. Excision is a good method if the operation can be performed in a short time and all the morbid parts can safely be removed without loss of too much blood. The ligation of angiomatous tumors is indicated where they can be entirely grasped either without or with the aid of needles run through their base;

but time is required for them to fall off finally, and the wound demands careful and persistent antiseptic treatment until the danger from local infection has passed and a smooth scar has been perfected. Electrolysis has been praised very highly, particularly in the treatment of the extensive wine-marks. Still, personally, I never saw a satisfactory result in these cases. There remained always speckled, whitish scars of small size alternating with the original discoloration,—a result which I should not claim as an improvement upon the original condition. The actual cautery is the most satisfactory of all our remedies; very few will at present use it in any other shape than that of the galvano- or the thermo-cautery. The heat should not be excessive: white heat destroys blood-vessels too rapidly to permit of simultaneous coagulation of the blood, and produces hemorrhages. Dull-red heat will accomplish a cure. A momentary application suffices for a superficial nævus; its action can always be controlled and strictly localized, and the formation of the scurf secures against surface infection. Nor are large angiomata inaccessible to it. When these are to be destroyed, it is best not to attempt too much at first. It is unnecessary to destroy everything; long after the direct effect has passed away, coagulation in the blood-vessels and slowly progressing cicatrization result in the gradual lessening of the swelling. When the tumor ceases to diminish in size, the operation is repeated, sometimes after many weeks or even months. The cautery is then introduced into the very spot at which the previous application was made. In this way the cicatrix remains localized. As a general rule, a cicatrix following the application of the actual cautery is smooth and becomes more so and less perceptible from year to year.

TUBERCULOSIS

The definition of the term "*tubercle*" has experienced a great many changes. Originally it means a prominence or protuberance. In the Latin translations of Hippocrates it stands for cold (caseous) abscesses. Francis de le Boe (Sylvius, 1614-1672, in "Praxeos Medicæ Idea Nova," 1667-1674) applies the name to small bodies met with in different tissues and developed from presumed invisible glands, Baillie (1761-1823) to an abnormal product of scrofulous origin, Bayle (1774-1816) to an independent specific neoplasm endowed with great tendency to caseous degeneration. With him, indeed, the latter was characteristic of, and solely found in, tubercle. He and Lænnec (1781-1826) looked upon the tubercle as the cause of consumption (phthisis), the latter author adding to pathology and nomenclature the term "tubercular infiltration." Lebert (1813-1878) described the microscopical "tubercle corpuscle" as consisting of disintegrated cells, or free nuclei, thus enabling everybody to discover tubercle wherever it did and did not exist. Schönlein (1796-1848) was the first to use the term "tuberculosis."

According to Virchow, the tubercle is an organized, though not vascularized, neoplasm composed of round cells with very vulnerable and deciduous membranes and very numerous nuclei. These may be so copious, indeed, that the membranes are sometimes not discovered. The tubercle is small; even the smallest, however, is often a conglomerate; it is of gray color, turning yellow through caseous (fatty) degeneration, which begins in the centre. It leads to tubercular "infiltration" by the aggregation of many tubercles and secondary inflammation in the neighborhood; or to ulceration; or to the hardening of the small body ("fibrous tubercle") by disintegration and absorption of the cells and the increase of the, originally, scarce and thin connective tissue.

The small epithelioid cells with their nuclei were soon found not to be the only microscopical constituents of the tubercle. Virchow, Rokitansky, and many others, found "giant cells," and Th. Langhans claimed them as almost constant constituents. They are of spherical shape, contain from twenty to a hundred nuclei, with leucocytes in their periphery, and a very fine reticulated tissue between these constituents.

The reticulated tissue, and giant cells, are mostly found in chronic tuberculosis. In this process a considerable amount of fibrillar connective tissue is met with in the periphery of the deposits. In the acute process small spherical cells are more frequently found; they are also copious in the periphery of tubercles when they undergo caseous metamorphosis. This latter process is apt to spread into the surrounding congested or inflamed tissue; quite often the very caseous masses contain tubercles still intact.

To identify, however, caseous degeneration with tuberculosis would be a mistake. The former is no neoplasm, nor intimately connected with a specific neoplasm, but a retrograde metamorphosis. It is not characteristic of any single pathological tissue or condition, for, besides being found in tubercle and inflammatory deposits, it may be the final stage of development in pus, cancer, and typhoid infiltrations.

Nor are giant cells pathognomonic of tuberculosis. They are found in the disintegrating osseous substance, in the cavity of the uterine sinuses near the insertion of the placenta, near foreign substances experimentally introduced into the peritoneal cavity, in pneumonia, syphilitic endarteritis and gummata, in healthy granulations, sarcoma, and actinomyces, and in the subcutaneous tissue of animals into which silk, hair, and other foreign bodies had been introduced for the purposes of experimental research (Birch-Hirschfeld).

Thus, neither the histological structure of the tubercle nor its tendency to caseous degeneration suffices to characterize tuberculosis as a specific disease of an infectious nature. The latter has long been assumed to exist by com-

mon consent, and appears to be finally demonstrated by R. Koch's discovery of a specific bacillus which gives rise to a local irritation and the formation of the specific noduli. Modern pathologists have agreed in this, that only such products, though histologically the same or similar, as contain, and result from, the specific bacilli, deserve the name of tuberculosis. Thus, tuberculosis is defined as an infectious disease which shows, as the result of immigration and proliferation of a specific bacillus, conglomerates, small or large, consisting of cells with few or many nuclei and nucleoli, and (as they are without blood-vessels) disposed to undergo speedy caseous degeneration. In the latter condition, when recent, the tubercle is called yellow. The accumulation of a great many yellow tubercles forms what is called an infiltration. Calcification is the result of copious hyperplasia of cellular tissue round a tubercular infiltration. Softening is a more frequent occurrence, and leads to the disintegration of viscera, cold abscesses in the subcutaneous tissue, and alterations of mucous membranes.[1]

Etiology.—Congenital predisposition need not be identical with *hereditary transmission.* The former may result where numerous children are born of non-tuberculous parents in too rapid succession; from puny development of the infant; from under-size of the heart, from anæmia

[1] Thus, according to the present state of the pathological doctrine, tuberculosis demands the presence of the bacillus. Still, there are processes which are tuberculous in everything but the bacillus. Thus, Malassez and Vignal found zooglœa only, mostly without bacilli, in "tubercles" produced in experimental proceedings. Similar results were obtained by Cartro and Soffia: their zooglœa could be inoculated successfully. Biedert reports the case of an acute pulmonary tuberculosis without bacilli. Ribbert met with small bodies consisting of lymphoid and other cells, giant cells included, without bacilli, which he prefers to call multiple lymphomata solely because of the absence of the micro-organisms. Eberth describes the same condition under the head of "pseudo-tuberculosis." Biedert (Lehrb. d. Kinderkr., 1887, p. 532) suggests that there must be either an affection which cannot be distinguished from tuberculosis, or a condition of the bacillus which renders its recognition impossible.

based upon stenosis of the pulmonary artery, or from congenital shortness or premature ossification of the costal cartilages in the upper part of the chest, by which the apices are prevented from expanding and the circulation of the blood is impeded.

Hereditary transmission of tuberculosis has been claimed as a fact by common consent, because of the frequent occurrence of the disease at an early age, and the great number of cases observed in a family. Vogel looks upon heredity as the principal etiological factor. For he observed that a child of a healthy family when living with a predisposed family under the worst possible hygienic surroundings would not suffer, while all the rest would succumb. Thus he concludes that external influences are injurious to those only who are predisposed, no matter whether heredity is visible in the propagation of either a predisposition or a virus. It is the latter in which Baumgarten believes. Brehmer, however thinks but little of either mode of transmission, because "not more than one-third or one-half of all the cases" occur in families in which there is a multiplicity of cases.

Hereditary transmission ought not to be presumed to exist at all except in cases which occur at a very early period of life. Infants of tuberculous parents, though they fall sick with tuberculosis, or atrophy, or marasmus, when but a few months old, *may* suffer from the consequences of a germinative process, but their disease *may* also be due to direct contagion, or tuberculous food. Still less conclusive are those cases which make their appearance in bones, or glands after a number of years only. It is mainly this class of cases that has given rise to the theories based on predisposition, or on the gradual transmutation of scrofulosis into tuberculosis.

Hereditary transmission of tuberculosis is not accepted by a number of the most critical pathologists. Benda denies the possibility of the transmission of bacilli through sperma which has its origin in nuclei not infected by parasites. He did not find them in sperma secreted by tuberculous testicles, nor in that of phthisical patients whose testicles were healthy. Virchow takes it for granted

that tuberculosis resulting from infected sperma ought to develop at a very early period of life, in which it is rare, or at birth, when he knows of no such case. He even found the fœtus without tubercles when the mother had tubercular endometritis, and does not admit the possibility of a direct transmission unless the circulation of the placenta be abnormal. Still, under certain circumstances the blood-vessels of the placenta are known to be pervious. Coloring substances have been found to penetrate into the body of the fœtus by Reitz and Mars, while other experimenters have but negative results. The bacilli of anthrax have been found in the fœtus by a single observer, those of septicæmia by a very few. That, however, some medicinal substances will traverse the placental circulation and be found in the fœtus, we know; also that syphilis, variola, relapsing fever, malaria, may be transmitted from the mother to the fœtus. Such facts exist, though they may be explainable only by the assumption of a morbid alteration in the walls of the blood-vessels of the placenta or its insertion.

There are, however, some facts which render the theory of a direct transmission of tuberculosis somewhat probable. Thus, in the spermatic canals of non-tuberculous testicles, in eight men dying of phthisis, C. Jani found bacilli five times, and four times in the prostate glands, out of six autopsies. Besides, there are a few cases of congenital tuberculosis of animals on record. I willingly exclude Czokor's calf of three weeks, and the two calves of Hertwig's of two and four months; for all of them may have contracted acute tuberculosis after birth by direct communication or the milk sucked from a diseased udder. But Johne has the report of an eight months' fœtus of a calf, with universal tuberculosis.

In the human race no case of a similar nature has been known, but in 1861 I attended a phthisical woman in her first confinement. She belonged to a consumptive family, had suffered herself before she got married, and died in the third week after confinement. The fœtus was born at the end of the seventh month of utero-gestation, and lived a few minutes only. There were numerous gray

miliary tubercles in the tissue of the liver near the surface, a few in its peritoneal covering and the spleen, and on the pulmonary pleura. The father was healthy and remained so for years. Thus this isolated case, the only one of the kind ever observed by me, appears to prove the possibility of a direct hereditary transmission from the mother to the offspring. Epstein's two hundred babies of tubercular mothers yielded a negative result. There is but one of them who had tuberculosis at the age of ten weeks.

There are other observations which appear to prove that hereditary transmission is more frequent than is allowed by those who insist upon inhalation as the only cause of tuberculosis. Indeed, such observations are numerous. In the earliest period of life, tuberculosis is mostly found in the lymph-bodies and the bones. Why not first in the lungs, if inhalation brought it on? It has been noticed that healthy babies, raised in tubercular families, are not liable to be infected, while the children of parents who died of tuberculosis while the former were quite young, would still die of tuberculosis, though removed to healthier quarters.

Though the cases of tuberculosis in the very first weeks of life be ever so scarce, we cannot say that any *age* is entirely exempt. Baumgarten met with cases of tuberculosis at the age of one month, which were so advanced as to make its starting during fœtal life probable. Steiner and Neureutter report cases of tuberculosis occurring at the age of eight weeks, F. Weber cavities at less than three months, Demme on the twelfth day, Steffen at three weeks. Demme has another case of a baby three weeks old with tuberculosis of the intestine, and bacilli; and another one of four weeks with pulmonary cavities. Between the fourth and sixth months of life I have met with it in a number of instances. Lorey gives the ages of one hundred and sixty-two tubercular cases among children as follows: from the first to the third month, one; from the third to the ninth, eleven; from the ninth to the twelfth, thirty-one; between the first and the second year, fifty-five; from the second to the fourth, forty-one; and from the fourth to

the twelfth, twenty-three. In Biedert's tables containing the ages of the young affected with pulmonary tuberculosis six and eight-tenths per cent. were observed under one year of age, forty-eight from the first to the fifth, twenty-seven from the fifth to the tenth, and eighteen per cent. from the tenth to the fourteenth year. Thus tuberculosis is comparatively rare under one year, undoubtedly because of the comparatively few opportunities for infection: as a rule, these early cases are due to, or connected with, the existence of catarrhal pneumonia, or intestinal difficulties, or marked scrofulous disposition. Between the ages of two and four years it is quite frequent, the lungs, pia mater, and intestine being the very organs through which it is apt to become fatal. In the former two, in early childhood it is not readily of a primary character; at that age the intestines, bones, and lymph-bodies are more liable to be the seats of the original inlet than the lungs. These are more easily affected, primarily, in advanced childhood, and about the period of puberty.

The former belief that acute tuberculosis was more frequent in the young, and the chronic variety in the old, holds good no longer, since a larger number of diseases of the bones and lymphatic glands have been recognized to be of a strictly tubercular character. It is particularly the latter organs that are exposed to infection, because of their superficial location, and, in infancy and childhood, the comparatively large size of the lymph-ducts, the greater vulnerability of the surface which facilitates the access of a virus, and the physiological activity of the whole lymph-circulation.

This is but one of the many instances of the peculiarities of disposition depending on the nature of the tissues. Others are found in the different degrees of the energy of respiratory movements, the various conditions of the epithelium, the secretion of the muciparous glands, and the circulation in the lungs. In the latter, tuberculosis is not so frequent in the apices of the young as in those of the adult, because of the larger amount of air entering them in the former. In them, indeed, it is the lower parts of the lungs which are often the preferred seat of the malady.

And those lungs which are anæmic, either on the basis of general anæmia or as the result of the stenosis of the pulmonary artery, are much more liable than those affected with chronic venous stasis depending on emphysema, kyphosis, or congenital or acquired disease of the heart.

Animals have been made tubercular by the *inhalation* of tubercular sputum. The viability of the bacilli and their spores is such as to render them dangerous though, or because, they have been in a dry state on the floor of the room, in carpets, linen, or clothing, for a long period. They will not easily locate in the external parts of the respiratory organs where the air is cool and its current capable of carrying them out as well as in. That "bad" air is a cause of general tuberculosis has always been accepted as undeniable. The latter would increase with crowding. In the foundling asylum of Stockholm, Abelin noticed that the proportion of cases of tuberculosis would increase with the number of inmates. In the light of modern pathology the "bad" condition of the air may signify as well the prevalence of bacilli as the presence of injurious gases and the diminution of individual air-space.

Inhalation has always been considered as one of the principal sources, or the principal source, of acquired tuberculosis. Many of the reports, however, which were meant to prove the frequent occurrence of such cases, leave ample room for doubt: thus, for instance, those of the ten new-born babies said by H. Reich[2] to have been infected by a consumptive midwife, who had the unfortunate habit of insufflating the respiratory organs of the young with her own breath.

In order that virus, or a bacillus, may find a resting-place, the surface must be in a morbid condition. A mucous membrane of normal consistency and function is not very liable to admit infectious diseases. Neither diphtheria nor tuberculosis finds a safe nest on a healthy membrane. As long as a mucous membrane is covered with normal mucus and protected by vibrating epithelium, foreign bodies, from particles of carbon and metal to bacilli, are liable to

[2] Berl. Klin. Woch., 1878, No. 37.

be expectorated. Only the air-cells which have no fimbriated epithelia allow bacilli to rest and to develop. All the other surfaces of the respiratory organs are endowed with means of self-defence. The latter, however, is greatly interfered with either by an abnormal structure of the integuments or by actual lesions. The former may be inherited from parents suffering from chronic infectious diseases, such as tuberculosis or carcinosis, or acquired by previous exhausting ailments, anæmia, or chlorosis; the latter may result from measles, whooping-cough, typhoid fever, or scarlatina, or inflammation or gangrene of the lungs, which thus give rise to a predisposition to tuberculosis by having prepared the surface for the admission of the virus.

The bacillus, however, is not found floating in the air and ready for inhalation unless under exceptional circumstances. To be inhaled it must be dry. As long as sputum is moist, or after having been dry, is again exposed to moisture, it cannot be mixed with the air and thus enter the lungs of another person. Besides, the bacillus has a greater specific gravity than air, and falls to the ground. But it may adhere to bedclothing, or the bedstead, or the walls of the room, or the floor which has been soiled. Thus, children of a phthisical mother may all be infected by their close contact with her and her surroundings, while a nurse, or the husband who goes about his business, is not suffering. Thus, also, the phthisical patients in the wards of a hospital are uninjurious as long as no expectoration is permitted anywhere but in a spittoon containing some water.

Still, the frequency of tuberculosis makes its transmission easier than the explanation of the latter in every case. Thus, for instance, Spillmann and Haushalter,[3] having made the observation that flies would concentrate round the sputa of tubercular patients, kept a number of them under a bell-glass, where they died the following day. Their excrements deposited on the glass and the contents of their abdomens exhibited an abundance of bacilli tuberculosis. As these bacilli are very hardy, their transportation by

[3] La France Méd., 1887, t. ii. No. 101.

the fly to the food of human beings, and those contained in the dried remains of the fly, appear to open a possibility to the transmission of tuberculosis to an almost incredible degree.

Besides, the bacillus of tuberculosis is of slow growth, and thus facilitates self-protection on the part of the endangered organ and organism; though, on the other hand, it is very tenacious of life. For a five-per-cent. solution of carbolic acid destroys it after twenty-four hours only, and a still longer time is required by a one-per-mille solution of bichloride of mercury. It does not even perish when exposed to a high degree of heat: G. Cornet exposed mattresses to the effect of public steam-heating apparatuses six times, and still found bacilli uninjured and active.

The entrance of tuberculosis through the *skin* or *wounds* is among the possibilities. As long, however, as the skin remains in a normal condition, it affords protection against the entrance of tuberculosis. But abrasions and wounds create a disposition. Still, the development of bacilli appears to require a higher temperature than that of the very surface, and a sufficient time for their sure installation. Thus is explained why the number of authenticated cases of the invasion of tuberculosis through the skin is still limited. Willy Meyer collected[4] twenty-eight such cases; M. B. Schmidt and others have since published a few more. Eighteen of the twenty-eight were those of Jewish infants subjected to ritual circumcision, which permits, or requires, the sucking out of the wounds by the lips of the operator. The incubation-period lasted from ten to fourteen days; after that time the first symptoms showed themselves as inguinal adenitis. Of the eighteen, nine died, five exhibited symptoms of scrofula, and four were not under observation afterwards. In a few (adult) cases of wound-infection the disease remained local; still, it is probable that, as the development of tuberculosis is a gradual one, many isolated cases due to local infection may become generalized after a while. Chronic inflammations of the skin may frequently give access to the virus. Demme

[4] *N. Y. Med. Presse,* June, 1887.

found chronic impetigo in four hundred and thirty-seven out of eight hundred and seventy-three cases of diseases of the bones and joints.

In the Congress[5] assembled at Paris in July, 1888, for the study of tuberculosis, Dr. Degive, of Brussels, alluded to the possibility of transmitting the disease by *vaccination.* In his city the calf from which the virus has been taken is killed; when it is found to have been healthy, the virus is used for both human vaccination and the artificial infection of other animals. But even the danger from virus taken from a diseased animal is but very slight. For the bacillus does not easily penetrate through merely superficial wounds, and certainly not into the serum of the vesicle any more readily than is done by the syphilitic poison. Thus no danger appears possible unless blood be mixed with the serum of the vesicle used for the vaccination of the human being.

One of the inlets of tuberculosis is undoubtedly the *alimentary canal;* indeed, there are some who attribute every case—or almost every case—of tuberculosis in the young infant to the influence of food containing the bacillus. Koch has established the fact that the latter may pass through the stomach and remain intact; in the intestinal canal it may be found mixed with food and nasal and pharyngeal mucus. In the healthy digestive organs it will do no harm; indeed, the normal stomach will not permit it to live. But the absence of acids in the feverish stomach, and the changes produced in the mucous membrane by abnormal digestion, sedentary life, emotions, serious illness, or constitutional ill-nutrition of the digesting surfaces, may yield conditions favorable to the invasion.

This may take place when the bacillus is an *accidental admixture* to the ingesta, or is swallowed with the *expectoration,* all or most of which is carried downward by infants and children. Thus a constant auto-infection is added to the original disease when this is located in the lungs. But the main opportunity for the invasion is furnished by the *meat* and *milk* of tuberculous animals. In the

[5] Congrès pour l'Étude de la Tuberculose, Paris, 1889, p. 157.

slaughtering houses of Rouen there were 1.43 per mille tubercular heads of beef, 0.09 of calves, and 0.38 of hogs: these figures are the average of the four years between 1884 and July of 1888. There were furnished in Montauban, in the course of seven years, 4.07 per mille of tubercular beef among all that were slaughtered. Fürn found twenty-two tuberculous geese in three hundred and sixty-five autopsies, Reimann sixty-two hens among six hundred, and eleven pigeons affected with the same disease among one hundred and thirty-eight autopsies. Walter K. Sibley found bacillus mostly in the peripherous parts of caseous masses removed from fowls,[6] and in undoubted lymphomata, undergoing central necrosis,[7] taken from a serpent, also from a peacock and an owl. Among sheep and goats, which move in fresh air, there were but few affected with tuberculosis. The influence of air and exercise is quite marked, so much, indeed, that T. Spillmann found from thirty to forty per cent. of all the stall cows of Nancy to be sick with tuberculosis. Even more than this percentage of tubercular animals is obtained by Brush for those which are "improved" by persistent breeding in. The opinions in regard to the danger attending the eating of meat taken from tuberculous animals are by no means uniform. In the muscular tissue the bacillus develops but incompletely: indeed, it has been observed to die within six days. E. Nocard found invariably that the inoculation of meat juice taken from tubercular animals had but little success; and Arloing, another of the great veterinarians of France, had the same results in his experiments. Both, however, found an abundance of bacilli in the glands, kidneys, spleen, and liver of the diseased animals. All of these organs are declared to be very dangerous under these circumstances, but the meat is deemed to be innocuous or but little dangerous in all but a very few cases. G. Butel, however, considers the meat of tubercular animals to be injurious under all circumstances. Baillet fears it only when the malady has rendered the animal thin and languid; but, again,

[6] *Trans. Path. Soc.*, London, 1888.
[7] Virch. Arch., vol. cxvi. p. 104, 1889.

Veyssière advises the exclusion of the meat of every animal suspected of tuberculosis, and emphasizes the fact that hogs are very subject to the disease.

The same difference of opinion prevails in reference to the milk of tuberculous animals. B. Bang found that milk of phthisical women could be inoculated with no danger at all. The inoculation of milk taken from twenty-one diseased cows yielded a trifling success in but two instances. But the majority of authors see more harm in such milks, and there are those who, like V. Galtier, find bacilli and danger not only in the milk of infected cows, but also in its products, such as cheese, buttermilk, and whey. Koubassoff attributes great danger to every milk of tubercular cows, Bollinger and Nocard only to that which is taken from tubercular udders. Still, authors of equally high reputation, such as Bouley and Bang, do not deem the presence of a tubercular mastitis necessary; the latter is declared to be a rare disease by Nocard, a frequent one by Degive and Van Hertsen. Upon this, however, all appear to be agreed, that heat destroys the dangerousness of milk obtained from infected animals. From 60° to 75° C. diminish it considerably. Milk heated to 85° C. is deemed safe.[8] For thirty years I have insisted upon the necessity of avoiding raw milk among the foods of children.

Localization.—There is hardly an organ in the infant or child which may not be affected by the tubercular process.

Cutaneous tuberculosis may appear in a primary and secondary form.

The primary form, or lupus, is not very frequent during childhood, but still many of the cases met with in adolescence and advanced age date from early life. It has a very slow development. It is found on the face and extremities, and sometimes extends to the mucous membrane of the mouth, nose, pharynx, and larynx. On all of the latter it yields a diffuse infiltration, not nodulated, of gray color and irregular surface, inter-

[8] Congrès pour l'Étude de la Tuberculose, Paris, 1889.

rupted by rhagades and ulcerations; while in the former it consists of red or brownish noduli, which are deeply embedded in the corium, with an occasional tendency to disintegrate and either form ulcerations or result in a desquamative process or a cicatricial atrophy. Anatomically, it is composed of small nests of round cells embedded in the interior of the corium, giant cells (mainly in the large noduli), and hyperplastic proliferations resembling those of epithelial carcinoma. It contains the tubercle-bacillus, and tuberculosis can be produced by its inoculation. It is not uncommon to find general tuberculosis in other members of the same family. Still, the tubercular nature of lupus has been doubted by Kaposi, because of the paucity of the bacilli in the morbid changes, the non-appearance of general tuberculosis in the same individual after a long duration of the lupus, the impossibility of multiplying lupus by inoculation, and the almost universal immunity from lupus of the other members of the same family.

The secondary form of cutaneous tuberculosis starts from tubercular joints, mucous membranes, and caseous and suppurating lymph-bodies. Fistula in ano may give rise to it, as, indeed, tuberculosis is apt to appear near the mouth, the anus, and the genital organs. In one of my cases, that of a girl of seven years, the process commenced from a neglected abscess in the right axilla. The fistulous and undermined ulcerations spread in every direction, extended over the chest, resulted in tuberculous abscesses extending towards the abdomen, and finally in pyothorax, with general miliary tuberculosis. This form is not nodulated, not hard, and not of that slow growth extending over years so characteristic of lupus, but is more ulcerous, of irregular outlines, and with but little infiltration. From syphilis of the cutis it is best diagnosticated by its very slow growth and the absence of the indurated boundary peculiar to the syphilitic ulceration.

In the *joints and bones* tuberculosis is frequent. Many of the cases of caries are of that nature; a large percentage of the cases of ostitis of the foot and ankle and of spondylitis belong to this class; also a number of cases

of caries of the mastoid process, with or without facial paralysis, and of otitis media, extending to the bone. The fungous arthritis is pre-eminently tubercular, for bacilli may be found in many a case. This class of cases is quite dangerous when left alone to such an extent as to lose its local character. If removed by an operative procedure, the localized tuberculosis loses its dangerous nature, and general infection may be avoided.

On the *pleura*, also, tuberculosis may be either primary or secondary. In infancy and childhood the former occurrence is but rare; as a rule, tubercular pleurisy, or tubercles on the pleura, are met with in generalized tuberculosis. In that case the tubercles are small or large, gray, yellow, or caseous; large caseous tubercles are mostly found on the point of contact of the adhering pleura. The assumption that every pleurisy is tubercular is based on theory only; for the cases of chronic pleurisy, of thickened pleura carried many years without a trace of tuberculosis, are by no means rare. The fluid of the pleural cavity found in tubercular pleurisy is either serous or purulent; in very rare cases there is blood mixed with the serum, or clear blood. Tuberculosis of the *pericardium* I never found, except complicated with that of the pleura, or as a part of general acute miliary tuberculosis.

The low temperature of a part of the *nose*, the constant motion of the air-current, and the presence of secretion on the mucous membrane render primary tuberculosis of that organ a rare occurrence. Still, the so-called scrofulous ozæna is very often tuberculous; even that, however, is quite often not primary, but the result or accompaniment of neighboring or general tuberculosis. In and about it, giant cells and bacilli are met with. The majority of cases of nasal tuberculosis are of a secondary nature. It is either miliary, the nodules are gray or yellow and disintegrate very readily, or it exhibits large ulcerations of irregular shape, or, thirdly, large tumors, mostly on septum or conchæ; they rarely extend to the bone, and consist of connective and granulation tissue and miliary tubercles.

Both primary and secondary tuberculosis of the *pharynx* is relatively scarce in infancy and childhood, though its

surface be constantly exposed to the contact with infected expectoration. Still, I have seen quite a number of cases, mainly between the ages of seven and fourteen, in which both miliary tubercles and painful tubercular ulcerations were found on the soft palate, tonsils, posterior wall of the pharynx, and nares. In a few cases the ulcerations were so deep, and the accompanying œdema so extensive, that fluids would escape through the nose. In one case the diagnosis from syphilis could not be made except after a certain time; as a rule, however, syphilitic ulcerations are less numerous, but deeper and steeper, and apt to heal under specific treatment.

Tuberculosis of the *larynx* is not so frequent in children as in adults. Of primary cases, or such as I could take for primary, I have seen but very few. At all events, when the diagnosis of tuberculosis of the larynx had been made, the appearance of pulmonary symptoms was but a question of a short time. Still, there is no reason why bacilli should not locate in the mucous membrane predisposed by the presence of catarrhal erosions, mainly on the vocal cords and in the interarytenoid space, also on the edges and the inferior aspect of the epiglottis. It is on these localities that both miliary tubercles and ulcerations are sometimes found. Mild symptoms of catarrh, hoarseness, cough, are observed at an early period, speaking and pressure are painful, the expectoration contains pus, blood, bacilli, and sometimes elastic fibres, and the laryngoscope reveals an incomplete closure of the glottis, the presence of tubercles or ulcerations, and, occasionally, localized œdema (perichondritis).

In the *thymus* gland tuberculosis is not rare at all. It was met with by Dr. Koplik and myself three times in sixty autopsies of infants under a year, twelve of whom had generalized tuberculosis. Sometimes it is found in the thymus, while no other organ, and no other member of the same family, is affected.[9]

Tuberculosis of the *peritoneum* is rarely a primary dis-

[9] Congrès pour l'Étude de la Tuberculose, Paris, 1889. See Index.

ease, and then acute or with high fever and urgent symptoms. It is mostly secondary, a part of general tuberculosis, or connected with protracted suppurations, or depending on embolism. It may originate in more advanced age in uterine tuberculosis, the tubes being the connecting link, or result, in the child, from intestinal ulcerations or disintegrated mesenteric glands. Sometimes it is quite local, in an intestinal adhesion opposite an open or cicatrized ulceration; in other cases it extends over large surfaces and may result in wide-spread adhesions, contractions, perforations, and hemorrhages. The tubercles found may be small or large, gray, yellow, or caseous. The accompanying inflammation may result in the effusion of large quantities of serum containing much albumen, or in fibrinous thickening of the peritoneum of the abdominal wall, liver, spleen, and omentum, with considerable glandular swelling, or the formation of large masses of exudation, between which and malignant tumors, mainly sarcomata, the diagnosis may be quite difficult. Still, not all of these exudation-tumors are of tubercular nature. I have seen them, from the size of a hazel-nut to that of a goose-egg, sometimes in large numbers, as the result of a chronic exudative peritonitis of non-infectious character, and diminishing in size and disappearing altogether until a permanent recovery. The temperature may not be very high ("peritoneal tuberculosis"), or may be quite elevated ("tubercular peritonitis"); other symptoms, such as fluctuation, pain, dulness on percussion, meteorism, diarrhœa or constipation, jaundice by compression of the ductus choledochus, obstruction by pressure on, or contraction of, intestines, depend on the extent of the affection and its more or less acute character. In the case of a boy of seven years who died with general tuberculosis, I found, beside large quantities of serum, which filled the abdominal cavity, complete adhesion and thickening of all the intestines, so as to yield the consistency and hardness of pasteboard. In the very young children isolated peritoneal tuberculosis is but rare; it is, however, a frequent occurrence in generalized miliary tuberculosis; in older children I have seen many cases in which—mostly on the founda-

tion of glandular degeneration—the disease, usually of a chronic character, appeared to have been the starting-point of the general affection.

The tuberculosis of the *liver, spleen,* and *supra-renal bodies* is, with very rare exceptions, secondary to, or a part of, general tuberculosis. Those organs are generally affected only towards the fatal termination, the tubercles being gray or yellow, seldom large and caseous.

The *kidneys,* both capsule and substance, participate in generalized tuberculosis. A large tubercle, of the size of a hazel-nut, I have seen in the left kidney of a girl of eight, who exhibited caseous degeneration of many of the bronchial and mesenteric glands, and cavities in both apices. Such a condition may be presumed to exist when a tuberculous child exhibits hæmaturia or dysuria. Tubercular ulcerations of the *ureters* or *bladder* I have not met with.

Tuberculosis of the *vulva,* in a girl of seven years, I have seen but once. It appeared in the shape of lupus complicated with angry-looking ulcerations, the edges of which were lined with miliary tubercles. The uterus and its appendages, except in cases of general miliary tuberculosis, I have not seen affected.

Tuberculosis of the *testicles* is not quite rare. Henoch has seen a few cases at the age of from one and a half to seven years, the epididymis being hard and nodulated, occasionally; and Koplik has but lately described the case of an infant. Sometimes it is primary, but almost in every case there was tuberculosis in other organs, mainly in the bones (caries) and peritoneum. My youngest case was seven months old; at that time the right testis was of the size of an egg, hard, and irregular. It had been known to swell but six weeks before it was presented. It grew rapidly to double its size, and had not lost its hardness when the infant died of general miliary tuberculosis (meningeal, pulmonary, and mesenteric, mainly) within a few months. In the case of a boy of three years, who also died of (chronic) general tuberculosis, the right testicle was of the size of a walnut when first seen, and did not increase much in size when caseous degeneration

took place, and both testis and the adhering scrotum were pierced by a number of suppurating fistulæ. Cicatrization of such fistulæ has been observed, but none of my few cases lived long enough for such a termination of the local process.

The interior of the *intestinal tract* may become the seat of tuberculosis through the medium of the circulation, or by the ingestion of bacilli contained in sputum, meat, or milk. I know of no instance where intestinal tuberculosis, well developed, was proved to be the primary or sole affection, nor is it probable that tuberculosis processes should develop to any extent without implicating the neighboring glands at least; but it must be admitted that there may be such a possibility. The solitary follicles and Peyer's patches are the main localities for tubercular deposits; their forms are those of miliary nodules or infiltrations, their changes the same as those which take place in other organs. They disintegrate in the centre, ulcerate until they perforate, unless peritonitic adhesions prevent this ominous termination, and give rise to secondary miliary deposits in and round their very edges. These ulcerations are found mostly from the lower part of the small intestines to the ascending colon, but also to the rectum. According to their seats, they produce pain, diarrhœa containing mucus and blood (in one case Biedert made the diagnosis by the presence of tubercle-bacilli in the evacuations), and tenesmus.

The lymphatic *glands* are involved in almost every tuberculous process. That swelled " scrofulous " glands preceded, or were complicated with, tuberculosis, was acknowledged to be a fact long before the bacillus was recognized. The lymph-bodies of the neck and omentum, and the bronchial and retroperitoneal glands, are among those most frequently affected. Their morbid condition remains sometimes latent for a long period. When they undergo caseous degeneration and suppuration, they may give rise, through embolism, to pyæmia or general tuberculosis, or, when near the surface, to tuberculous ulceration and fistulous destruction of the skin.

Their relation to tuberculosis has been described in the

article on scrofulosis, in the "Cyclopædia of Diseases of Children."

As far as the subject of the abdominal glands is concerned, we shall have to return to it in the discussion of tabes mesenterica. There the consideration of intestinal tuberculosis will again occupy our attention. The bronchial and tracheal glands in their connection with the tuberculosis of the *lungs* will also be treated of under the head of tubercular consumption; and the tuberculosis of the *nerve-centres* will form a part of the article on tubercular meningitis.

Blood-vessels are the seat of tuberculosis very frequently, inasmuch as their walls are the main receptacles for the deposit of the bacilli and tubercles in acute miliary tuberculosis. It originates along the finest ramifications. In very rare chronic cases, larger blood-vessels are affected, and may give rise, by weakening the elasticity of the walls, to aneurisms.

Symptomatology.—If we are again to characterize in a few words the nature of the tubercular infection, the process will be described thus: Through inhaling the dried and pulverized sputum of the consumptive, or through a local tubercular deposit undergoing disintegration and absorption, the bacilli are admitted into the circulation. That admission takes place through the lymph-ducts or the blood-vessels, mostly of the smallest size. But the largest vessels also have been known to be the direct carriers of the poison,—for instance, the thoracic duct, in a case of Ponfick, and large arteries and veins (Weigert) which become adherent to and perforated by neighboring caseous tubercles. If but little morbid material be admitted, or but little in repeated doses, the result is chronic tuberculosis or isolated tubercles in a gland, bone, joint, or nerve-centre; if there be much at a time, the result is acute miliary tuberculosis. A predisposition may be created under the influence of serious diseases, extensive suppurations, debilitating causes of every description, overcrowding and impaired health in cellars, factories, schools, nurseries, orphan asylums, prisons, and barracks, and by a number of infectious diseases which are eminently dangerous to

the structure of the respiratory mucous membranes, such as measles and whooping-cough.

General tuberculosis has no such distinct symptomatology of its own as many of the other infectious or contagious diseases. Its localizations are so numerous that the individual cases exhibit a great variety of symptoms. Under the heads of the different organs, in the future essays and volumes of this work, the tuberculosis of the glands, the lungs, the meninges, the peritoneum, etc., will be discussed. Thus a few remarks must suffice here; they will refer mainly to the symptoms of the *chronic* and the *acute* form.

In both, the symptoms belonging to the general disease may be obscured by those of the organ solely or mainly affected. Still, there are a number of changes, mostly in the *chronic* condition, which, if they do not suffice to establish the diagnosis, render it highly probable. The majority refer to the state of the general nutrition.

In most cases this is defective. The children are thin and puny, or emaciate visibly, in spite of good and sufficient nourishment and fair digestion, and the absence of fever. Others, particularly infants fed on breast-milk, are, moreover, troubled with cough and elevated temperatures, but may lose no weight for many months; still, they arouse our suspicion by the above-mentioned symptoms and some unaccountable anæmia. The complexion in most cases is either pale or sallow; occasionally this result of anæmia and ill-nutrition alternates with a general or circumscribed flush on the cheeks, or is replaced by a cyanotic hue in those in whom the venous circulation is embarrassed by large glands or pulmonary disease. The sclerotic is bluish, the eyes moist or dry, and their expression languid or sad.

The skin is flaccid, wrinkled, and devoid of elasticity, dry, and liable to peel in very small scales. Perspiration and sudamina are found in such only as develop incidental attacks of fever or have a somewhat elevated temperature constantly. When anæmia has reached a rather high degree, there is œdema about the ankles or lumbar region (the locality depending on the position of the child, whether

mostly erect or recumbent), and about the face when there is glandular swelling near the jugular veins.

The bronchi are mostly affected with catarrh, but frequently to a very slight degree only. Contrary to what might be expected in the presence of but few local pulmonary symptoms, there may be much dyspnœa, due to the multitude of miliary tubercles, or to the intensity of the hydræmic condition, or to the debility of the heart-muscle, or to all of these causes combined.

A frequent occurrence is the enlarged size of many of the accessible glands. Palpation reveals them round the neck, also in the inguinal regions, seldom in the axilla or abdomen. The tracheal and bronchial glands are often very numerous, and the dulness on percussion over their site is quite marked. It is particularly perceptible over the manubrium sterni, where, however, the persistence of the thymus gland may give rise to mistakes, and in the subclavicular regions. Here, too, the diagnosis may be difficult. For not only may the glands be swollen mainly on one side only, or more markedly than on the other, but the lungs, or one of them, may yield the same percussion-note in the presence of a chronic infiltration.

It is the *acute* form of tuberculosis which participates eminently in the characteristics of infectious diseases. It is always attended with fever and the appearance in many organs of numerous isolated miliary tubercles, which but rarely have the time to become confluent and form infiltrations. The latter, when found at autopsies, are mostly of older date than the miliary deposits. In these cases the infecting material spreads through the circulating lymph and blood from a single centre, which can be recognized in many instances. Caseous degeneration has long been suspected, and finally recognized, as the fountain-head of the generalized disease. The lymphatic glands, bronchial, tracheal, mesenteric, and retro-peritoneal, in their intimate relations with the lymph-ducts and the circulation of the blood, furnish the morbid material an easy road to the rest of the body. If that material consist of disintegrated cells and nuclei only, the result will be some process or processes of embolism, with local anæmia, inflammation,

disintegration of tissue, or pyæmia; if it contain specific bacilli, miliary tubereulosis will follow. The most rapid course of the malady must be expected when the growing gland proliferates into the lumen of a vein. In this way, besides the glands, caries of the bones, tubercular arthritis, and purulent pleuritis or ulceration of mucous membranes will lead to the same end. Defective conditions of the latter, such as are the results of whooping-cough, measles, or typhoid fever, furnish, besides, ample opportunities for the admission of the bacillus from outside. After this has been accomplished, the formation of a tubercle is explained by M. V. Cornil[10] in this way: that bacilli penetrating into the tissue-cells give rise to a nutritive and formative irritation, exhibiting as its first result a subdivison of the cells. This process takes place in the cells of the connective tissue, the endothelia of the blood-vessels, and the epithelia. Besides, the presence of bacilli produces embolic processes in the capillaries, and gives rise to alterations in the walls of the blood-vessels and emigration of leucocytes. These again emigrate, and penetrate into the tubercles while in the process of formation.

The tubercles are either gray—in the very recent state—or yellow. Both varieties are mostly found together. They are met with in and on the liver, lungs, kidneys, intestines, pia mater, peritoneum, pleura, bones, dura mater, brains, pericardium, stomach, thyroid, but rarely about the genital organs and the muscles.

The order in which they have been here enumerated indicates their susceptibility and numerical importance. The thymus gland has proved to be also affected more frequently than was known before. Indeed, I have found an instance in which that body was the primary seat of the disease. It is probable that it will be found to be a more frequent abode of tubercular deposits than the choroid, retina, and iris.

The very multitude and variety of organs in which the tubercular deposits gain a footing and undergo further de-

[10] Études exp. et clin. sur la Tuberculose, publ. sous la dir. de M. le Prof. Verneuil, Paris, 1887, fasc. i.

velopment, explain the difference in, and the multiplicity of, the symptoms. The fever and some tumefaction of the spleen are common to all acute infectious diseases. Indeed, the latter is enlarged though there be no local tuberculosis of the organ either on the surface or in its tissue, and may, under these circumstances, be mistaken for that of typhoid fever.

When the respiratory organs are the principal seat of the tubercular infection, the symptoms do not always correspond with the extent of the lesions. As, however, this subject will be treated of more extensively in a subsequent paper, an outline only of the changes and symptoms connected with the pulmonary localization of general tuberculosis will be given on this occasion. There is bronchitis, sometimes quite extensive, with all the physical signs of hyperæmia and thickening of the mucous membrane, and expectoration which, when brought up at all, contains fewer bacilli than are found in tubercular consumption proper. Blood appears but rarely, except in the latter form. Cough is not so frequent as the pulmonary and bronchial changes would lead us to expect, because of the frequent prevalence of the brain-symptoms. There is sometimes a high degree of dyspnœa, particularly in those cases which exhibit cardiac debility at a very early period of the malady. Respiration is often quite rapid (without much apparent dyspnœa), though there may be but little solid infiltration. Indeed, percussion yields often but a negative result even in advanced cases. Not infrequently the soft friction-sound of accompanying tubercular pleurisy is more evident than are physical symptoms belonging to the lungs, with the exception of those instances in which an acute and extensive pneumonia takes the place of the multiple, but small, alterations.

Encephalic tuberculosis and tubercular meningitis will form the subject of a special article. Here it may be mentioned only that the principal symptom of an infectious disease, viz., fever, is often absent in these forms. Indeed, though the disease is of the most serious nature,—the localization in the brain giving rise to retarded and irregular pulse, vomiting, peripheral contraction, and par-

alysis of a multitude of muscles in different organs, to the suppression of secretions, and even to convulsions and coma,—the temperature of the body is not liable to be raised before the very end of life.

Diagnosis.—The diagnosis of miliary tuberculosis is by no means easy. Both in the adult and in the child it has often been mistaken for typhoid fever, and *vice versa*. It is true that in miliary tuberculosis there is "often" pallor and cyanosis, slow and intermittent pulse, and dyspnœa without objective symptoms; but these are the cases which offer no difficulty, as a rule. The most serious cases are exactly those in which the diagnosis is apt to go astray. Typhoid fever in the young is by no means the regular strait-jacket disease, as some text-books still insist upon describing the same disease when in the adult; its temperature does not follow the exact curve claimed in print, the daily curves are sometimes double, the temperatures are either high or low through the whole course of a case, there are, or may be, bronchitis, splenic tumor, diarrhœa, roseola, or chills. Now, all these symptoms are found in acute miliary tuberculosis as well. Even Ehrlich's diazo-test of the urine is not conclusive; indeed, it has long been acknowledged that, in the differential diagnosis between the two, it is unreliable. Now, it is true that in miliary tuberculosis the bacillus may be found in the blood, in the expectoration if there be any, or in the stools, or miliary deposits may be discovered in the choroid or retina. But there will be many cases in which even the most expert diagnostician will fail. Indeed, even as well-marked an affection as tubercular meningitis may be difficult of diagnosis from typhoid fever, particularly on account of the fact that genuine meningitis (not to speak of meningeal symptoms) may be an actual complication of typhoid fever.

The diagnosis of tuberculosis from a malarial process is not always made quite readily. The latter may linger longer; there may be no fever observed or existing; or an occasional rise of temperature, lasting from a day to a week or more, is noted, and occasional apyrexia extending over days or weeks. There is now and then thirst, dry and hot skin, perhaps no chill, but increasing emaciation, anæ-

mia, and listlessness. The same symptoms will be found in chronic tuberculosis, in which the local symptoms may be very indefinite or obscure. Even feverish cases of tuberculosis may not be quite conclusive, in the absence of positive local symptoms. In tuberculosis exacerbations of temperature take place mostly towards the evening, those of malaria frequently in the forenoon. But "frequently" and "mostly" yield no diagnosis in an obscure individual case; it must not be decided by a presumable average any more than by the result of questionable treatment. For the assertion that quinine will relieve the fever of malaria, while it is ineffective in that of tuberculosis, must be received with many grains of salt.

Prognosis.—The prognosis of tuberculosis is always grave. The termination of the acute miliary form is almost always fatal. The large number of recoveries sometimes reported does not agree with the experience of those who see their cases from beginning to end. A single visit does not always suffice to make the diagnosis; on the contrary, localized miliary tuberculosis may often be presumed to exist without a sufficient cause. Thus only can I explain the fact that one of the foremost and most conscientious consulting physicians in the American profession gave it as his honest conviction that one-sixth part of all cases of tubercular meningitis got well.

The chronic form may recover. Even in autopsies made on persons who died of miliary tuberculosis we are apt to find localized tubercles so hardened and encysted that they at least cannot be accused of having given rise to the acute infection. Besides, the finding of solitary tubercles in the lungs (or occasionally other organs) in the post-mortem examinations of people dying of miscellaneous diseases is more than an occasional occurrence. It is quite frequent in the adult, and not unusual in the bodies of children of ten or twelve years. Thus, indeed, chronic tuberculosis may heal, temporarily or permanently; but still the prognosis in every case which has been diagnosticated ought to be rather worse than merely guarded. That rule is more imperative in the young than in the adult; for it is in the former that, in consequence of the greater activity of lymph

and blood circulation and absorption, a universal infection originating from a local cause is more easily accomplished. Many organs are affected at the same time. In one hundred and sixty-two cases of tuberculosis, Lorey found twenty-two of acute miliary infection, sixty-two of tuberculosis in the bronchial glands, eighty-three in the lungs, twenty-nine in the brain, twenty-one in the bones, and twenty in the spleen.

Treatment.—Tuberculosis cannot be *prevented,* or limited, under our political and social circumstances, by the prohibition of marriages of tuberculous people, or the separation of children from their parents, or the removal of phthisical workmen from their shops or factories. Nor would such measures be successful to such an extent as has been presumed by hasty reformers. For, indeed, the danger of the propagation of tuberculosis from person to person by respiration is but slight; no current of air is capable of removing bacilli or spores from a moist surface such as the mucous membrane of the bronchial tubes or the surface of a cavity. For the same reason, neither the fæces expelled from a tuberculous intestine nor the urine eliminated from diseased urinary organs can often transmit the malady.

The bacilli conveying the disease are far from being ubiquitous. They have a higher specific gravity than air, water, or even pus; their growth is slow, and easily interrupted by the presence of putrefaction and other schizomycetæ endowed with rapid proliferation; they require a temperature of at least 30° C. (86° F.), which they cannot find permanently except in the animal body; and it is in the latter only that they find their nourishment. Here they develop and multiply, and become dangerous when, after leaving it, they are preserved in a dry state. Even thus, a certain length of time—perhaps six months—destroys their efficacy; and, though one-seventh part of mankind die of tuberculosis, mostly of the lungs, it is evident that the expectoration of months and years becomes dangerous in relatively but rare instances. In order to be so, the sputum must be dry, finely distributed, and inhaled; for, though tuberculosis may be found in most tissues and

organs, the lungs are the principal inlet and outlet. Even here, however, the invasion into the system is not easy. For its principal locality must be the very finest ends of the bronchial ramifications and the air-cells; if deposited in the larger bronchi, the bacilli would be readily expelled by the secretion of the muciparous glands and the uninterrupted activity of the ciliated epithelium. Still, it is the sputum, dry, finely pulverized, and entering the lungs or coming in contact with sore surfaces, which yields the principal danger, and the main preventive measure is its disinfection or destruction before it can do any harm.

Though the bacillus is long-lived and not easily destroyed, there are a great many ways of preventing the disease from spreading. The best preventive is a healthy mucous membrane. A simple catarrh may afford an inlet, and ought, therefore, not to be made light of in a family or surroundings in which tuberculosis has found a home. The bronchitis of measles and whooping-cough, rendering the surface amenable to infection, requires care; nothing can be more dangerous, therefore, than the supercilious indifference too often exhibited by practitioners dealing with these diseases, as unworthy of their attention, because they are self-limited in their course of weeks or months. As the communicability of the bacillus is very great when it is in a sufficiently dry state to be inhaled, the expectorated substances must not be permitted to be preserved on towels or handkerchiefs, or to remain on bedding and floor, or spoons, or vessels, or whiskers from which the innocent kiss of the child will be poisoned. The sputum must be deposited in a moist vessel, and soon removed; in the sink and sewer, or on the field with the rest of the sewage, which will render the bacillus of tuberculosis innocuous by moisture or destroy it by putrefaction, it will do no harm. The patient will protect himself from auto-infection by remembering that his own sputum, when dry, is a weapon turned against himself. Besides, a thorough disinfection must be applied to clothing and furniture by excessive heat, great care exercised in the selection of the school, companions, and nurses, and the room thoroughly disinfected in which a consumptive patient has lived or died.

Von Esmarch recommends to rub down the walls, and the wood of the furniture, with bread.

Much may be done by the enforcement of public hygiene. Among the working-men or -women of a factory ten per cent., more or less, are consumptive. Their sputum is expectorated on floors and furniture, will get dry and pulverized, and inhaled. Thus the germ is carried over the community, old and young. From the tailoring establishments large and small, ready-made clothing-shops, etc., the material to be worked up is given to the tens of thousands of men and women in whose dingy tenements tuberculosis, diphtheria, and other contagious diseases are indigenous. From these they infect the community. This frightful fact is sufficient to discourage the most hopeful philanthropist; it proves again the embarrassments and dangers of our social conditions, and the great difficulties an enlightened public hygiene will have to overcome.

That no child ought to drink milk without its being thoroughly boiled, goes without saying, when it is understood that tuberculosis is a frequent disease of the cow, and both its milk and its meat may become the cause of infection; the former, however, only (though there are those who do not agree with this statement) when the udder participates in the disease, which is of common occurrence, though difficult to diagnosticate; the latter but rarely, because the muscular tissue is almost exempt from tuberculosis. Thus, indeed, the danger is reduced to a minimum when the meat is thoroughly heated, and the organs of the animal most subject to the invasion of the disease (such as liver, thymus, lungs, and viscera in general) are excluded from the bill of fare.

The preventive extirpation of tubercular glands has been recommended and practised extensively. It is mainly the glands of the neck which are accessible. They are infected by every irritation of the head, face, mouth, and nares. In all of these parts primary tuberculosis is not frequent at all, but the invasion of bacilli and their transmission from the superficial sores to the glands is at least a possibility. At all events, however, the larger number of the tumefactions owe their origin, not to the specific

bacilli, but to an irritation of a less dangerous kind. Now, when caseous degeneration takes place in a gland swelled by any cause whatever, though not of a specific order, the absorption of the detritus may lead to embolic processes; if, however, the caseous gland contains the bacillus, tuberculosis will follow absorption. In every case, then, the extirpation is advisable. But the final result of every such operation is jeopardized by the fact that, generally, we have not to deal with a single isolated gland, but with a great many. For this reason the operation is liable to fall short of its aim, because of the impossibility of removing everything morbid. It is particularly in young children that this ill success has been experienced.

Cold abscesses, of tubercular nature, must be treated according to their seat and origin. Those of the subcutaneous tissue may be incised, their walls scooped out, disinfected, and either drained or filled with iodoform gauze. Now and then the advice has been given to wait for a spontaneous rupture of the surface, but incision and antiseptic treatment are preferable. Those connected with bones, and sometimes so by long and sinuous fistulæ, require operations of greater magnitude, extending to and including the bones.

The treatment of tubercular disease of the bone must be local, though in many cases it be as unpromising as general medication. In tubercular spondylitis neither the operative nor the expectant nor the medicinal plan is very successful. Coxitis is more amenable to the former, and its results are more favorable. The same can be said of the tubercular affection of the knee-joint, the ankle-joint, and the bones of the tarsus. The methods of the operation cannot be identical; whether resection, the scoop, or ignipuncture is selected must depend on the extent and location of the lesion. After the operation, and sometimes without it, iodoform treatment has been found beneficial. At all events, the diseased capsular ligaments must be effectually removed.

Whatever aids in fortifying the tissues against the invasion of bacilli must be looked upon as welcome, inasmuch as the treatment of the established disease is among the

most unpromising. For the effect of antifermentative or antibacteric remedies when introduced into the animal organism unfortunately does not correspond with that produced in the test-tubes. G. Cornet publishes a series of experiments[11] made on one hundred guinea pigs and ten rabbits previously infected with tubercle-bacilli, either subcutaneously, or through inhalation of the finely-distributed material. The remedies employed were tannin, acetate of lead, garlic, pinguin, sulphide of hydrogen, menthol, corrosive sublimate, creolin, and creasote. The latter diminished the secretions, but none of them, though introduced in large doses and for long periods, exhibited any antibacillary effect. Nor did altitude have any effect, for some of the animals infected in Berlin were sent to Davos in Switzerland, unsuccessfully.

The antibacteric medicines which thus far have been of most service to operative surgery cannot be expected, with our present knowledge, to be made useful in the treatment of chronic or acute general tuberculosis. The subject, however, will be discussed more extensively in the article on pulmonary tuberculosis. The very necessity of emphasizing the strengthening of the system against the inroads of the disease, indicates the comparative powerlessness of the body against its devastations when once begun.

My experience with arsenic in pulmonary phthisis, as a tissue-builder and nutrient, leads me to recommend it in the other forms of localized and universal tuberculosis. Of phosphorus I have not seen so much in this direction, but its effect is the same, and its superior efficacy in the chronic and subacute diseases of the bones ought to justify its administration in behalf of the system threatened with tuberculosis. As the feeble connective tissue requires arsenic and phosphorus, so the incompetent heart-muscle needs its own tonics; for digitalis, spartein, and caffein, while stimulating the heart into supplying the provinces of the body with more blood, render the same service to the heart, and thus improve the general nutrition. When acute tuberculosis has made its appearance, the medical treatment can

[11] Zeitsch. f. Hygiene, 1888, v., 98-133.

be symptomatic only. The general principles of therapeutics must be applied here as elsewhere: antipyretics, narcotics, and stimulants will find their places according to the most prominent symptoms. Unfortunately, the disease, when fully established, leaves the practitioner no better opportunities than to fulfil the indications suggested in the interest of euthanasia.

PHTHISIS

It was but a few years ago that the question could be raised in earnest whether tuberculosis and phthisis were identical. As great an authority as Ruehle denied that identity, though he admitted that phthisis was more than a mere inflammation, and questioned, though phthisis caused tuberculosis, whether the latter gave rise to the former in every instance.

Of late, not only are tuberculosis of the lungs and phthisis considered identical, but both are assumed to be the exclusive result of the invasion of a specific bacillus, whose effect consists in local irritation, with formation of small neoplasms and a morbid process with either an acute or a chronic course, the latter of which terminates in either extensive destruction or induration of tissue.

Its symptoms either are those of a general morbid condition, such as emaciation, pallor, fever, anorexia, perspiration; or there are some direct symptoms, such as cough, expectoration, dyspnœa, pain, and palpitation. Besides these symptoms, there is not infrequently the same invasion of a specific bacillus into glands, bones, and joints.

In the adult the tubercular deposits in the lungs prefer the apices. The reasons for this predilection are various. The lungs are firmly fixed at the hilus; thus the diaphragm cannot change the consistency of the pulmonary tissue and the lumen of the bronchial tubes to the same extent in the apices as in the lower lobes. Besides, the weight of the arms presses mostly upon the upper lobes. Furthermore, the current of air brought up from the lower part of the lungs is liable to repel the secretion trying to find its way out, into the upper lobes. This very secretion, the apices being less supplied with blood than the rest of the lungs, is thicker and more viscid, and prevents the air from getting in to the same degree as in

the other parts of the lungs; and, finally, what has been called the phthisical habitus is mostly developed in the upper part of the chest, thus compressing the upper lobes of the lungs more than the rest. Thus the circulation in that part of the lungs is more sluggish, and bacilli which have once entered are not apt to be easily expelled.

Contrary to what we see in adults, in whom tubercular deposits mostly take place in the apices, the principal changes in the tuberculosis of children are often seen in the lower lobes. The reason may be found in the fact that the influence of the phthisical habitus develops in advanced years only. For the disproportion between the costal cartilages and the ribs, particularly in those cases in which premature ossification takes place, increases from year to year, thus adding to the difficulty of aëration in the upper part of the chest in the course of advancing years. Besides, the frequent attacks of broncho-pneumonia, which are apt to be the starting-points of tuberculosis, are more frequently observed in the lower lobes, and near the mediastinum.

Age.—According to Portal, tuberculosis of the lungs may be congenital. James Clark found it frequently after the second year; Meessen rarely in the first year, somewhat more frequently in the second; Koranyi very seldom before the third or fourth year. Ruehle met with acute miliary tuberculosis in some instances during the first period of life, with pulmonary phthisis, not, however, before the first dentition; Trousseau very often in the first years of life; Papavoine only between the fourth and fifth years; and of Guersant's hospital patients one-eighth of all those in the second year were tubercular.

The large institutions of New York City afford few facilities for adding statistical material of this kind, because of the very small amount of hospital accommodations for such children and the incompleteness of the information to be derived therefrom. But every practitioner with ample means of observation meets with a great many cases of general miliary and likewise pulmonary tuberculosis. Demme had under hospital observation in the course of twenty years, 36,148 cases, 1932 of which

were of tuberculosis; 1580 of the latter were pulmonary. Biedert collected 8332 cases of tuberculosis, 6.4 per cent. of which were those of children. Within three years Fürst observed 4000 cases of children's diseases up to the fourteenth year of life. Of the 330 tubercular cases among them, 247 were pulmonary; one was two weeks old, one six, one seven, fifteen from two to three months, seventeen from three to six months, forty from six to twelve months, sixty-six from one to two years, eighty-two from two to four years, thirty-nine from four to six years, forty-six from six to ten years, and twenty-two from ten to fourteen years. Thus, according to Fürst and Demme, the largest number of cases was met with between the second and fourth years. According to Baginsky, eight per cent. of all cases of pulmonary tuberculosis are met with under the tenth year.[1]

Some more points connected with the question as to the age at which tuberculosis may be met with, the reader will find discussed in the essay on tuberculosis contained in this volume.

Causes.—The etiology of tuberculosis in general has been treated of so extensively in the paper on tuberculosis just alluded to that I may be permitted to refer to it for all particulars. It is worth while, however, to insist upon a few points.

In children the pulmonary artery is relatively larger; thus the lungs are more succulent and liable to furnish a very fair resting-ground for the bacillus. Besides, in the early years of life the right heart is still predominating, with the same result.

The invasion of the bacillus which is not only the cause of phthisis, but also the principal source of broncho-pneumonia and caseous pneumonia, may take place by direct inspiration. In every instance it is the smallest bronchi that furnish the best resting-place. In these cases the bronchial tubes are found thickened at a very early period. The upper air-passages, nares, pharynx, and larynx, being

[1] Maximilian Herz, Ueber Lungentuberkulose im Kindesalter, Wien, 1888.

cooler and more exposed to strong currents of air, have therefore fewer cases of local tuberculosis. Even before the discovery of the bacillus, the inhalation of sputum was proved to be the cause of tubercular infection by Tappeiner, who, at that early time, accused beds and clothing of transmitting the disease. Contagion is not only not prevented by the drying up of sputum, but, on the contrary, it appears that as long as it is moist it is not attended with any particular danger. When tuberculosis develops from cheesy degeneration, the first changes are found in the blood-vessels or in the lymph-ducts and glands. The former are thickened, the latter enlarged.

Hereditary disposition has formerly been characterized from two points of view. A direct transmission can be proved in but few instances, but the propagation of a peculiar debility or inefficiency of either the whole organism or special organs deprives the individual of its power to resist injurious influences or deleterious invasions. Altogether, the number of cases in which hereditary influences can be traced is very great; in Demme's cases of tuberculosis of bones and joints in 69.6 per cent., in that of the lymphatic glands in 65.4, in visceral tuberculosis in 71.8, and in lupus in 37.8 per cent.

The relation of scrofula to tuberculosis has been discussed by Dr. Ashby in the Cyclopædia. He proves that the assumption of a disposition on the part of scrofulous persons to become tubercular has to give way to the knowledge that what was called scrofulous was tubercular in many instances. In "scrofulous" deposits the bacillus tuberculosis has been found, and scrofulous material has been inoculated so successfully as to produce tuberculosis. Schüller inoculated caseous masses taken from a gland, with the result of producing tuberculosis of the osseous tissue; the same experiments of many observers resulted in general tuberculosis. Cohnheim proved the tubercular nature of fungous arthritis, caseous adenitis, and pneumonia; Cornil, of many hypertrophied glands and fungous synovitis; Demme, of ostitis, multiple periostitis, and the granulating ostitis of the phalanges. Many cases of chronic "scrofulous" eczema and nasal and aural catarrh ex-

hibit the bacillus. Still, there are cases in which the latter is absent, but the necrobiosis (Virchow) of the glands is such as to facilitate the invasion of the bacillus and to impair the resisting power of the cells.

The introduction of the tubercular virus through the digestive tract, by means of the milk and meat of tubercular cows, particularly in cases of tubercular mastitis, is of at least occasional occurrence. It cannot be denied, though many feeding-experiments proved failures. Skin, mucous membranes, and glands are also ready gates for the entrance of the bacillus. It has been stated before that eczema and impetigo, scrofulous inflammations and abscesses, and nasal and aural catarrhs are liable to be infected with the bacillus.

The phthisical habitus may not give rise to pulmonary phthisis at all; a disposition is but one of the factors. Its definition comprehends a great many changes, not one of which, by itself, would appear dangerous. But the sum total of the symptoms exhibited even in early childhood has something very characteristic. There are the relatively great height of the body compared with its weight, the thin bones and muscles, transparent and delicate skin, scanty subcutaneous tissue, the extensive nets of superficial veins, the flushed or pale cheeks, pale mucous membranes, flat chest with short sterno-vertebral diameter, large intercostal spaces, shortness of costal cartilages either congenital or resulting from premature ossification, the marked depth of the supra- and intra-clavicular fossæ, the prominent scapulæ, the clubbed finger-ends, and the feeble heart.

Varieties of Pulmonary Tuberculosis.—Pulmonary tuberculosis is met with in three forms, viz., 1st, acute miliary tuberculosis of the lungs; 2d, acute or subacute caseous pneumonia; 3d, chronic phthisis.

Acute miliary tuberculosis has formerly been shown to result from the local tuberculosis of joints, bones, and glands. It is but the termination of the tuberculous process which, after having been local, becomes general through an extensive embolic distribution. Acute tuberculosis may also be mostly local, and death may set in

before the disease becomes generalized. It is liable to remain confined to the lungs when the starting-point was from the bronchial or mediastinal glands.

Acute and subacute caseous pneumonia takes its origin from catarrhal (broncho-) pneumonia, as a rule; in some instances, from the fibrinous variety. It is attended with cough and fever (somewhat remitting in the morning), frequent and superficial respiration, all sorts of auscultatory signs, from the finest sibilant and subcrepitant to the large, moist, and dry râles, and occasional cyanosis, from a slight hue of the lips to the ashy discoloration of intense suffering. Bronchophony is more frequent than bronchial respiration. The results of percussion are not always conclusive; there are but slight changes sometimes; it is here that the gentlest tapping only will yield differences of sound. Recovery is apt to take place in from ten to fifteen days. Relapses—or, rather, new attacks—may occur, and still recovery take place. Particularly is this so in cases resulting from or complicated with pertussis or measles; they may last months. In many the respiration never becomes normal, either through induration of the pulmonary tissue, or through fatty degeneration or enlargement of the heart. Many such cases undergo extensive caseous degeneration,—mainly those which originated in whooping-cough, measles, scarlet fever, and diphtheria, particularly in such children as suffer from the results of rhachitic contraction and curvature, and incompetency of the thoracic muscles.

Chronic phthisis is the most frequent variety. Still, it is not common before the end of the first year. Fürst's cases[2] run from the fourteenth month to the twelfth year. But there is not a year which does not furnish me with a case or two at that early period. Children of a few years are frequently affected, and cases occurring at eight years and upward are by no means rare.

Their symptoms do not vary particularly from those of adults. In younger children some symptoms are difficult to discover. Cough is often overlooked for some time; it is

[2] Maximilian Herz, Ueber Lungentuberkulose im Kindesalter, Wien, 1888.

short and apparently easy, or, on the other hand, hard, or loose, and mucous. Expectoration is either scanty, or is inaccessible to inspection and examination because it is swallowed. Hemorrhage, mild or severe, is of rare occurrence.

Temperature is high in the afternoon and in the night; remission takes place in the morning. But rarely the high temperature is met with in the morning. Sometimes the remission is so intense that the temperature becomes quite normal or even subnormal. Remission of too short a duration means danger. After midnight perspiration is as frequent and intense as it is in adults; it is liable to increase the tendency to emaciation, which is always very great. A girl of four years, weighing forty-five pounds, I have seen losing sixteen pounds in ten weeks. When, in addition, the digestion becomes disturbed and diarrhœa sets in, the fatal termination is reached sooner.

Respiration is superficial and frequent; this symptom sometimes precedes every other, before auscultation and percussion reveal anything. But in most cases there are one or more limited areas of dulness. Gentle percussion reveals it more readily than strong tapping. By itself, however, the dulness is no conclusive evidence of tubercular infiltration, for, as a result of simple interstitial inflammatory hyperplasia and cicatrization, retraction of pulmonary tissue, particularly below the clavicle, diminished respiration, prolonged expiration, even slight cavernous breathing resulting from dilatation of a bronchus, may remain behind. But in these old and permanent indurations the symptoms are not changeable, and there are no acute or recent ones to accompany them. In phthisis, however, there are auscultatory signs of an acute or a subacute character, and mostly quite extensive. Large and small rhonchi—viscid and loose, loud and fine, dry and moist, crepitant, subcrepitant, sibilant (particularly on deep inspiration)—are heard together or in alternation. Now and then there is bronchial respiration; still, bronchophony is much more frequent than bronchial respiration, because of the relative smallness of the infiltrations which permit of air-space between them; cavities yield cavernous breathing in propor-

tion to the size of the abscess. When it is small, as it is apt to be, cavernous breathing is very apt to disappear temporarily, when the cavity fills up with secretion or pus.

Pathological Anatomy.—In dead bodies the results of the tubercular process are various; slight they are but rarely. Indeed, I remember but a single case, that of a girl of six years, who died suddenly at a very early period of the disease, of hemorrhage. The post-mortem appearances differ in acute and chronic cases. In the former the tubercular deposits are gray, after some time yellow, small, and very numerous. A great number are found on the bronchioles, many of which are thickened. When the process lasts longer, infiltrations take the place of nodules, through confluence; the bronchial glands are swollen, sometimes cheesy in the centres, and the pleuræ are adherent.

The invasion of the bacillus results in local irritation and hyperæmia, emigration of leucocytes, formation of giant cells, and increase of the epithelial cells. Thus miliary nodules are formed and the connective tissue is increased; thus tubercular infiltration is brought on, and the lumen of the bronchus may become narrow, and atelectasis result therefrom. The tubercle, being without vessels, is apt to undergo caseous degeneration; thus the alveoles are filled with the caseous mass, and form small cavities, many of which coalesce by the disappearance of the perishable septa and develop into cavities of larger or even immense size. The transmission of the process into other parts of the lungs takes place either in the proximity, by contiguity of tissue, or through blood-vessels or lymph-ducts. Sometimes the formation of cavities takes place late, if at all; in such cases a whole lobe may be solidified, partly through large masses of tubercular infiltration and partly through the new formation of interstitial tissue. Its hyperplasia takes place through the proliferation of connective-tissue cells and their transformation. Its existence prolongs the course of the disease and affords a certain degree of safety; for not infrequently it forms hard and thick capsules for small or large abscesses, which thus are deprived of a great deal of their danger. They may even be retained so long that exsiccation and calcification occur.

Other anatomical changes are the following: bronchiectasis,—the bronchial tubes become dilated by the shrinking of the adjacent newly-formed connective tissue; emphysema in the pulmonary tissue not yet filled with tubercle; suppurative pleurisy, in consequence of the presence of tubercles in or near the surface of the pleura, and through the direct communication of blood- and lymph-vessels between lung and pleura, in which case adhesion and thickening of the pleuræ become additional causes of disturbances of circulation and blood-supply; pneumothorax, when the pleura was perforated before adhesion became established. Finally, dilatation of the right ventricle, often with fatty degeneration of the heart-muscle, is the frequent result of the difficulty encountered by the cavities of the heart in trying to discharge its contents.

Symptoms.—One of the earliest symptoms of pulmonary phthisis is atrophy in many of the patients. It is more common in the very young than in those of more advanced years. I knew a tubercular baby of seven months that weighed exactly seven pounds. This atrophy is probably so intense for the reason that the disease is not confined to a single organ. The skin is flabby, waxy, yellowish or white, wrinkled, inelastic, and often covered with pityriasis; the bones, cheeks, and scapulæ are prominent; the eyes half closed, or open and staring, without expression, listless. The subcutaneous tissue is very scanty, the voice thin, and the cry low or inaudible. These symptoms of complete atrophy, however, are not characteristic of tuberculosis; but in every case of atrophy the lungs ought to be examined with the utmost care, no matter whether there is much cough or not. Pulmonary changes may be very much advanced and still the physical symptoms not very evident, and, again, tubercular infiltration not very extensive but the physical signs very perceptible. Now and then those of catarrh or of pleurisy only can be found, both of which may improve either spontaneously or under treatment.

It is the totality of the symptoms that is important for diagnosis,—the simultaneous existence, for instance, of hereditary influence, chronic eczema or impetigo, disease of

bones and joints, glandular swellings, some dyspnœa, cough more persistent than, perhaps, violent, and the permanence and relative invariability of the physical signs.

Fever is more distinctly noticed in children of somewhat advanced age. The temperature must be taken frequently, inasmuch as remission may be expected daily and the temperature is sometimes subnormal. The fever is either continuous or hectic, or its type is inverse. Brunniche found that the morning temperatures are apt to be higher than those of the evening in all cases in which pulmonary tubercular infiltration is complicated with miliary general tuberculosis.

Cough is not a prominent symptom in the incipient stage of chronic tubercular infiltration of the lungs. It is sometimes not noticed at all by the attendants, is frequently merely short and hacking like that arising from a slight pharyngeal irritation, and becomes more frequent and vehement later on. It may then often be found paroxysmal, resembling that of whooping-cough, with cyanosis, dyspnœa, and vomiting. It may be dry and very painful, the pain being attributed to the epigastrium, the muscles of which are under a perpetual strain; or moist. Still, sputa are scanty, for the expectoration is swallowed as soon as it reaches the pharynx. When some of it is obtained, the microscopical appearance is that found in more advanced age. Of pulmonary elements there are disintegrated alveolar epithelia and elastic fibres of lung-tissue. Bacilli are found, but not always so readily as in the adult.

Blood is not a frequent admixture in the expectoration of phthisical children. Now and then it is met with, but profuse hemorrhages are rare in children. They may be idiopathic, for in one case of I. Hoffnung's no disease of a lung could be found. One case of his occurred from thrombosis of the pulmonary artery, one from pulmonary apoplexy in a new-born child, two from gangrene, one from a suppurating gland which perforated into a branch of the pulmonary artery and a bronchus, and five in pulmonary phthisis. In four of the latter the bleeding came from a ruptured aneurism of the pulmonary artery. I do not remember more than half a dozen cases of pulmo-

nary hemorrhage in children except those which took place in violent attacks of whooping-cough. Only one of my cases—phthisis—was three years old; one, a girl of eleven, had repeated attacks extending over a year, which appeared to depend on or were accompanied by a mitral insufficiency, and exhibited infiltrations of the upper lobe afterwards; the others occurred in children affected with phthisis, early or late stage of from seven to eleven years. From a diagnostic point of view the absence or presence of larger amounts of pus may be noticed. I remember cases of pulmonary abscess, a few of them resulting from perforating empyema, which bled quite freely. In pertussis copious hemorrhages are frequent. They may become dangerous in this, that blood coagulating in the finest bronchioles may give rise to local collapse of the lung—atelectasis—and lobular pneumonia in consequence, in this way increasing the disposition or liability to tubercular invasion.

The part played by the lymphatic glands is a very important one. Their primary swelling may be due to general "scrofulosis," or result from the bronchial catarrhs so often met with in small children, particularly those affected with rhachitis and pertussis. The disintegration and liquefaction of their centers may give rise to embolic processes and result in pyæmia. The mucous membrane of the respiratory surface being hyperæmic and eroded, the bacillus finds its way into the gland, where it irritates and produces the changes mentioned above. Two possibilities then arise. The bacillus may not stop long in the gland, but may be carried through the vasa efferentia into the circulation, and thus light up a miliary tuberculosis. Particularly is this the case where the gland is in close communication with large lymphchannels; thus peritoneal tubercles are very apt to be carried into the thoracic duct. Or the irritation produced by the presence of the bacillus can give rise to excessive formation of connective tissue; the capsule of the gland and its interstitial tissue will be thickened, and thus the bacillus locked up. Thus the gland may reach a considerable size, and feel fairly hard to the touch, even when its center is already much advanced in its softening

process. The very size of the glands may give rise to serious symptoms: the circulation of the pulmonary artery and vein, the superior cava, and the jugular may be compressed, resulting in œdema, hæmoptysis, infarctus, and considerable swelling of external veins, very probably, also, in passive accumulation of blood in the cavities and the muscle of the heart. Their softening and suppurative perforation affect, and infect, the neighboring parts of the lungs. Thus it is that the tuberculous process is so very apt to begin, and to be most extensive, about the hilus, where the glands are present in large numbers. The pneumogastric nerve, too, and its branches, are annoyed by numerous and swelled bronchial glands. Persistent hoarseness, before any laryngeal symptoms can be made out, and indeed before those of phthisis have been developed at all, can be explained in this way. Fleischmann observed a case of intense laryngo-spasm which was thus caused. Early pleuritis, and dull pain posteriorly, here find their explanation. Intense dyspnœa may be the result of large glandular swellings and their mechanical effect upon a large bronchus or the trachea, and hæmoptysis that of a glandular abscess perforating into a blood-vessel. All such occurrences may take place unexpectedly. For the presence of large masses of glandular swellings is not easily diagnosticated, sometimes is not even suspected. The closed cavity of the chest does not permit palpation, auscultation is sometimes not successful because the respiratory murmurs are easily transmitted through the solid bodies, and even percussion does not always give a satisfactory result. But quite often the local absence, or diminution, of respiration, or the coarse character of the latter in a limited locality, besides dullness over the manubrium sterni, and occasionally near its left or right margin, together with the presence of glands about the neck, in the axilla, and in the inguinal regions, bids fair to facilitate a correct diagnosis.

Complications.—The complications of pulmonary tuberculosis with tuberculosis of other organs are very frequent. I hardly remember a case of the former without an affection of the pleura, either simple adherent, or suppurative, or tubercular pleuritis, or pneumothorax. Tubercular menin-

gitis is not frequent in cases of chronic phthisis, but in those complicated, either from the beginning or toward the fatal termination, with miliary tuberculosis of the lungs, it is often found as the result of the distribution of the process over the whole system. The liver participates with a perihepatitis which sometimes glues the organ to the diaphragm, or with fatty degeneration, which is quite common in chronic phthisis, or with small or large tubercular deposits upon or in the liver. Their size varies: some are large, the majority small. They undergo softening but rarely. The tubercular degeneration of the system is of a similar nature, perisplenitis and tubercles being met with, but not so commonly as in the liver. The kidneys exhibit the same class of changes, only in smaller numbers. Pyelitis has been observed as the result of the disintegration of a tubercle, and abscesses in the parenchyma I have seen myself, from the same cause. The stomach suffers less than most other organs. Externally tubercles are found as a part of tubercular peritonitis, internally an ulceration has been found occasionally; its functions are often not disturbed. Gastric catarrh may result from the impediment to circulation connected with every pulmonary or cardiac disease, but, as a rule, the function and particularly the secretions remain normal, and facilitate the ingestion and assimilation of large quantities of food. The bowels participate much more freely. In a chronic consumption they are rarely normal; hyperæmia is frequent, and ulcerations are not uncommon. They are mostly found in the lower parts of the small intestine, as future papers will show, but not uncommonly also in the duodenum, cæcum, colon, and in protracted cases even in the rectum.

Prognosis.—The prognosis depends on a great many factors. Intense scrofulous diathesis and hereditary disposition, and protracted morbid processes in glands, bones, and joints, yield a bad prognosis, though the duration of the tubercular process be ever so long. Measles and whooping-cough contracted under such circumstances are bad, because they are liable to lead to extensive lesions of the lungs. They occur frequently between the second and the fourth year, and therefore tuberculosis is readily

developed at that age. Those cases which occur in the first year, as also those before puberty, about and after the tenth year, are quite unfavorable. Rapid increase of atrophy, with loss of appetite, is bad. So are rapid respiration and persistent high temperature, cyanotic hue and night-sweats, and the presence of a cavity. The permanence of mixed auscultatory symptoms, such as fine sibilant and moist râles, large moist rhonchi, and bronchial respiration (or only bronchophony), is a very ominous sign.

Treatment.[3]—Hereditary predisposition to tuberculosis being quite frequent, and transmitted even by parents who still appear to be in fair health, every catarrh in the children of such parents must be carefully watched. The premature ossification of the costal cartilages, most frequently found about the superior part of the chest, and the consecutive shortening of the sternovertebral diameter, give rise to contraction of the thorax and insufficient expansibility of the (upper lobes of the) lungs. In such cases the aëration of the blood suffers at a very early date, catarrh and inflammatory thoracic diseases are liable to become dangerous, and gymnastic exercises are required in early childhood.

Direct transmission from the parents to the children is probably not frequent, but it is possible, and therefore the child must not share the room and bed of the consumptive. Kissing must be refrained from; it may often be the cause of contagion, though tuberculosis is not so frequently transmitted in that manner as some other diseases,—for example, diphtheria.

A consumptive mother must not nurse her infant. She is a greater danger than one afflicted with syphilis. Her milk is a positive injury, as is the milk of tubercular cows, though the udder may not be diseased. Two cows out of a hundred are tubercular. Hence the least that can be done is to boil the milk intended for the nourishment of the infant. By thus observing the rule which I have enjoined these twenty-five or thirty years, the milk can be made

[3] Some of the following pages are from the *Archives of Pediatrics,* October, 1888.

more innocuous than is possible for the butter or cheese obtained from such cows. These rules ought to be strictly obeyed, though there be exceptions to the universal experience. An instance of such exceptions is mentioned by Biedert, than whom there is no more reliable observer. He reports the cases of children who were fed a long time on the milk of tubercular cows without being attacked themselves.

Great care must be taken in the selection of a wet-nurse, and of the help about the house with whom the children are to be in contact. The air about the house and about the school must be pure, the school hours interrupted by physical exercise, and chronic ailments, such as rhachitis, carefully watched and treated, to avoid the debility of the tissue which facilitates the invasion of the tubercular guest. It is particularly measles and whooping-cough that must be carefully watched.

But all these and other measures which are the results of the different adjuvant causes in the development of tuberculosis have been elaborately discussed in my paper on tuberculosis, to which I here refer.

Among the causes of consumption monotony of food has been enumerated by many. It is evident that it cannot account for much in the cases of infants or children, whose habits are plainer and whose digestive functions are more adapted to simpler and more uniform articles of diet. Most of these, while in health, are satisfied with milk, cereals, and but little meat. Sweet cream may be added to the milk, but more than a few ounces are not digested through the course of a day. Cod-liver oil acts mostly through its fat. During the afebrile condition and chronic emaciation of phthisis, overalimentation, introduced by Debove, may be tried to advantage, while insufficiency of gastric digestion, if it exists at all, may be stimulated by the administration of artificial gastric juice (pepsin with muriatic acid) and mild stomachics (gentian, nux, diluted alcoholic beverages). Where exercise cannot be procured to a sufficient extent, or is contraindicated by the necessity of enforcing temporary, but absolute rest, massage, according to S. Weir Mitchell's plan, will take its place. During fever,

overalimentation has to be stopped; it deranges digestion and slowly increases the fever. Alcoholic stimulants will at that time often take its place to advantage. While they do not act well in certain over-irritable natures, with oversensitive hearts, and in hæmoptysis, they are good stimuli for the general system, diminish perspiration, and act favorably in diarrhœa.

In the treatment of tuberculosis no single factor is beneficial by itself. The quality of the air alone will not cure the sick, any more than will a certain mixture of salts and water in a mineral spring, or some known chemical relation of albuminoids and carbohydrates in an article of food. Insufficient clothing and bedding, unheated rooms, draughty halls, indigestible food, strong coffee and tea, hot cakes and cold drinks, late hours, lively hops, brass instruments and pianos disturbing midnight rest, kill as many, in proportion, in Colorado, Florida, Southern France, and Italy, as in New York. It must never be forgotten that the change of climate is mostly a negative remedy, and cannot be expected to offer more than the possibility of favorable external circumstances.

Moist air is a better conductor of warmth than dry air. Hence loss of temperature is more rapid in moist air than in dry air. Dry air, therefore, may be very much cooler, and is still better tolerated in spite of its lower temperature, and affords more protection. In adults hæmoptysis appears to be a frequent occurrence during the season of increasing atmospheric moisture (spring). According to Rohden's researches, a rapid increase of the percentage of water in the blood is frequently sufficient to produce a hemorrhage. The drinking of large quantities of water, therefore, ought to be avoided, and no residence should be selected for a patient subject to hæmoptysis where the atmosphere is very moist. Dry altitudes, such as those of New Mexico, have given me good results in pulmonary hemorrhage. At all events, no place must be selected where the percentages of moisture in the air are liable to change rapidly. The uniformity of an insular climate, while benefiting the average case of phthisis, is, therefore, not so dangerous to those who have bled from their lungs.

Nevertheless, dry air and a higher scale of the barometer are preferable.

The diversity of opinions in reference to the climato-therapeutics of phthisis resulted from the circumstance that the indications were not distinctly understood. Neither cold nor warm, neither dry nor moist, air by itself is a remedy. Warm air does not cure, but it enables the patient to remain out of doors. The temperature must be uniform, sudden currents of air avoided, and the atmosphere free of microphytes. At an altitude of sixteen hundred feet their number is greatly reduced (Miquel), there are but few at a height of two thousand six hundred feet (Freudenreich), a very few at six thousand, and absolutely none at twelve thousand feet, provided the parts are not, or but little, inhabited. Over-population of elevated villages and cities diminishes or destroys their immunity. In the factories of the Jura Mountains, with a large working population, at an altitude of three thousand five hundred feet, tuberculosis is frequent.

Protection against sudden gusts of wind and rapid changes of temperature is an absolute necessity. The elevated valleys (or rather recesses of mountains) of Colorado deserve their reputation in pulmonary diseases. Davos is dusty, windy, and exposed to frequent changes of temperature during the summer, and must not be advised for that season. Woods are warmer in winter, cooler in summer; so is the ocean. Both, therefore, well deserve their reputation in the chronic ailments of the respiratory organs.

Not the thinness of the atmosphere, but its purity, is the requisite, together with a high percentage of ozone. The latter is developed under the influence of intense light, the presence of luxuriant vegetable growth, particularly of evergreen trees (Terebinthinaceæ), and the evaporation of large sheets of water. Thus, ozone is found on moderate or high altitudes, in needle-wood forests, and near or on the ocean.

In the general hygienic treatment of tuberculosis the skin requires particular attention. Sudden changes of temperature, which strike the surface suddenly and work their effects on internal organs by reflex,—"colds,"—in spite

of the modern superciliousness of some who deny any pathological change unless the exclusive work of bacteria, will always hold their places in nosology. The skin must be both protected and hardened. Wool, or wool and cotton, must be worn near the skin, the feet particularly kept warm, no wet or moist feet permitted, undergarments changed according to season and the alternating temperatures of days or weeks, and every night and morning. It is of the greatest importance to impress upon the minds of the very poorest that they must not wear during the day what they have slept in. Still, while protection is to be sedulously sought after, vigor is to be obtained by accustoming the surface to cold water. The daily morning wash may be warm at first, and become gradually cooler, —alcohol being added to the water in the beginning (alcohol alone is unpleasant through its withdrawing water from the tissues), and salt always. The temperature of the water being gradually diminished, the same treatment can be continued during the winter, with a pleasant sensation of vigor. The subsequent friction with coarse bathing-towels sends a glow over the surface and through the whole body. The easiest way to start the habit is by washing; a short sponge- or shower-bath will take its place soon, and a cold plunge will be borne even by the weak afterwards.

It has become fashionable with many to feign a contempt for internal medicines in the treatment of tuberculosis, pulmonary and otherwise. I am glad I cannot share their opinions. Thus, for instance, I look upon arsenic as a powerful remedy in phthisis. It was eulogized as early as 1867 by Isnard, in a monograph, for its effect in both malaria and consumption, in both of which he explained its usefulness through its operation upon the nervous system. He claimed that suppuration, debility, emaciation, vomiting, diarrhœa, and constipation would improve or disappear under its administration. The doses of arsenious acid used by him in the cases of adults amounted to from one to five centigrammes (one-sixth to five-sixths of a grain) daily.

Arsenic is certainly a powerful remedy. It is known to

act as a poison and a strong caustic. It prevents putrefaction, though as an antiseptic it ranks even below salicylic acid. It acts favorably in malaria, chronic skin diseases, and maladies of the nervous system, and has considerable, and sometimes unexpected, effects in the treatment of lymph-sarcoma and sarcoma. It is also said to improve, in the adult, sexual desire and power, and in animals physical courage. Thus there is a variety of effects the intrinsic nature of which may be found, uniformly, in the action of the drug on the function and structure of the cell, which, though varying in different organs, has the same nutritive processes. Arsenic has a stimulating effect on cell-growth. In small and frequent doses it stimulates the development of connective tissue in the stomach, in the bone and periosteum, everywhere; in large doses, by over-irritation, it leads to granular degeneration. Like phosphorus, arsenic builds in small doses, destroys in large ones. By fortifying the cellular and all other tissues, both fibres and cells, it enables them to resist the attack of invasion, both chemical and parasitic, or to encyst or eliminate such enemies as have penetrated them already. Thus it finds its principal indication in the blood-vessel walls resulting in pulmonary hemorrhage.

The doses must be small. A child a few years old may take two drops of Fowler's solution daily, or a fiftieth or fortieth of a grain of arsenious acid, for weeks or months in succession. This amount may be divided in three doses, administered after meals, the solution largely diluted. There is no objection to combining it, according to necessity, with stimulants, roborants, or narcotics, and to giving it for an indefinite period, unless the well-known symptoms of an overdose—gastric and intestinal irritation and local œdema—make their appearance. But they seldom will, particularly when small doses of opiates are judiciously added to it. In almost every case, perhaps in every one, it is desirable to administer it in conjunction with digitalis.

In the vertebrate animals digitalis increases the energy of the heart-muscle and its contractiton; thereby it increases arterial pressure and diminishes the frequency of the

pulse. By increasing arterial pressure it favors the secretion of the kidneys, improves the pulmonary circulation, empties the veins, thereby accelerates the flow of lymph and the tissue-fluids, and exerts a powerful influence on the metamorphosis of organic material,—that is, general nutrition. In addition, what it does for the general circulation and nutrition it also accomplishes for the heart-muscle itself. The blood-vessels and lymph-circulation of the latter are benefited equally with the rest. Thus digitalis, while called a cardiac stimulant, contributes largely to the permanent nutrition and development of the organ. This effect is not only of vital importance for the economy of the system on general principles, but an urgent necessity in view of the fact that there appears to be a relative undersize of the heart, either congenital or acquired, in cases of phthisis; and there is certainly such a predominance of the size of the pulmonary artery in the young, particularly over the aorta, that the normal succulence of the lung becomes pathological quite readily when the insufficiency of the heart-muscle tends to increase low arterial pressure within the distributions of the pulmonary. The selection of the preparation to be administered is not an indifferent matter. The infusion and the tincture are sometimes not well tolerated by the stomach; digitalin, not being a soluble alkaloid, but a glucoside, is not always reliable in its effects, nor of equal consistency and strength; a good fluid extract, or the extract, is borne well and may be taken a long time. A child a few years old may take about two minims of the former daily, more or less, for weeks and months, or its equivalent in the shape of the extract (two-thirds of a grain daily); the latter can easily be given in pills, to be taken in bread, or jelly, and combined with any medicines indicated for special purposes, such as narcotics, or nux, or arsenic, or iron, —the latter to be excluded in all feverish cases, or in all cases while fever is present. So long as there is no urgent necessity for a speedy effect, digitalis will suffice by itself; as a rule, it does not operate immediately in the small doses above mentioned. The addition of strophanthus, or spartein, or caffein, all of which are speedily absorbed

and eliminated and exhibit their effect rapidly and without danger or inconvenience of cumulation, will prove advantageous in many cases.

Other medicines have been used in great numbers. Specifics have been recommended, and symptomatic treatment has been resorted to. The success of the latter depends on the judgment of the individual practitioner. No text-book or essay can teach more than general principles and their adaptation to the average case, and the measures to be taken in a number of exceptional occurrences. The indications for the use of narcotics, stimulants, expectorants, and febrifuges will change according to the cases and their various phases and changes. In every case the necessity may arise for antipyrin, antifebrin, phenacetin, salicylate of sodium, or quinine. It may be necessary to decide the question whether the administration is to be made through the mouth, rectum, or subcutaneous tissue, or how their effects are to be corrected or combined. I have often found that a hectic fever would not be influenced by quinine, or by antipyrin, or by salicylate of sodium, but the combination of the first with one of the latter would frequently have a happy effect. However, in a great many cases where the fever persists, the use of quinine in sufficient doses, from five to ten grains daily, proves more satisfactory than the modern antipyretics with their prompt but temporary action.

The change in our pathological views, or rather the addition of a new factor in our etiological knowledge, has directed our attention to the antisepsis of the respiratory organs. It is not necessary to destroy bacteria in order to make them relatively harmless. It is impossible to kill the bacillus without killing the normal cell, but very mild antiseptics suffice to stop the efficiency and proliferation of the parasite. Thus we can hope that the future will teach us to reach the destructive process in the lungs. It is quite possible that the inhalation of hydrofluoric acid will not prove more beneficial than the rectal injection of sulphide of hydrogen, but the internal use of creasote (one to three minims to a child daily) and terebene (two to four minims every two or three hours) and the inhalations

of turpentine, eucalyptol, menthol, and many others, appear to rouse our hopes for a future effective treatment. Much more than hopes we cannot have at this moment. But it is useless to despair, either passively or actively. For the present, it is certainly a desperate activity which tempts an enterprising hero of the reckless knife to cut away a part of a lung which is the seat of a general and disseminated process, and a misdirected enthusiasm tempered by mercenary tendencies that pretends to bake bacilli out of existence by means of a clumsy and inefficient apparatus.

Ulcerations of the tongue and pharynx are painful sometimes to such an extent as to require frequent attention. A well-directed spray of one part of nitrate of silver in two hundred parts of distilled water (glass to be of neutral, blue, or black color), administered once a day, will be found serviceable in average cases. Some are so bad as to interfere seriously with deglutition. I have been obliged to use a cocaine spray before every meal.

Gastric catarrh must be relieved, for a healthy stomach is indispensable for the economy of the organism. It is liable to suffer from the disordered pulmonary circulation, but just as often suffers by mistakes made in the diet of the patient. Large quantities of alcoholic beverages or the same not sufficiently diluted are often the causes of disturbances. So is iron which has been given injudiciously for the alleged purpose of meeting the prevailing anæmia. Milk is sometimes not tolerated; it may be substituted by butter-milk, koumys, kéfir, matzoon, or peptonized milk; or it may be prepared with dilute hydrochloric acid, in such a manner that one part of the latter is mixed with two hundred and fifty parts of water and five hundred parts of raw milk; the mixture is then scalded: it keeps better than plain milk, and proves very digestible. Or milk may be mixed with barley, oatmeal, rice, etc., or replaced altogether, temporarily, by farinaceous food. Fermentation in the stomach requires resorcin, bismuth, or creasote; the anorexia of intense chlorosis is sometimes benefited by small doses of sulphur; and a protracted catarrhal condition may be speedily improved by the washing

out of the stomach with warm water in which bicarbonate of sodium, resorcin, or thymol in small doses has been dissolved.

As tubercular patients are liable to be affected with pleural irritation and inflammation, they must not undergo great exertions, as climbing, or give way to boisterous laughter. An attack of pleurisy requires a recumbent posture, mostly in bed, and warm poultices. A subcutaneous injection of a small dose of morphine will relieve the pain, and table-salt, half a teaspoonful to a teaspoonful in water, several times a day, proves the best of diuretics and absorbents.

Among the localizations of tuberculosis in children, that of the larynx is not frequent, but it is met with. According to Heinze, laryngeal tuberculosis is not produced by contact, but through the medium of the blood. But the expectorated masses are undoubtedly a frequent cause of the local infection, and, as a rule, the larynx is invaded rather than the lungs. Besides nodulated inflammatory swellings in the mucous membrane, submucous tissue, and glands, sometimes even between the muscles, there are small granulations and ulcerations on the cords, with universal catarrh, œdema, and phlegmonous destruction. The symptoms are those of catarrh and ulceration, and depend on the locality and severity of the lesion. In some cases the diagnosis of pulmonary tuberculosis could not be made in the beginning, and that of the local affection was based on the duration of the ailment, the persistence of the fever, and the steady emaciation. At first the laryngoscopic examination revealed catarrh only, and later ulceration and infiltration. The local treatment is that of the catarrh,—inhalation of warm vapors, steam, turpentine, carbolic acid, muriate of ammonium; poultices round the neck; opiates at bedtime. The lactic-acid spray and the application of iodoform have not served me so well as a daily spray of a solution of one part of nitrate of silver in from two to five hundred parts of distilled water. Stronger solutions are rather harmful. The pain produced by ulcerations located on the epiglottis and arytenoid cartilages is somewhat relieved by the application (by brush

or spray) of bromide of potassium, morphine, or cocaine, or an appropriate mixture of two or three of them.

The air around patients suffering from laryngeal phthisis may be moist; but it is a mistake to believe that it must be warm. Cold air is warmed before it enters the larynx and lungs, provided it enters the respiratory tract through the nares. Only when it is admitted through the mouth does it remain somewhat cool when reaching the larynx. Thus the nares must be kept as normal as possible, and competent no matter with what difficulties. Nor will open windows interfere with the comfort of the patient, provided draught is avoided; this can be easily accomplished by screens or otherwise.

Tubercular ulcerations of the intestines may descend to the rectum; in that case the local symptoms, and mainly the tenesmus, may be alleviated by warm injections containing gum acacia or bismuth, with or without opiates. Food and drink must be warm. Bismuth may be given in doses of from two to ten grains every hour or two, so as to form a protection to the sore intestine. Tannin I have not seen do very much good. Naphthalin sweeps the whole length of the tract and acts favorably as a disinfectant. I have seen almost immediate improvement after its use. From four to ten grains may be given daily. Now and then the stomach rebels against it; in that case, resorcin, in doses of from one-fourth to one grain, in powder or in solution, may be given for the purpose of disinfection from three to eight times. Though it is very soluble, it is effective to a certain extent. All of the above may be combined with bismuth, or lead, or opium. Such preparations of salicylate of bismuth as were accessible have not rendered the services I had expected to obtain, judging from the reports of some European writers. Hydragyrum bichloride cannot be relied upon for any effect in the lowest parts of the intestinal tract, because of its great solubility, the necessity of great dilution, and its ready absorbability.

Fistula in ano is a rare occurrence in children under all circumstances. I remember but two cases, in tuberculous girls of about ten years. No matter whether they be

accidental complications, or the tubercular poison (bacilli) be conveyed to the parts through the circulation, or the fistula be the result of the presence, in the fæces, of bacilli, and their action on defective epithelium, practice has changed entirely during the last decade. The axiom that fistulæ in a consumptive patient must not be interfered with has given way to a more rational theory and sounder practice. The sooner they are operated upon and treated, the better.

In pulmonary hemorrhages the application of a lump of ice or an ice-bladder over the locality of the hemorrhage acts favorably, either through the direct influence of the cold temperature or through the reflex contraction of the bleeding vessels. Subcutaneous injections of fluid extract of ergot, or of ergotin in glycerin and water, are apt to give rise to induration or abscesses: hence it will be left to the practitioner to decide in an individual case whether that risk may be taken. Sclerotinic acid has been recommended for the same purpose. A syringeful has been injected hourly of a solution of one part in five of water. It is claimed that no local injury is done by it; but it is painful, and has been corrected by the addition of morphine. The latter may be given internally also for the purpose of relieving the patient's symptoms, both objective and subjective. If it cannot be swallowed well, the proper quantity of Magendie's solution, not diluted in water, is readily absorbed through the mucous membrane of the mouth or throat. The internal administration of ergot may be supported by that of mineral acids and digitalis. Of the latter, a single dose of from two to five grains, or its equivalent, acts well. The dilute sulphuric acid is both efficient and palatable; ten or fifteen drops in a tumbler of (sweetened) water will be readily taken to advantage. Acetate of lead, in doses of one-sixth to one-half of a grain, every hour or two, according to age and the severity of the case, is preferable to tannin; it can be given with morphine or digitalis, or both. The patient requires absolute rest and encouragement, and must be induced to make long forcible inhalations, and told to suppress the cough as much as possible. To relieve it

opiates may be required. For the purpose of stopping hemorrhages the inhalation of the sesquichloride of iron (one to one hundred) has been recommended. As it was not expected to enter the bronchial tubes, its effect was presumed to be by reflex action. I have tried it, but cannot sufficiently recommend it.

As a general rule, among adults as well, a subcutaneous injection of morphine in the very beginning has a good effect. The pulse becomes fuller and softer, the patient quiet. The application of a ligature round an extremity I have not had occasion to try on a child. So long as there is any bloody expectoration the patient must remain in bed, and be kept on plain and fluid food.

Night-sweats are not uncommon in the tubercular phthisis of children from five to twelve years of age. They are favorably influenced by the same remedies which are apt to relieve the adult; such are sponging with vinegar and water, or alum, vinegar, and water. A powder of salicylic acid three parts, oxide of zinc ten, and amylum ninety, or salicylic acid three, amylum ten to twenty, and talcum eighty or ninety, dusted over the suffering surface, is quite beneficial and soothing. For internal administration the dilute sulphuric acid, ten or fifteen drops in a tumblerful of water, is found enjoyable by a great many. A single dose of atropinæ sulphas (one-three-hundredth to one-hundredth of a grain) at bedtime, or agaricin (one-fiftieth to one-twentieth of a grain), or duboisin (one-hundredth to one-fiftieth of a grain) will succeed in bringing relief. When there is an indication for opium, it may be combined with any of them. When the digestion is good, a sufficient dose of quinine (three to six grains), with or without ext. ergot. (the same dose), or ext. ergot. fluid. (one scruple to half a drachm), deserves a trial when for any reason the above remedies are discarded.

PULMONARY TUBERCULOSIS

The following pages are meant to supplement, not to repeat, the article on "Phthisis," and, as far as it concerns pulmonary tuberculosis, that on "Tuberculosis." Hence the remarks on the varieties and the pathological anatomy as well as on the symptomatology of pulmonary tuberculosis will be found brief. The attention of the reader is mainly asked for the chapters on etiology and on the preventive and curative treatment, which may be found interesting when read in connection with the previous two papers.

I. NATURE AND DEFINITION

The question raised on page 105 of this volume, in the article "Phthisis," concerning the identity of "phthisis" and pulmonary tuberculosis, was answered affirmatively. Still, Malassez and Vignal succeeded in the experimental creation with or without co-operation of bacilli, by zooglœa, of tuberculous masses and small "tubercles" in which nothing but zooglœa were found. Similar microbes were met with in bone-abscesses by Castro and Soffia two years later (in 1885). Ribbert examined in 1884 miliary tubercles and found no bacilli, but big and giant cells, and preferred the name of multiple lymphoma for that reason. Biedert, however, when having the same experience, suggested that the occasional presence in the blood or in pus or serum of some additional alkali, which might interfere with perfect staining, explained the absence of bacilli. Eberth produced in guinea pigs tuberculosis which contained no bacilli and was therefore called pseudo-tuberculosis. Eppinger found in such tubercular infiltrations *not* bacilli, but cladothrix, and called his prod-

uct pseudo-tuberculosis cladothrichica. But all these exceptional facts or products should not militate against the acceptance of the essential unity of the tubercular process, which cannot exist without the bacillus tuberculosis (Koch), no matter whether it is found in the lungs, bones, glands, or other tissues.

Tubercle bacilli retain their infecting power a long time. But they *proliferate as parasites* only, and even become less virulent by passing, in the course of experimentation, through a series of living bodies. They also suffer from putrefaction and persistent dessication to such an extent as to cause merely local affections with a tendency to heal, but no general infection; and those originating in the animal body seem to be less dangerous than those raised in the human body. Thus a certain comparative safety is afforded, after all. When an invasion of bacilli has taken place, their first effect is a copious proliferation of the tissue cells, particularly of those of the connective tissue. Epithelial and giant cells are formed in large numbers; their nests show a sharp delineation; leucocytes increase in their neighborhood by emigration. These processes, together with the formation of a surrounding capsule, take from ten to fourteen days after invasion (inoculation); then the "tubercle" is perfected. When there are many round cells in the composite mass the product is called a lymphoid tubercle; when there are but few of them (particularly in the periphery), the mass is accordingly called a large cell (or epithelial) tubercle. The enclosed bacilli are sometimes destroyed by pressure and become harmless; if not, a new infection may take place in the neighborhood, or bacilli are spread by the blood, and still more by the lymph-currents. The tubercle is devoid of blood-vessels, and therefore a disintegration of the central mass is of frequent occurrence. This disintegration spreads in the direction of the periphery and causes the tubercle to look yellowish white. This "*caseous*" degeneration is mainly observed in larger tubercular masses, but also in the smaller "miliary" deposits. Cascation is very liable to terminate in softening, rarely in calcification. The latter is equivalent to com-

plete recovery; the former is a constant source of local irritation, of new bacillary invasion, of repeated bronchial and peribronchial congestion and diffuse infiltration of the pulmonary tissue (caseous pneumonia). It should not be forgotten, however, that casecation does not necessarily mean tuberculosis, for it is also met with as the final transformation of suppuration, or of cancerous or of typhoid infiltration. Nor are giant cells characteristic of tuberculosis. Without the presence of the bacillus tuberculosis the diagnosis of tuberculosis should not be considered complete.

II. DISPOSITION

The *disposition* to tuberculosis of the lungs is partly local, partly general. The relatively smallness of the heart (Brehmer, Fels) and the contraction or narrowness of the pulmonary artery render the tissue of the lungs anæmic. Shortness of the cartilage of the rib, found to be congenital by Freund forty years ago, and rhachitical alterations of the chest interfere with respiration and circulation. The rhachitical depression, mainly acting upon the lower part of the chest, cripples particularly the lower lobes of the lungs and prepares them for inflammation and tubercular deposits. Infants puny at birth, twins, babies born in rapid succession or of anæmic and poverty-stricken parents, over-crowding in ill-ventilated, smoky dwellings and school-houses, previous catarrhal pneumonia, whooping-cough, measles, or influenza, trauma by blow or fall, glandular enlargements, bone-disease, or cold abscesses anywhere in the body, persistent eczema or furunculosis, chronic nasal catarrh or ulceration, pharyngitis, amygdalitis ("tonsillitis") of various kinds, sometimes even chronic gastritis or enteritis, offer under favorable circumstances just as many inlets to pulmonary tuberculosis. Other infectious diseases, such as scarlatina, croupous pneumonia, or typhoid fever, do not so frequently create a predisposition. Like rhachitis, which does not act by its mechanical results only, but by the general anæmia caused by it, scrofulosis, not identical with tuberculosis, prepares the

soil for it by its constitutional anomalies; for scrofula is characterized by vulnerability of all the tissues, the long duration of and slow recovery from superficial or deep-seated lesions, the frequency of relapses, the rapid disintegration of newly-formed tissues, and the enlargement of glands and their tendency to caseous degeneration. It is particularly the latter organs which are often connected with the first symptoms of pulmonary tuberculosis. In two ways the bronchial (and other) glands may become responsible for them: either the bacilli enter the vulnerable glandular tissue with greater facility (for even healthy epithelia and mucous membranes allow bacilli to penetrate), or the capsulated and dormant bacilli, unless destroyed by pressure, are waked up and disseminated by the chronic congestion of the parts.

It has been intimated above that every disturbance of general or local metamorphosis creates a dispositon to tuberculosis by impairing blood and tissues. That is why bad innervation from loss of blood, slow convalescence, care and trouble (in the older child and the adolescent), and also why colds, have their bad influence and predispose to pulmonary tuberculosis. Indeed, the dangers of sudden exposure and of abrupt changes of temperature, which alter the circulation both of the surface and of the deep tissues, either directly or by reflex action, are too evident to be reasoned or smiled away by the fad of recognizing nothing but microbes as the sole and omnipresent sources of every ailment or malady.

In close connection with this subject is that of the danger arising from bad or insufficient *air*. Density of population, crowded rooms, uncleanliness and closed windows work in two directions. By the exhaustion of oxygen and increase of carbonic acid and noxious gases they impair the blood and tissues. By the accumulation of bacilli on floors and walls and in the air they disseminate the almost ubiquitous malady, and the other detrimental influences—dirt, improper food, and so on—are liable to go hand in hand with those enumerated above. This is equally the case in animals and in man. The report of Dr. E. W. Hope, medical officer of health of

Liverpool,[2] is particularly interesting. According to him, the cow shipments in Liverpool are under the immediate supervision of two well-qualified inspectors, who attend to the legal requirements as to light, ventilation, and cleanliness, while no such supervision is required in the country. The result is that of one hundred and forty-four samples of milk taken from sources within the city, in three, or 2.8 per cent., was found the bacillus tuberculosis, while of twenty-four taken at the railway stations 29.1 per cent. infected the guinea-pig.[3]

A disposition is also created by a *defective condition of the respiratory tract.* Though bacilli may be swept through a normal tissue, it ought to be taken as a fact that as long as a bronchial mucous membrane is covered with normal mucus and protected by vibrating epithelium, foreign bodies, from particles of metal and carbon to bacilli, are liable to be expectorated. *Only the air-cells which have no fimbriated epithelia allow bacilli to rest and develop with greater facility.* All the other surfaces of the respiratory organs are endowed with means of self-defence. This is, however, greatly interfered with either by the abnormal structure of the integuments or by actual lesions. The latter need not be direct, as in whooping-cough or measles; they may be indirect. For but lately Kohler [4] published a case which makes it prob-

[2] British Medical Journal, July 17, 1897.

[3] Some of the facts reported to prove the absolutely favorable influence of fresh air are rather startling. When Hutinel makes the statement that among eighteen thousand children in charge of the Paris "assistance publique" there were but twenty cases of tuberculosis, we are—considering the immense mortality of these children—tempted to ask whether they lived long enough to develop the disease. S. Bernheim reports the cases of three pairs of twins born of three women: one of each pair was supplied with a wet-nurse and kept at home, and died of tuberculosis; the others were fed artificially, but in the country, and remained healthy. Such results, if not too surprising to be believed, are too exceptional to establish a rule. It looks as if they proved too much.

[4] Viertelj. f. gerichtl. Med., July, 1897.

able that the disposition to tuberculosis may be increased or a previous affection may relapse as the result of a trauma, but also that when an injury or a concussion of the thorax is not very conspicuous, their effects may be long delayed.

Abnormal structure of the integuments may either be inherited from parents suffering from chronic infectious diseases, such as tuberculosis or carcinosis, or acquired by previous exhausting ailments, anæmia, or chlorosis. (P. 81.)

The question whether *vaccination* may cause tuberculosis or scrofulosis has been in Germany the subject of an official inquiry, and replied to lately by Gerhardt and Leyden. They refer to the fact that the discovery of the bacillus excludes the possibility of such a causal connection except in those rare cases in which the fever attending vaccination may be assumed to favor the proliferation and dissemination of bacilli previously lodged in tubercular lymph-bodies, or in which erysipelas, sepsis, or syphilis is caused by a gross mistake in vaccination. They also point to the frequency of tuberculosis at all times, and emphasize that it has certainly not increased since vaccination was made compulsory; that, on the contrary, in the armies of the German Empire, since vaccination was made obligatory, the mortality from tuberculosis has decreased. These experiences and the conclusions therefrom tally with mine as stated on page 82.

The small vaccination wounds do not count. They cannot be compared in any way with those of *circumcision* or other operations whose occasional influence in admitting tuberculosis was discussed on page 82, nor with the long-lived erosions and sores of *eczema* and *impetigo*. Whenever bacilli are admitted in this way, the result is more apt to be a generalized miliary than a pulmonary tuberculosis.

III. ETIOLOGY

The origin of pulmonary consumption is in almost all instances attributed to the *inhalation* of bacilli. As they are certainly deposited on bedding, clothing, and on the

floors and walls of rooms, nothing appears to be easier than that the long-lived microbes should be admitted to the air of the room and thus be inhaled. In this way the contagion of acute exanthems is certainly disseminated. Tubercle bacilli, like everything solid, when floating in motionless air, are certain to sink gradually, and the inference is that children are more liable to inhale them, a mode of infection which I have claimed to be probable in cases of diphtheria.[5] This mode of propagation has been taken to be the principal one in pulmonary tuberculosis. On page 81 I said that the bacillus, "to be inhaled, must be dry. As long as sputum is moist, or, after having been dry, is again exposed to moisture, it cannot be mixed with the air and thus enter the lungs of another person. . . . The phthisical patients in the wards of a hospital are uninjurious as long as no expectoration is permitted anywhere but in a spittoon containing some water." To such an extent has this belief controlled the teachings of medical men that the rules and regulations of health departments have concerned themselves with this mode of transmission only. Experiments, however, appear to prove that the air-currents usually found in a room are not sufficient to detach dry bacilli fastened with their surrounding sputum to the walls or floors. It is only strong currents, such as are caused by sweeping, beating, brushing—perhaps even by violent slamming of doors—that will float them. Under these latter circumstances it is certainly possible that dry bacilli may be detached in this way and infect those present. But experiments on animals have not yet proved that they could be infected by inhalations thus conducted; and it is quite possible that boards of health will have to alter or rescind both their opinions and the practical rules built on the foundation of former knowledge.

But lately Flügge[6] published a long series of experiments and observations which appear to be able to stand accurate tests. Crying, sneezing, coughing, even talking,

[5] Treatise on Diphtheria, 1880.

[6] Zeitsch. f. Hyg. u. Inf. Krankh., Bd. xxv., 1897.

detach sputum in more or less invisible quantities. Everybody's experience yields such instances—palpable ones—in the sick and the well. Such *moist particles,* mostly infinitely small, were proved to remain in the air of a room five hours. Indeed, an air-current of from one to four millimetres in a second (equal to from twelve to fifty feet an hour) sufficed to float them for that length of time. In this manner the contagiousness of pulmonary tuberculosis is even more pronounced than by assuming the dry sputum to be the only means of conveying the disease, and the direct transmission from husband to wife or children, or between patients in a hospital ward or sanitarium, becomes almost a matter of course, so that the medical and humanitarian devices planned on hitherto imperfect knowledge require a far-reaching revision.

However, the occurrence of *direct contagion* is difficult to demonstrate as long as one-seventh of the population of the temperate zone dies of pulmonary tuberculosis, and as long as the inroads into the circulation on the part of bacilli are so numerous, indeed, and often so mysterious, that Bollinger speaks of "cryptogenetic origin." It will be stated in another place that the initial lesion need not correspond with the locality of invasion; subcutaneous infections cause pulmonary lesions; lymph-nodes are diseased without an affection of the corresponding mucous membranes, and represent the "latent" form of tuberculosis. It has been the tendency to underestimate the amount of direct contagion. A committee of the French Academy examined the cases of two hundred and thirty-three consumptive couples; in about twenty direct contagion could be found. Still, if the experience of the thousands of general practitioners be consulted, the results will be different.

It has also been stated that nurses and employees in hospitals and State prisons, as long as they are not overworked and underfed, do not become tubercular; but other reports prove the danger to which nurses in consumptive wards are exposed. Cases of tuberculosis occurring in a hitherto healthy family after the return of a consumptive member are quite frequent. The increase of tuberculosis

in proportion to the density of the population points in the same direction; and cases like that of Demme, who boarded a healthy baby with the family of a consumptive man, and acquired for it at the age of eight months ozæna, bacilli in the nasal mucus, and tubercular meningitis, are not at all exceptional.

Direct contagion is perhaps at no time more readily accomplished than immediately after birth, when the baby is kept in bed with the mother and exposed to the dangers of contact. What I stated as the result of Flügge's recent experiments and the facility of inhaling the finely distributed particles of contaminated sputum explains best the unfortunate situation of the newly born. Fröbelius, whose babies were transferred from the obstetrical wards to the foundling hospital after a number of weeks, had a mortality from tuberculosis of 0.4 per cent. of all his deaths in the first year (21.7 per cent. general mortality in 91,370 infants from 1874 to 1883). Epstein, who transferred immediately after birth, had none at all.

Direct *hereditary* transmission was discussed by me on pages 76-78. There are still those who are convinced that there is no congenital tuberculosis in man;[7] those who believe in its direct transmission;[8] those who suspect its existence, though the malady exist in relatives only;[9] and those who think it but rare. That it occurs in some instances, at least, there can be no doubt. If there were but isolated cases like those reported by me (see page 77) and by Birch-Hirschfeld, who found bacilli in the liver of a calf extracted by Cæsarean section, the question would be decided affirmatively. Meanwhile the list of undoubted cases is longer.

Hereditariness of tuberculosis and hereditary disposition should not be considered equivalent, as has been shown elsewhere. It is true it is difficult to discriminate between the two in the case of a tubercular infant of a few weeks or months. For the younger the tissue, and the

[7] Biedert, Handbook, p. 93.

[8] Liebermeister.

[9] Lorey.

more copious its proliferation, the less is its resisting power. It is a well-established fact that pathological changes are most liable to take place during the period of most active physiological growth. Moreover, the formation of a tubercle need not take more than ten or fourteen days after the invasion of a bacillus. On the other hand, there is no reason why tuberculosis, like syphilis, could not be stowed away in a single organ, and remain latent, or dormant, for an indefinite period.

Hereditary transmission may be either placentar or germinative. The placenta, when healthy, is a perfect filter, but, in spite of this perfection, anthrax, malaria, variola, and so on, are known to pass it, and tubercle bacilli have been found in the blood of the umbilical vein, the liver, spleen, and kidneys of the fœtus. In connection with this subject I do not care to emphasize the finding by F. Lehmann of giant cells in the villi of the chorion, for giant cells are not exclusively found in tuberculosis, but also in sarcoma, syphilitic endarteritis and other conditions. The possibility of germinative transmission is proved by Iahni and Weigert, who found bacilli in the juices of testes and prostates without tubercular alterations of those organs; by Spano, who found them in sperma; by Maffucci, Baumgarten, Pänder, and Gärtner, who injected bacilli into the external layer of the egg-albumin and caused the chick to be tubercular. It appears, however, that a certain number of bacilli are required to cause an infection. To have that effect, a bacillus culture diluted in a proportion of one to four hundred thousand was required in subcutaneous injections, one to one hundred thousand was demanded for inhalation, and one to eight in feeding. When but eight (up to forty) bacilli were injected, no infection took place. If, therefore, a certain condensation or number be required, it becomes doubtful whether one ovule or spermatozoon may be sufficiently saturated with them to cause during cohabitation an hereditary transmission. Besides, not all the bacilli are of equal efficacy. Still, as from forty-five to seventy-five millions have been calculated to dwell in a single cubic millimetre of sputum, the number of the microbes is so incalculable as to sug-

gest their power to do harm wherever their presence, though in small number, is discovered.

Age.—There are not many additional facts concerning the occurrence of tuberculosis in early age since the data given on page 107. It becomes, however, more and more evident that it is very frequent. J. Mackenzie states that of 1591 consumptives who died in London hospitals, only 65 were under fifteen years; but we do not learn to what extent children were admitted, as compared with adults. Among 3575 deaths from tuberculosis in one year, there were in Berlin 95 under one year, 89 from one to two, 91 from two to five, 38 from five to ten. Of Demme's 59,000 sick children, 2410 (4 per cent.) were tuberculous; 87 of them died of acute tuberculosis. Of all the deaths occurring in Tübingen under one year, there were, according to Dennig, of tuberculosis 25 per cent.; from one to two, 20; from two to three, 8.3; from three to four, 6.7; from four to five, 11.7; from five to six, 3.3; from six to seven, 6.7; from seven to eight, 3.3; from eight to nine, 6.7; from nine to twelve, none; from twelve to thirteen, 3.3; from thirteen to fourteen, none; from fourteen to fifteen, 5 per cent. Calculated in periods of five years each, the first yields, among all the causes of death, 71.7 per cent. due to tuberculosis, the second 20, the third 8.3 per cent. For the same periods, O. Müller furnishes 50, 26, and 23.3 per cent. Altogether, in 500 autopsies made at Munich, he found tuberculosis in 40 per cent. L. Emmet Holt has added valuable material, thus refuting for these last years my statement made about ten years ago that New York institutions had failed to contribute to our statistical knowledge by publishing the results of 1045 autopsies made in the New York Foundling (Northrup) and the Babies' Hospitals. In the 1045 autopsies, tuberculosis was found in 14 per cent. in those of the Babies' Hospital (sick infants only admitted); in the Foundling Hospital (admission indiscriminate, sick or well), 10 per cent. Total number of Holt's cases, 119.

In these 119 cases the lungs were affected 117 times, the pleura 69, the branchial lymph-nodes 108, the brain

40, the liver 77, the spleen 88, the kidneys 46, the stomach 5, the intestines 40, the mesentery 38, the peritoneum 10, the pericardium 7, the endocardium 1, the thymus 3, the adrenals 2, the pancreas 3.

Among the organs accused of being the direct cause of pulmonary tuberculosis is the *nose*. It contains cocci and bacilli of all sorts, for no organ is more accessible; indeed, no cavity is free of microbes, not even (according to Zaufal) the middle ear. On the Schneiderian membrane and all over the naso-pharynx they are met with in large numbers; adenoid growths are covered with them; some writers go so far as to claim them as positively tubercular. Dieulafoy inoculated sixty-one guinea-pigs with the secretion of healthy persons; eight of the animals became tubercular. That does not prove anything, however, but that the surfaces of our integuments may be and are covered with all sorts of noxious elements which become pathogenous only when causing ulcerations, or when carried, by accident or intentionally, into the circulation. In the same way several infectious diseases result from inoculations made from the scrapings of a healthy mouth.

Primary tubercular ulcerations of the nose are acknowledged to be quite rare. It should not be overlooked that while bacilli are frequently found and catarrhal erosions are numerous, the latter should not be taken for tubercular. On the other hand, it is claimed that normal nasal mucus is bactericide. If that be true, as microbes are ubiquitous, most nasal discharges would no longer be "normal" if the microbes remained active enough to cause an infection. Still, a modern author utters the startling news that "retro-nasal catarrh is the main foundation of pulmonary tuberculosis."

According to others, this exclusive claim of the naso-pharynx seemed ill founded. Their attention was mostly fixed on the *tonsils*. Like the larynx, the tonsils were found to become infected by expectoration. When pulmonary tuberculosis was not very extensive, or the disease was confined to the bones, or the mucous membrane of the pharynx was either not much inflamed or was cica-

trized, and the tonsils were small, hard, and pale, the latter were mostly found not to be much affected, and even when bacilli were found in or on the tonsils, in which no caseous degeneration was shown, the cervical lymph bodies would mostly be exempt. But, on the other hand, it has been claimed that in nearly all cases of pulmonary tuberculosis the disease is also in the tonsils;[10] that it begins in the superficial lacunæ, the morbid contents of which are forced into the tissue by the act of deglutition; and, finally, that while pulmonary tuberculosis is almost always accompanied by that of the tonsils, the latter is not only attended by but causes the former.

What I mean to insist upon is this: that undoubtedly bacilli are found frequently in the nose and in the pharynx. But their presence does not mean tuberculosis. Nor does it appear that tuberculosis of the lungs is (often) occasioned by their presence. Among the four hundred and sixteen autopsies of Fröbelius on tubercular infants the lungs were affected in every case, the pharynx in none. When the pharynx and naso-pharynx are tuberculous they are liable to infect the neighboring lymph-nodes first. Moreover, it appears that if intestinal and mesenteric tuberculosis is apt to be present with that of the pharynx, that may be so in consequence of a uniform morbid disposition on the part of the whole intestinal tract. The uniformity of morbid disposition is a well-established fact on other—for instance, the respiratory—tracts also.

IV. SYMTOMATOLOGY

The symptomatology of chronic pulmonary tuberculosis is amply discussed elsewhere, pp. 113-115. The difficulty of diagnosis in many cases has not been lessened. Frequently it is still the totality of, in part, insufficient symptoms that is to be consulted. Percussion never yields a reliable result except when quite gentle; auscultation may be valuable, but in some cases it reveals nothing whatso-

[10] E. Schlesinger, Berliner klinische Wochenschrift, September, 1896.

ever. The normal puerile respiration may be a little coarser, generally or locally. The usual symptoms of bronchitis are sometimes all that can be found. Suddenly, now and then, a localized bronchial respiration can be heard corresponding with a local dullness, for infiltrations take place quite frequently. They may disappear again, or they may migrate; some or all of the deposits may either disappear or remain. Respiratory murmurs may change. A bronchial respiration which was of long standing may temporarily disappear because of the obstruction of a normal or the filling up of a dilated bronchus. The most characteristic auscultatory symptom is the *persistence,* in a given locality, not always near the hilus or in an apex, of a subcrepitant râle. Cavities are rare, and generally small. They are difficult to find, and often their diagnosis is deceptive—more so than in the adult. Percussion that yielded dullness near a clavicle may not do so after a while; an infiltration may contract; the neighboring pulmonary tissue may in part cover the hardened spot, or may become emphysematous and yield a semi-tympanitic sound in place of the former dullness. This emphysematous change does not so readily take place in cases of extensive interstitial pneumonia (peribronchitis), which finally results in retraction of an extensive part of the pulmonary tissue, preferably in the upper lobes.

A heart-murmur may accompany chronic tuberculosis. When it is not cardiac, it may, in rare cases, result from compression, by cicatrizing tissue, or by an infiltration, of the pulmonary vein.

In connection with what was said on page 114, on the *fever* accompanying chronic tuberculosis of the lungs, it will be remembered that the temperature has no particular type. It is sometimes higher in the morning and at noon than in the evening; frequently it is only the expression of the collateral bronchitis and pneumonia, therefore in the course of time it may be high or low alternately. When suppuration sets in it may be hectic. In acute miliary tuberculosis of the lungs, which may occur without for some time being complicated with general tu-

berculosis, the temperature is generally higher—104° F. and more, sometimes less. Miliary tuberculosis may be confined to a part of the lungs; then the temperature may be moderate. It may become normal after a while, to rise again when a new miliary infiltration takes place in the same or another portion of the lungs.

The condition of the *blood* is not materially changed. What alterations there are result from accompanying septicæmia or fever (red cells diminished), or from hæmoptysis, extensive infiltration, the presence of cavities, and from pyogenic fever (leucocytosis).[11] Some changes of the blood which have been noticed in (tuberculosis of) the nursling, such as the presence of eosinophile cells and of occasional nucleated red cells (normoblasts), are physiological and not pathological.[12]

Nor is the condition of the *urine* conclusive of tuberculosis. It was believed to exhibit an undue amount of indican. The latter is found in proportion to the atrophy or the increased intestinal putrefaction which accompanies chronic tuberculosis, and to its complication with bronchopneumonia and the inflammation of serous membranes.

V. COMPLICATIONS

Complications with tuberculosis of the *stomach,* the *intestines,* and the *mesenteric glands* are not so frequent in children as they are in adults. Indeed, the stomach is rarely affected. Primary tuberculosis of the intestine is very rare indeed, and but few trustworthy examples are found in the literature besides those furnished by Demme. The mesenteric glands are the seat of tuberculosis far less frequently than the bronchial glands (one to ten). Therefore the number of cases of tuberculosis acquired by inhalation exceeds immensely those depending on intestinal infection. In those children whose gastric juice is not sufficient, or is entirely absent, bacilli may pass the stom-

[11] R. C. Cabot, A Guide to the Clinical Examination of the Blood, 1897.

[12] Hock and Schlesinger, Beitr. z. Kinderheilk., ii., 1892.

ach and prove injurious. Tubercular mothers who (not an uncommon practice) chew their children's food before giving it to them may thus transmit their disease. In the milk of tuberculous cows bacilli are, as a rule, found only in the presence of general miliary tuberculosis and of tubercular mastitis. Thus direct transmission through milk is an exceptional occurrence. Still it does occur, and therefore pasteurization or sterilization is demanded as a matter of safety. It should not be forgotten, however, that the successful inoculation of milk bacilli into guinea-pigs does not prove that the same danger attends the same milk when it is introduced into the human alimentary tract.

The *kidneys* of tuberculous young children suffer like those of tuberculous adults. Amyloid degeneration and chronic diffuse nephritis, toxic nephritis of variable severity, and congestive conditions in different stages depending on venous obstruction are not uncommon. Besides, transitory albuminuria, with or without an excess of phosphates or of urates, or of both, is frequently observed, mostly in very anæmic children and those in whom hereditary disposition to tuberculosis is well marked. That it is common in tuberculosis of the kidneys, which appears to complicate that of the lungs quite often, even before marked symptoms of nephritis are in evidence, is readily understood.

VI. DIAGNOSIS

The surface alterations of scrofulous children are closely connected with the lymph-bodies and lymph-circulation, which is more active, as the vessels are larger, at an early age. To distinguish between the scrofulous and the tubercular nature of the swelling of the lymph-bodies we have no means besides their bacteriological examination. The main question is whether in the first period of scrofulous affections the tubercle bacillus can be found. Litten[13] reports the results of nineteen autopsies of scrofulous children. In one only a few bacilli were

[13] Berliner klinische Wochenschrift, 1897, N. 28.

found in the lymph-bodies; in that case, there were also the symptoms and pathological changes of pulmonary tuberculosis. Nor were other scrofulous symptoms identical with tuberculosis; no bacillus was found in one hundred and twenty-nine cases of dry or vesicular eczema. Of forty-two softened lymph-bodies of the neck and thirteen extirpated glandular conglomerates, three only had scanty bacilli; these three were complicated with extensive lesions in the glands and bones, one of them with such in the knee-joint. Twenty-three children with acute multiple suppurations of the subcutaneous tissue had no bacilli; the result was also negative in five cold abscesses with thin pus, but positive in seven with thick, caseous pus and proliferating membrane. There was no bacillus in the catarrhal secretions of the noses, the ears and the eyes of one hundred and thirty-eight scrofulous children. Thus in the initial stages of scrofula there are no tubercle bacilli, therefore these cannot be the causes of scrofula, nor are they the sources of the peculiar vulnerability and the singular form of chronic inflammation characteristic of scrofula.

VII. PROGNOSIS

The remarks on prognosis made on page 117 are correct as far as our present and past knowledge goes. To them I beg to refer the reader. Prognosis is mostly grave, in many instances doubtful. Pulmonary tuberculosis may practically heal, however; that is proved by the autopsies, which reveal the presence of caseous, indurated, even calcified tubercular infiltrations which either were or never were diagnosticated during life; but even in such bacilli retain their vitality a long time, and may be enabled any time to renew their virulence and proliferation by the occasional influence of bronchitis, pneumonia, Koch's tuberculin, or other irritants. Therefore, not to speak of the unfavorable prognosis furnished by extensive infiltration or cavities, a dormant or an apparently recovered case, in spite of ample nutrition, fresh air, exercise, and cold water, ought not to be pronounced cured without mental reservation.

VIII. PREVENTION AND TREATMENT

The peculiar *scrofulous condition* of the tissues, mainly of the skin and mucous membranes, with their passive congestion, facile disintegration of the epithelia, and sluggish recovery after injury or disease, is the very soil for the invasion of tuberculosis. Identity of the two conditions does not exist except in an erroneous diagnosis.[14] The very efficacy in scrofula of remedies which are not borne at all in tuberculosis would prove the differences in the nature of the two. The treatment of scrofulous infants and children has the purpose of rendering the tissues more capable of resisting the invasion of infectious processes. Sea-bathing and the use of mineral springs containing iodine, such as St. Catherine's or Kreuznach, the systematic use of cold water, with friction of the surface, the occasional administration of diaphoretics, and the persistent use of iodides (of potassium, sodium, or iron) and of cod-liver oil, will be required in scrofula. Of all this medication the use of cold water to harden the skin and to stimulate and strengthen both the cutaneous and the general circulation, and of cod-liver oil, is the only treatment applicable both to scrofula and to established tuberculosis.

Among the *preventives* of pulmonary tuberculosis the *destruction of the tubercle bacillus*—easily accomplished outside the organism—before its entrance into the lung-tissue takes a high rank. No internal remedy, however, will prove effective, for no living tissue bears disinfectants strong enough to annihilate the microbe. Whenever lymph-bodies, cavities, sinuses, ulcerations, joints or bones are affected with tuberculosis and the disease is almost certain to spread, timely surgical interference will prevent the extension of the morbid process. A tubercular gland must not be permitted to suppurate and burst, but should be enucleated in time. Tubercular *abscesses* and

[14] See article by Ashby, Keating's "Cyclo. of Dis. of Children," Vol. II.

fistulas should be scraped out, the pyogenous membranes removed, and the surface kept disinfected until recovery is completed. Tuberculous joints and bones may require exsection, but in most cases repeated injections of *iodoform emulsions* (better than solutions), with the occasional removal of loose particles, will prove effective. Another method of conservative treatment has been introduced by A. Bier. Encouraged by the fact that lungs in a condition of passive hyperæmia resulting from cardiac disease or from kyphosis have a rather pronounced immunity from tuberculosis, he advised the production of a passive venous congestion of the tubercular joints by bandaging the limb below the affected joint and compressing it above with an india-rubber band. To secure a moderate amount of hyperæmia and local cyanosis only, the bandage should be loosened once or twice daily. Such a degree of passive hyperæmia is known to give rise to the new formation of connective tissue and to induration, which is expected to afford a certain degree of protection [15] against the proliferation and action of bacilli. That is what Landerer expected to accomplish by the local injection near the joint of *cinnamylic acid*, and Lannelongue by that of a 10 per cent. solution of *chloride of zinc*. That is also the effect Koch meant to attain when he advised *tuberculin*. The remedy was expected to light up a sufficient amount of interstitial irritation and consecutive hyperplasia to encapsulate the bacilli and render them innocuous.

The bacilli should be destroyed in *milk* and *meat*. Pasteurization of the former and thorough heating of the latter are all that is required. Muscles are seldom tuberculous, more frequently the kidneys, spleen, and liver are; it is principally the latter which require attention. After all, tubercular infection from these two sources is not frequent, but ought to be, and may be, avoided altogether. (Pages 83-84 this vol.) When cow's milk is suspected, the buttermilk, butter, or cheese made of it should not be eaten. The milk of a tubercular mother or wet-nurse may be dangerous; what is more so is the direct contact of

[15] See my Therapeutics of Infancy and Childhood.

the baby with the tuberculous patient and the inhalation of bacilli.

As preventives and curatives, proper feeding, clothing, and the hygienic treatment of the *skin* (pages 121-122) are of the first importance. Nothing of any account could be added to former rules. As to the *climatic treatment* of pulmonary tuberculosis, I refer to on page 120. I think I have given these matters much attention then and since. The remarks I then made I could but repeat now; the briefness of this reference to what I consider most important should not be a temptation to think of bacilli first and last and of hygiene least. The most urgent indication is always to protect the organism against an invasion, and to fortify it and enhance its powers of resistance.

Among the *preventives,* as a means of diagnosticating tuberculosis in cattle I should mention tuberculin. After it failed as a healing agent, the attempts at reducing its danger and rendering it a positive remedy have not been given up. Tuberculoidin and *tuberculocidin* (Klebs) were obtained by clearing the tuberculin of its bacilli by treating it with alcohol, but the confidence these modifications commanded was not greater than that placed in a serum recommended by Maragliano, which seems to contain no antitoxin, or the *cantharidin* introduced by Liebreich. But lately Koch recommended a *new tuberculin,* obtained by disintegrating dry bacilli by a mechanical process (the latter is claimed by Buchner, a priority question we have nothing to do with). The new tuberculin, which contains the insoluble parts of the bacilli (while the old was said to contain those soluble in glycerine), is claimed to possess a positive immunizing power. It is sold in vials holding one cubic centimetre (=15 minims=15 grains). One per cent. of it is the dry material of tubercle bacilli in a condition of mechanical disintegration. The first dose to be injected into the subcutaneous tissue of an adult should be one-five-hundredth of a milligramme of the dry substance (one-fifth milligramme of the fluid). To obtain this dose, one part (one minim) of the fluid tuberculin may be mixed with five thousand parts of a preserving fluid. One minim of this mixture contains the required

dose of one-five-hundredth of a milligramme. The solvent is a six per mille salt-water solution containing twenty per cent. of pure glycerin. Salt water alone will not preserve. Injections should be made every other day, and the temperature should be watched. An elevation of more than $\frac{1}{2}^{\circ}$ C. should be avoided, and no new injection be made until the temperature is again normal. Slowly the doses should or may be increased to twenty milligrammes of the dry substance (two cubic centimetres, two original bottles of the fluid). If there be no reaction, it is best to desist, or to inject at long intervals only. Before this amount is reached, the injections ought to be made once or twice in a week.

There are cases, however, without any reaction. A patient of mine, who died in Bellevue Hospital lately of pulmonary tuberculosis, received from me a daily injection of the new tuberculin. The first dose was one-tenth of a minim, which was carefully but persistently increased. Within a fortnight the dose reached three minims, with no effect on the temperature whatsoever.

The exaggerated claims of the old tuberculin are not repeated for the new. This is said by Koch to exert its influence in the very beginning of the morbid process, when there is no complication with streptococci or septicæmia, and when the temperature of the body does not exceed 38° C. (100.4° F.). It is readily seen that under these circumstances there will be but few cases of pulmonary tuberculosis in children in which, because of the difficulty of the diagnosis at that age and in that stage, the remedy could be administered with any show of justification.

Behring,[16] while claiming that Koch's new tuberculin is weaker than the old, announces that he has prepared a stronger one from very virulent dry cultures of tubercle bacilli. He claims to have a *tuberculin* twenty-five thousand times stronger than a dose fatal for one gramme of guinea-pig weight, or eighty times stronger than a dose

[16] Twelfth International Medical Congress, Berlin, Session of June 10, 1897.

fatal to a guinea-pig of ten ounces in weight. His mode of preparing his tuberculin is evidently similar to that of Koch, but his statements are made with his old intrepidity.

Immunization, either indirect, by employing the blood-serum of immune animals, or direct, by injecting small quantities of bacteric poison, virulent or attenuated, as the case may be, has less favorable results in tuberculosis than in some other bacteric maladies. Koch's tuberculin was a glycerin extract of pure cultures of tubercle bacilli containing a great many of the latter. Its remedial effect was, when the first universal enthusiasm had cooled down, either soon found to be *nil,* or, on the contrary, many chronic cases were rendered by it acute and speedily fatal. But it has retained a great power for good as a preventive, through its application for diagnosis. When injected into cattle, those affected with tuberculosis re-act speedily by some elevation of the temperature. If all the cattle of the land were subjected to that test, and those responding affirmatively were killed, the country would be cleared almost entirely of the tuberculous animals which supply milk and meat. It is true that the percentage of cases of tuberculosis contracted from either milk or meat, according to what has been stated before, is small; but, though small, it is too large if it is avoidable.

Medicinal treatment (page 126) of pulmonary tuberculosis takes no low rank.

Creosote was introduced into practice, both for inhalation and for internal administration, in 1877. No direct influence on bacilli should be looked for from it. What it can do is to better the condition of the patient. It will often improve appetite, combat putrefaction, thereby facilitate assimilation, and (sometimes) relieve diarrhœa. The doses vary. Almost incredible doses have been given —from ten to fifteen cubic centimetres=from two to four drachms daily, and more, to adults. Probably from one to ten drops daily is a dose for children which, according to their ages, may be administered for a long time. The carbonate of creosote, almost tasteless, and easily borne, is a proper substitute in similar doses. Neither ought to be persisted in when the appetite does not im-

prove within a reasonable time, or during a pulmonary hemorrhage, or when the urine, which requires frequent examination, contains, or is beginning to contain, albumin.

These last seven years I have replaced creosote by *guaiacol,* which forms nearly sixty per cent. of the very best creosote in the market, recommended by Schüller, Sahli, and others. A child will readily take from six to fifteen drops daily (according to age) in from three to four doses. It is best taken after meals, in sugar-water, in milk, or in cod-liver oil. There are but few who object to it. Those who do may take one of its salts—the benzoate (benzosol), salicylate, cinnamate, or carbonate. Of these I have employed mostly the last, occasionally the first. They are (almost) tasteless, and are readily taken in doses of as many (or more) grains as the fluid guaiacol contains drops. With guaiacol I have been less disappointed than with any other internal remedy administered in pulmonary tuberculosis, cod-liver oil not excepted. It is a good stomachic, appetite and digestion improve under its use, the cough gradually becomes looser, less purulent, and the râles more mucous, and the body-weight is apt to increase. While creosote is not well tolerated in the stage of cavities and hectic fever, guaiacol is not only borne, but appears to exert its beneficial influence even in that condition. There are few patients who do not derive some benefit from its internal use. Externally, it has been recommended to subdue hectic fevers. For that purpose the chest and abdomen are painted with the pure guaiacol several times daily. It has the advantage over creosote of not being contraindicated either in hemorrhage or in renal complication.[17]

I do not fear that it will be replaced by *ichthyol* (sulpho-ichthyolate of ammonium), which has been eulogized by Cohn, Scarpa, Le Tanneur, H. Fraenkel, and others. Adults (children in proportion) are expected to take from one-fourth of a grain to four grains in a capsule before every meal, or from twenty to forty drops four times a day of a solution in equal parts of distilled water. In

[17] See my paper in the *International Medical Magazine,* November, 1892, and *Transactions of the Climatol. Association,* 1892.

spite of the admixture of aromatic oil, it has a bad taste, and will be administered with difficulty.

The favorable influence of *cod-liver oil* in the chronic pulmonary tuberculosis of children is an established fact. Its effect is probably not due to its minute percentage of potassium, sulphur, iodine, bromine, phosphorus, and iron. Perhaps the large number of peculiar organic bases (aselline, morrhuine, etc.) contained in it, particularly in the dark varieties, has more to do with its effects on metamorphosis and nutrition. At all events, the free fat acids, of which there is one-half of one per cent. in the light, five per cent. in some dark specimens, appear to control digestion. Its wholesome effect cannot be due to its fat, for cream or some other fat, in daily doses of from two to eight teaspoonfuls, could not replace cod-liver oil. It is quite possible that we have not yet found out the exact nature of the remedy. Perhaps its action is due to some glandular substance which works similarly to the thyroid extracts.

Arsenic in small doses (page 123) still justifies in my experience its reputation as a cell-growth stimulant and general nutritive when administered either by itself or with digitalis. Fowler's solution should be given, well diluted, after meals, in three daily doses, for weeks and months, or until (which is rare) gastric or intestinal irritation or local palpebral œdema makes its appearance. The daily dose depends on the age of the child, and should vary between one and five drops. If Fowler's solution be not well tolerated, its equivalent in arsenous acid will act equally; indeed, the latter is often tolerated for a much longer time than the former.

The preparations of *digitalis* are the same that were formerly recommended. What we now know of digitoxin and digitalinum verum, which have similar effects, does not commend them for general practice. A good tincture of the English leaves, the fluid extract, and the solid extract are best fitted for children's use. When complaints are heard of their inefficiency the fault lies generally with the insufficiency of the dose. As soon as digitalis begins to cause arrhythmia of the pulse it is advisable to reduce

the dose and combine it with strophanthus, or adonis, or caffeine, for its most favorable effect is obtained before the pulse becomes irregular. In the first stages of its effect it lowers the pulse and increases the blood-pressure, mainly of the left ventricle; and thus, while it stimulates the whole circulation, it relieves the lungs, they being supplied by the right ventricle, which is not so stimulated by the drug.

Inhalations of different kinds were discussed on page 126. In addition (and partly in repetition) it ought to be remembered that they are (or were) intended to destroy bacilli, to act on the products of inflammation or of disintegration, or to influence cough or expectoration. No bacillus can be reached except, if at all, in the tissue which harbors it, and inhalations take effect on the surface only. Neither medicines nor *hot air* have any other effect. Oxygen, nitrogen, sulphide of hydrogen, hydrofluoric acid, iodoform, carbolic acid, creosote, have been employed in vain. *Turpentine* inhalations are frequently beneficial by loosening, in some cases diminishing, expectoration from suppurating surfaces, and, mixed or not with eucalyptol or other disinfectants, by relieving the fetor of pulmonary gangrene. The inhalations of *compressed air* will prove advantageous in chronic processes where the object is to expand the contracted lung-tissue.

Operative procedures are less indicated in pulmonary tuberculosis of children than in that of advanced age. The opening of a superficial large and copiously secreting abscess is a rare indication, for the latter seldom occurs except in the semi-adolescent, and, if it does, the prognosis is at any rate absolutely fatal. Besides, the dissemination of the tubercular process is so general in the lungs of the young that not more than a slight temporary improvement can be expected of an operation.

The symptomatic treatment of *cough* is one of the urgent indications of pulmonary consumption. When it is mild it requires no attention. Severe spells of coughing, however, may injure the pulmonary tissue by the rapid alternation of expiratory pressure and spasmodic inspiration; indeed, they may lead to emphysema of the hitherto

healthy parts. They may force muco-pus with bacilli into alveoli not yet affected, and thus spread the morbid process. Docile children should be taught to suppress cough, no matter from what source, for cough begets cough. When the irritation is pharyngeal, the frequent drinking of water, or of an alkaline water, or of milk, or the sucking of a liquorice lozenge, or of a part of the officinal trochiscus of ipecac and morphine (one-fortieth grain in each), from time to time, is indicated. The latter, or a part of it, will render good service in this also, that it may prevent vomiting when taken from five to fifteen minutes before meals. A drop of Magendie's solution on the tongue, not diluted, will have the same effect. Sprays with alkalies or turpentine, the inhalation of steam, whether pure or medicated with aromatics or disinfectants, and, finally, the long list of expectorants, the indications of which every one is familiar with, may or ought to be used according to indications, and a dose of Dover's powder, or codeine, or some other opiate, administered at bedtime if required. Sulphonal is credited with diminishing exuberant expectoration, while acting as an hypnotic. Docile children should be taught how to expectorate. When the acid secretion of the stomach which destroys bacilli is deficient, the appetite poor, and the mucous membrane of the intestine catarrhal or ulcerated, the ingested bacilli are capable of lighting up intestinal, mesenteric, or peritoneal tuberculosis.

In the management of the *fever* which attends pulmonary tuberculosis (page 125) we should remember that it is the effect of various agents. The invasion of bacilli into new territories, the proliferation of the microbes of suppuration and putrefaction, and the progress of inflammatory changes are equally concerned. The question whether it is proper to interfere with every rise of temperature is a very nice one. It is true that it increases the disintegration of albuminoids, and ought not to go on for an indefinite time, but many patients feel better with a moderate rise than with a normal (or perhaps subnormal) temperature. High hectic fevers are better influ-

enced by a combination of quinine with a coal-tar preparation than with either of the two. The latter has a quieting and soporific effect not possessed by the former; still, in every individual case the indications may vary. Whenever acetanilid, or phenacetine, or antipyrin, acts unfavorably on the heart, it ought to be combined with caffeine, or strychnine, or camphor in appropriate doses. When they cause an undue amount of perspiration the remedies recommended (page 130) for night-sweats will be aptly combined with them. Atropine, agaric acid, camphoric acid (0.25-0.5 gramme, four to eight grs. daily), may then be given in fractional doses, while full doses would be administered for night-sweats at bedtime.

Former remarks on pulmonary *hemorrhage* (pages 129-130) are still valid. The most powerful remedy is absolute rest, which should continue for days after its cessation. The applications of ice and morphine sufficient to enforce rest, both physical and mental, are indicated. The popular and frequently effective dose of a teaspoonful or more of table-salt in a little water, with or without the addition of vinegar, may cut short an incipient bleeding. Drinking should be reduced to a minimum, to avoid unnecessary blood-pressure. The doses of acetate of lead, in order to be effective, should be "large." From four to twelve grains a day may be given a child of ten years to advantage. It should be remembered that they are demanded a few days only, and no poisonous effect need be feared. Some opiate, the extract of opium or codeia, should be continued, so as to keep up the quieting effect of the first doses of morphine. Coughing, sneezing,—indeed, efforts of any kind,—are dangerous. That is why inhalations advised for the (very questionable) local effect of astringents should be omitted. Tying the extremities to stop bleeding should not be continued long; the ligatures ought to be loosened after twenty or thirty minutes, and should never be so tight as to constrict arteries as well as veins. Our knowledge of the action of ergot in hemorrhages of the lungs (or other organs) has neither increased nor been refuted during the last decade. Some attribute its effects to the diminu-

tion of blood-pressure owing to the presence of ergotinic acid, others to the artery-contracting action of the cornutine. At all events, as long as the chemical and physiological researches concerning the drug are not finished, clinical experience ought to be valued most highly. It is favorable, but the subcutaneous effect is marred by the local irritation apt to be produced by the fluid extract. Sclerotinic acid, besides being painful, is liable to be decomposed by microbes, which are rarely absent from ergot preparations, and will hardly fulfill the expectations in regard to it.

The *complication with intestinal tuberculosis* is not frequent; less so in children than in adults, perhaps because the former do not suffer as long as the latter. It is infrequent (in comparison with the large number of cases of pulmonary tuberculosis) because of the facility with which bacilli are either destroyed in the acid secretion of the stomach or swept through the whole length of the intestinal tract. That is why the presence of tubercle bacilli in the fæces is not a conclusive evidence of intestinal tuberculosis. Nor is it permissible to claim diarrhœa as the conclusive proof of tuberculous enteritis. A simple catarrh, or the presence of hardened fæces which require castor oil or enemata, may be expected during the course of tuberculosis as under ordinary circumstances. When the suspicion of tubercular colitis is justified, large enemata (the hips being raised), containing from one to five per cent. of subnitrate of bismuth, and possibly some disinfectant like thymol (1 : 2000 of warm water or of starch decoction) are indicated. They should be given daily, or several times a day. Internally, the remedies recommended formerly (page 129) will act well. What I said of bismuth, opium, lead, naphthalin and resorcin still holds good. Corrosive sublimate I do not value any more highly at present than formerly. Salol may be added to bismuth, from eight to thirty grains (0.5-2.0) daily. Warm fomentations (water or poultices) over the abdomen have a gratifying effect when there is colic or persistent sensitiveness pointing to the presence of a tubercular peritonitis.

DENTITION AND ITS DERANGEMENTS

FIRST LECTURE

To a truly scientific physician nothing is more evident than that the physiology and pathology of the human organism have not been sufficiently elucidated. The medical sciences are by no means completely developed; they never will be, for they combine a knowledge of all the varied and intimate physiological functions and obscure pathological changes of the physical and mental organs of the human frame; they never can be, for their basis, the human organism, will and must undergo changes and further development. Those powerful minds who have done most, and are still in our times working most successfully, for the advancement of medical knowledge, have been and are still the first to admit the truth of this proposition, and are the first also to acknowledge that more remains to be done than has been done hitherto. Fortunately, however, there are a large number of subjects so well known and so clearly understood, that even in this ever-changing science we are enabled to point out the way to further investigations, to arrange in mathematical order our conclusions, and win thereby for medical science not only a place amongst the so-called exact sciences, but the acknowledgment of educated men, that it is the noblest and most comprehensive amongst them.

Having the honor, as I believe, of being the first in this country to teach infantile pathology as a distinct and fully independent branch of medical education, I did not deem it proper to begin with a subject liable to be misunderstood, mistaken, or misconstrued. A subject of this description I have therefore determined, in this preliminary course, to consider at length, viz., the Physiology and Pathology of Dentition—a subject which is but imperfectly understood. But there should be nothing mysterious about it; the pro-

cess of the early formation and the final development of teeth is well understood, and on this safe basis we are able to rest our conclusions relating to pathology and therapeutics. So little, however, can we rely on the correct interpretation of facts by observers, that even here we shall have to contend with prejudice and ignorance.

You know that among the public at large, even among the educated part of the community, teething is regarded as one of the two scapegoats of all the diseases of infantile age. Teething and worms are among mothers acknowledged as the universal and all-powerful sources of disease. Whenever an innocent ascaris or a puny oxyuris is observed in the fæces of a child, worms are, for years to come, considered as the undoubted cause of any disease that may occur. Teething, a normal, physiological development, taking place at an age which for many reasons is subjected to a large number of diseases, has a strong hold on the imagination of frightened maternal minds. The first dentition generally occupies the first years of early infantile life; a period in which the child is peculiarly liable to diseases both numerous and frequently of a dangerous character. As the protrusion of a tooth (and in the average a tooth will cut every month) is a remarkable phenomenon, and is something new and visible to the eyes of even the most shortsighted, it is believed to be the cause of every unfavorable occurrence in early life. A mother will bring to you her child, thin, emaciated, and anæmic, with sunken eyes and the wrinkled physiognomy of old age, and tell you that she is well aware the poor thing is suffering from teething, and that therefore nothing can be done to alleviate its sufferings. She will never be convinced that her child is dying from her own neglect; that she has allowed a slight catarrh of the intestines, perhaps, to degenerate into incurable ulceration of their follicles. Thus you will learn that ignorance and prejudice will attribute all, or nearly all, the diseases of the infantile age to a normal process. To the same cause are attributed inflammations of all the external and internal organs, the brain and its membranes, air passages and lungs, mouth, throat, stomach, and intestinal canal; as also cough, vomiting, diarrhœa, and dysentery,

derangements of the secretion and emission of urine, chronic eruptions of the skin, convulsions and paralysis, exudations of serum, and extravasations of blood, in any of the numerous organs of the infantile body. Teething is thus considered the sufficient cause of most of the terrible diseases which prove fatal to thousands of the rising generation. I can assure you that the readiness to attribute all the diseases of infantile life to teething has destroyed more human beings than many of the wars described in history. For though parents are so much impressed with the belief of the dangers of teething, still they never think of attempting to save the lives of their children by counteracting the supposed life-endangering power of a normal process.

The common supposition that teething is a predisposing cause of disease, nay, even a disease in itself, prevails over all civilized and half-civilized countries. What is now, however, the belief of the public, has been the conviction of the medical world through centuries, almost down to the present time. General experience shows that the persuasion of the scientific world, after having been given up to make room for more correct opinions, has remained in the public at large; and it is to be feared that it will not soon be removed. And it would be fortunate if this prejudice were confined to the public. But unfortunately it still lingers in the medical profession, and it is for this reason that I have dwelt upon it so lengthily. Nothing is more common than to hear doctors of medicine, young and old, in cases of infantile disease, diagnosticate teething, after mother and nurse have done so before; and nothing is more frequent than to be told that the death of a child was the consequence of dentition. I have seen, in this city, a certificate of death, in which the direct cause of the death of a child five years of age, with his jaws full of teeth, was attributed to teething. Consider for one moment the absurdity of the conclusion that a normal, physiological process is fatal to the existence of a living being. Who has ever ventured to assert that menstruation, or pregnancy, or the climacteric years, are the direct causes of death? It is equally absurd to assert it of dentition; yet such statements are daily made by physicians. According

to the census of England, in the year 1857, there were in the United Kingdom 3,992 deaths from teething, 3,791 of which occurred in children of less than two years; 201 in children of from two to five years. Between the years 1845 and 1850, there died in London, according to the report of the registrar-general, no less than 3,466 infants from teething, and the disorders caused by the general irritation attending dentition; the total number of deaths from all causes being 258,271, giving the proportion of one death from teething to seventy-four from all causes. And the census of the state of New York offers the following numbers: In the whole state there died, in the year 1855, from teething, 626 children; of these certificates of causes of death, 254 were made in New York County, 132 in Kings, 35 in Erie, 24 in Rensselaer, 41 in Albany, 30 in Monroe. It is not stated whether a part of those unfortunate children who died from teething had not the full contingent set of teeth of first dentition.

Let me first state that teething, in the common acceptation of the term, is not the gradual development or formation of teeth, but the time and act of their penetrating the gums. This takes place, in the average, beginning from the sixth, seventh, or eighth months to the twenty-fourth or thirtieth month of life. I may also in this place enumerate the symptoms which are often observed during, or (shall I say) in consequence of teething. In a large number there are no symptoms at all. The first, and the second, and perhaps all the other teeth, will cut, and without any disease or trouble of any kind. In others the mouth is hot and red, with the exception of those thin parts of the gums below which the teeth are visible; even the lips have a higher color and temperature; the child puts its fingers, or anything in its reach, into the mouth; is pleased with having its gums rubbed; bites the nipple when sucking; or if the mouth is inflamed and aphthæ are present, and the tonsils swollen, it is disinclined to take the breast, trying it often, but just as often loosing its hold. At the same time there is a copious salivation, the saliva being usually tough, viscid, and more like mucus than saliva. The child has all the usual symptoms of slight or moderate fever;

warm hands, a rapid pulse, flushed or pale face, intense thirst, vomiting, constipation, or diarrhœa with green mucous passages. The most common of these is diarrhœa. Pain in the bowels is very common, as digestion appears disturbed; tears are secreted abundantly; the blood-vessels of the conjunctivæ are injected. A slight cough, hoarseness, pain in passing the scanty urine, secretion from the nose, are not unfrequent occurrences. Such symptoms are apt to disappear entirely in three or four days or a week, with or without treatment. But sometimes the symptoms are graver from the beginning or they are aggravated by endemic or epidemic influences, or the peculiarities of individual dispositions to disease.

In some cases the fever will not disappear so readily without leaving grave consequences; the pulsations of the heart and arteries will not decrease in number; the action of the heart will not be of less power and impetuosity than before; the tongue, mouth, and lips remain dry; thirst so extreme that you cannot take the tumbler from your little patient's hands before he has completely emptied it. Respiration is accelerated, numerous, short, and superficial. The eye is sensitive to the light; headache becomes manifest from the corrugation of the muscles of the eyebrows, and the peculiar aspect of suffering. Excretions and secretions are scanty, fæces dry and hard, urine red. Vomiting and diarrhœa, if they had been present before, now cease. The child will appear more depressed, but easily excited; slight local convulsions will prove the introduction to severe attacks, which generally terminate fatally. In other cases the tongue is hard, dry, black; teeth and lips of the same color, corresponding with the symptoms characteristic of typhoid fever. Such cases are very likely to terminate fatally. The last symptoms in such cases are paralysis of some abdominal organ, especially of some part of the intestine. Another train of symptoms attributed to teething, is the following: A child is feverish; pulse frequent and small; temperature of the extremities considerable; but the face is pale from the beginning; lips and mucous membrane of the mouth, hot, red, and dry; tongue covered with a greyish white fur; restlessness; anxiety; respiration hurried

and short; vomiting and diarrhœa. Frequently such a depression of the general strength is combined with these symptoms—the more so as the most intense and often repeated vomiting and diarrhœa are very apt to exhaust the little patients—that the child dies in a day or two in convulsions consequent upon inanition, and local or general paralysis. In a certain number of cases the principal symptoms cease, and the child recovers. In a certain other number vomiting will stop, but the diarrhœa continues. The deluded mother who felt a little uneasy at the severe character which teething seemed to have assumed, is gratified, after the main symptoms have passed by, to find that her child is suffering from diarrhœa only, and that in this manner teething will be made easy and comfortable. But alas! this deception on the part of the mother is too often fatal to the child. The diarrhœa is allowed to go on for days and weary weeks; the digestion becomes hopelessly destroyed; the abdomen immensely distended with gas; the mesenteric glands swollen and impermeable to chyme; the catarrh and over-secretion of the glandular follicles of the intestine lead to deep ulcerations of the intestinal canal; the diarrhœa becomes also more frequent, serous, mucous, or bloody; the arms and legs of the little sufferer dwindle away; and the countenance becomes emaciated and senile. The scene closes with a consoling certificate from some doctor or druggist, affirming that teething was the cause of death. Thus millions of infants are destroyed by ignorant, prejudiced, and incorrigible advisers. I say incorrigible. I know that mothers will always consult their prejudices first, the prejudices of their neighbors next, perhaps at some late time common sense, and finally they may seek the advice of an educated medical man. I know that a mother who has just consigned a beloved child to the grave will go home with throbbing heart, and repeat the follies which cost her the child she has lost. If you remonstrate with her for neglecting the second, as she did the first, she will reply, Was not the child teething? Would you prevent the child from teething naturally? Is not teething necessary? Was it her fault that the child got teeth with difficulty? The true inference would be that

nature neglected much, and that it was greatly at fault in the matter of dentition. I once read the newspaper announcement of the death of a child, in which the parents, while inviting all their friends and acquaintances to attend the funeral, affirmed that "the Lord hauled the dear child up to heaven by the teeth." Now, in this case, neither the father nor mother was at fault.

I shall not, in this place, proceed to point out the other symptoms of diseases attributed, whether rightly or wrongly, to teething, as the symptoms of cerebral inflammation, of convulsions, of general and local paralysis. At a later period in this course of lectures I shall return to these subjects for practical purposes. It will better answer my design to give you a sketch of what dentition is, anatomically and physiologically, in order to show clearly the normal and abnormal course it may take. I shall thus be able to explain and *limit* the numberless complaints generally attributed to teething. If I can relieve your minds of the impression that dentition destroys the thousands and even tens of thousands of innocent beings who are yearly sacrificed in reality to the prejudices of other times, I shall be abundantly satisfied.

THIRTEENTH LECTURE

It has been the object of my lectures to prove that dentition is neither a disease nor a direct cause of diseases, except in very rare cases. I believe I have shown that all those diseases of the cutaneous, circulatory, respiratory, and nervous organs, generally attributed to dentition, are in no, or very loose, connexion with the physiological process of teething; that further, pathological occurrences cannot, in themselves, be accounted for by a simple and undisturbed physiological process; and finally, that disturbances are very rare indeed. It is, therefore, at least superfluous to more than mention these facts, as they are too fresh in your memory to require more than a mere reference to my former lectures. Now, if dentition is no disease, what right have I to speak of the therapeutics of dentition? I answer myself, that I have none. The diseases we have reviewed with each other, which were said to depend on

dentition, require a treatment of some kind. But you have learned that their presumed dependency on dentition had not the least influence on their treatment. Thus we cannot even say that dentition, as it has not the slightest effect on the nature of those diseases, the etiology of which may be very complicated, has certainly none on their treatment.

Thus there is no treatment of dentition as such. Whatever treatment has been resorted to, has even in former times been very rarely of a general character. We should have to except from this general remark the common practice of purging by remedial agents such children as would not suffer from diarrhœa during the protusion of a tooth or a group of teeth. But there are a number of local contrivances that have been resorted to, partially for the purpose of curing such diseases as were considered the consequences of dentition; partially, however, for their prevention. Among the latter I comprehend the articles prepared from leather, wood, bone, India-rubber, which are destined to help the little ones in the work or the gradual absorption of the gums, or to relieve whatever annoying sensation they have or are supposed to have. I do not think that they can hurt, at all events I am not afraid of the inflammation which several authors suppose to follow the frequent use of these things. As to other means of alleviating or escaping the sufferings of dentition, every country, both civilized and barbarous, has invented its own; and what the instinct of the people did not furnish, has very frequently been sinned by those who ought to have known, and taught, better. Thus, according to Dr. Magaziner, the inhabitants of the regions around the Caspian Sea fill a quill with metallic mercury, and envelop it in a piece of leather or a woolen rag, in order to influence the secretion of milk in the female breast. Suspended over the chest, it is believed to increase the amount of milk, which it is believed to decrease when the metal is suspended on the back. This popular belief Dr. Smirnoff has attempted to transfer into practice and science on quite a different territory. He applied the same contrivance in cases of " difficult dentition," and succeeded so well that he

instantaneously made his discovery public. Up to this time the world has proved ungrateful. The modern Greeks, as we learn from the communications of Pr. Landerer, of Athens, to the Archives of Pharmacy (Oct. 1851), alleviate difficult dentition, and accelerate the protrusion of teeth, by daily frictions of the gums with the fresh brain of hares. A number of curious facts of a similar nature could be collected, if it was worth while in times where the brains of medical persons are still overtaxed to excel by some unexpectedly clever invention of their own. I have availed myself of some former opportunity to speak to you of Dr. Delabarre's Dentition Syrup, by which not only the tickling sensation of the gums of teething children is removed, but at the same time the immense number of diseases following this tickling sensation are prevented. It ranks with the numerous nostrums of the newspaper advertisements, and will, I hope, be forgotten with them.

Of the treatment of such diseases as have been believed to depend on dentition, I have spoken at different occasions, at the same time when I took some pains to elucidate their etiology; the measures for the purpose of preventing disease, by protecting the infantile organs, and by a proper diet, further, the measures for securing easy dentition, by securing general health, have repeatedly been the subject of our conversation. There is, however, one of the numerous means used for the purpose of alleviating dentition and curing dental diseases, on which I feel both bound and inclined to make a few remarks, viz., scarifications of the gums for the purpose of allowing a more rapid protrusion of a tooth, and thus affording protection or recovery from dangerous dental maladies.

Scarification of the gums has been practised for hundreds of years. Ambrose Paré lanced the gums of his own children. Harris, Van Swieten, and others practised the same operation, but never before the gum would be stretched and prominent over the tooth, leaving its alveolus. They were of the opinion that the premature performance of the operation would be followed by a cicatrix of so solid a character that at a later time the tooth would find serious difficulties in piercing the gums. Benjamin Bell, how-

ever, and Richter, assert that deferring the operation until the period mentioned renders it entirely unnecessary; for the derangements following difficult dentition are perceptible before the piercing of the gums; therefore the gums must be lanced early in order to encounter the dangers of difficult dentition; if the incision were made prematurely, it might be repeated. Richter, moreover, believes the usefulness of lancing the gums to consist in the hæmorrhage produced by this operation. Others advise to delay its performance until other means to check or remove morbid symptoms have failed. Girtanner praises it as the safeguard of many children who would have been lost without it; Camus, however, declares it to be both useless and injurious; he also doubts if the convulsions so generally attributed to the influence of difficult dentition really depend on the presumed cause.

The methods of the operation that have been recommended are just as various as the opinions concerning its value. One makes a single transverse incision, the other, a cross incision; others act in the former manner over the incisors, in the latter, before the appearance of the molars. Boyer removes the whole portion of the gum as far as it covers the tooth, attempting in this manner to avoid the rapid reparative process generally following the operation, which is of such power and rapidity that Hunter was compelled to scarify ten times for the very same tooth. Again, others report that a single transverse incision is sufficient to remove very severe symptoms. This observation has particularly been made in cases of convulsions, which sometimes would not return after a sufficient incision. Mombert urges this fact, but at the same time advises not to lance the gum before the tooth is really ready to pierce it. His reason for this advice is the solidity of the cicatrization. He often repeats the operation, but is averse to cutting to any depth. In his opinion it becomes but rarely necessary for the incisors, more frequently for the molars, most often for the canine teeth; because in these the gums, from their pointed and conical form, are still irritated after the sharp crown has commenced penetrating. The incision is to be made without hesitation where, with the presence

of dangerous symptoms, the teeth show their white color through the gums, when these are extended, hot, and swelled, when the infants cry constantly, where soothing applications to the gums have been unsuccessful (such a soothing application is said to be: mel. rosar. ℥ ij; succ. citr. ℥ j; aq. amygdal. amar. ℈ ij), and where the general symptoms have not given way to the generally known remedies. If the symptoms are no less after the incision, or return after hours or days, the operation must be repeated; suppuration is very seldom observed. Unless, however, a third incision removes the morbid symptoms, there must be other causes for them. Thus, the author makes incisions where the symptoms were not removed by the generally known remedies; and where incisions will not help, he concludes that dentition is not the cause of the symptoms, and probably returns to his "generally known remedies." What they are is not known to us. A curious manner both of diagnosticating the nature of an ailment, and of curing it.

The most emphatic eulogizer of the scarification of the gums is Marshall Hall. I cannot do him more justice, nor prove more impartial, than by quoting his very words. He says:

"There is no practical fact, of the truth and value of which I am more satisfied, than that of the effect and efficacy of scarification of the gums in infants, and not in infants only, but in children. But the prevailing, I may say the universal, idea on this subject is, that we should lance the gums only when the teeth are ready to pierce through them, and only at the most prominent part of the gums, and as the occasion to which I have referred may require; and no idea of this important measure can be more inadequate to its real value. The process of teething is one of augmented arterial action and of vascular action generally, but it is also one of augmented nervous action; for formation, like nutrition, secretion, etc., generally, is always a nervo-vascular action; and of this the case in question is, from its peculiar rapidity, one of the most energetic. Like other physiological processes, it is apt to become, from that very character of energy, pathological,

or of morbid activity. It is obviously, then, attended with extreme suffering to the little patient; the brain is irritable, and the child is restless and cross; the gums are tumid and heated; there is fever, an affection of the general vascular system, and there are, too, frequently convulsions of various degrees and kinds, manifested in the muscles which move the eyeball, the thumb and finger, the toe, the larynx, the parietes of the respiratory cavities; and the limbs and frame in general, affections of the excito-motor part of the nervous system, and of the secretion of the liver, kidneys, and intestines, affections of the ganglionic division of that system.

"It is to the base of the gums, not to their apex merely, that the scarification should be applied. The most marked case in which I have observed the instant good effect of scarification, was one in which all the teeth had pierced the gums. Better scarify the gums one hundred times unnecessarily, than allow the accession of one fit of convulsions from the neglect of this operation, which is equally important in its results, and trifling in its character. And it is not merely the prominent and tense gums over the edges of the teeth which should be divided; the gums, or rather the blood-vessels, immediately over the very nerves of the teeth, should be scarified and divided. Now, while there is fever or restlessness, or tendency to spasm, or convulsion, this local bloodletting should be repeated daily, and in urgent cases even twice a day. A skillful person does it in a minute, and in a minute often prevents a serious attack; an attack which may cripple the mind, or the limbs, or even take the life of the little patient, if frequently repeated. There is, in fact, no comparison between the means and the end; the one is trifling, and the other so momentous.

"There is a phrase among nurses, viz., the breeding of teeth, which may be taken as evidence that *before* the teeth actually reach the borders of the gums, they may prove the source of much irritation."

Where "a phrase among nurses" is taken as "evidence," or where every case of convulsions is attributed to the process of dentition, because now and then a fit will occur in consequence of some irregularity in the protrusion of a

tooth, we may have to expect such practice as recommended in the quotations you have just been listening to. It is true that a simple incision into the gums is generally not at all a dangerous thing, but to repeat the same operation to such an extent, to again and again divide the gums, appears both cruel and absurd. Moreover, Marshall Hall's own countrymen report cases of scarification of the gums made after his fashion, after which copious hæmorrhages, suppurations, and ulcerations would take place. Not to speak of the fact, that all authors recommending frequent scarification were at the same time opposed to repeating it too frequently in rhachitic and scrofulous infants; but you know, that just these are the very ones who are most subject to the symptoms of what they call difficult dentition. Not to speak of the further fact, that both the practice of lancing the gums where you wish to avoid the trouble of making a diagnosis, and stopping to lance when you see no success, and therefore suspect some other cause of the morbid symptom, is unscientific and unworthy. Marshall Hall affirms never to have lost a child from difficult dentition—the greatest recommendation for his surgical cure of both difficult and easy dentition. I may state the same result of my own practice among teething infants, viz., that although I hardly make more than ten or twelve scarifications of gums in the course of a year, I have also never lost a case from " difficult dentition."

I see very few indications for the lancet during the period of dentition. You may cut where the gums are an impediment to the protrusion of a tooth or where the gums themselves are the seat of a disease giving rise to general symptoms, especially of the nervous system. Thus, inflammation of the gums justifies an incision, for the sake of relieving the tension of the tissue; the same practice is followed in inflammations of the tongue, of the fingers, etc. Even mild cases in very irritable children may be treated in the same manner. But the incision itself, especially when repeated, may be a cause of irritation, sometimes visible in the fact that during the prevalence of follicular or other stomatitis the gums will be found covered with superficial ulcerations. I need not

add, that while exudative processes, such as diphtheria, are active in the system, every wound of this description will give rise to new diphtheritic deposits. I, then, scarify the gum in cases of intense local hyperæmia and in inflammation: these are the cases in which the loss of a few drops of blood, which have no effect on either the healthy or the diseased system in general, is decidedly advantageous. I should scarify, and have done so, several times during my practice, in cases of convulsions in tender, delicate, irritable patients, in whom I found the gums swollen, and where a correct diagnosis could not be made instantaneously; especially in such as had been once relieved by the same operation; for I must confess that once or twice in my life, not oftener, I have observed the instant termination of an attack of convulsions after I lanced the gums. But always be sure that the tooth is near the surface. I know that new cicatrices will easily tear, but old ones will not; and I have seen real trouble arising from teeth that had been cut weeks before they were ready to pierce the gums; if you mean to call it a piercing, for under normal circumstances the process is one of slow absorption of the gum. I have known cases in which practitioners had lanced the gums two or three months before the final appearance of the tooth, a practice which is annoying, or useless, or dangerous to the child, and certainly not indicative of much diagnostical power and therapeutical knowledge in the doctor. It is not even uncommon to find a retardation of the protrusion of a tooth where you expected its daily appearance. A child becomes sick, with the symptoms of fever, and some local symptoms which you will or will not diagnosticate, according to your accomplishments as a diagnostician. You lance the gums, and expect not only the appearance of the tooth, but also a termination of the untoward symptoms. Nothing of the kind occurs. To the contrary, the child gets thinner and sicker, and no tooth. Where the system is intensely suffering, where emaciation takes place and nutrition is interfered with, it is but natural that the growth of a tooth should also stop. In such cases you may safely predict that no tooth will appear before the child will

get well, or at least better. During convalescence the tooth cuts. You say that it made its appearance after the organism had been sufficiently restored to allow of phosphate of lime being spared for the building of teeth; the mother says, that because the child was well when the tooth came and was through, the child suffered from its tooth. You say, the child cut a tooth, after it was well enough. She says, it got well after it cut a tooth. Certainly there are difficulties in teething, but often during, not from.

In one of my first lectures I have spoken of the direct injury done to the tooth by incisions. The consistency of the tooth is the less the younger the child; and that harm is done to a tooth by the effect of a hard and sharp instrument cannot be denied. If you expect to effect anything by an incision, you must be sure of dividing it down to the tooth. But you can scarcely avoid injuring the tooth in cutting down upon it. If this danger exists, and it does exist, it is the more to be feared from those often-repeated scarifications recommended by Marshall Hall and others. Thus while your incisions are of no use in the present, they are positively injurious to the future. There is something absurd and unworthy of the high standing of our profession in performing any, though slight, operation, which is useless; but it is a revolting thought to perform one that is worse than useless, viz., injurious. It is unworthy of the high vocation of our profession to resort to an action which gives the impression to the relations of the little sufferer, that not only something has been done, but that the right thing has been done, and which, nevertheless, is destined, in most cases, to cover the want of a diagnosis, and the ignorance regarding the causes of the disease. The language of disease in infantile life is intelligible enough. It is your province to listen to it, and to understand it.

FUNCTIONAL AND ORGANIC HEART MURMURS IN INFANCY AND IN CHILDHOOD

I ASK your permission to utilize the time afforded me for a presidential address by discussing a few points connected with cardiac murmurs, both functional and organic, mainly in infancy and in childhood. In the last volume of the Transactions of our Association, I published a paper on functional cardiac murmurs. I avail myself of this opportunity to again return to the same subject with a single contribution which I think of some importance. On that occasion I quoted a remark of mine of the year 1888 (*Brooklyn Medical Journal,* March) which reads: "The heart (of the infant) exhibits functional murmurs but rarely. Whenever there are murmurs present in the infant, it is safe to attribute them to organic disease rather than to mere functional disorder." The last few years have produced many contributions to the same subject, particularly in Germany. Two authors of eminence, Hochsinger and Soltmann, deny absolutely the occurrence in the first three years of life of functional murmurs. The persistent discussion of these statements, both in societies and in the journals, have, however, brought out a few instances of a murmur in the very young that may well be taken as functional. One of them I quoted last year. After all, it appears undeniable that even a single case contradicting the categoric dicta of the two eminent works is capable of shedding light on a difficult topic.

Helen D. (colored), thirteen months of age, rachitic, was admitted to the "Jacobi Ward" of Roosevelt Hospital March 19th, with pneumonia and some pus cells in the urine. The last physical signs of pneumonia disappeared about April 6th; on the 10th there was some vaginal discharge but no gonococci were found. It disappeared after

a few days. All this time there were marked remissions in her high temperature, the thermometer showing 105° F. and more in the evening, and less than 101° F., down to 99° F., in the morning. Plasmodia were not found in spite of renewed examinations which were made before quinine was administered. Large doses of the latter were then given daily up to 10 grains a day, also subcutaneous injections during the remission. Careful search for pus everywhere was negative. On April 10th a systolic murmur was heard which gradually increased and fortified the diagnosis of septico-pyeluria. Then, while quinine was continued, Credé's ointment, 1 gram daily, was used; within a day the temperature fell to 102° F. in place of 105° F., and the child appeared comfortable for some days, smiled and took food. At no time could pus be discovered. There was no dullness, and respiration had become normal with absence of any physical changes or symptoms. The murmurs grew less and could not be found on April 17th, nor afterward at any time. About the same time the temperature rose again and exhibited the same steep curves of previous weeks. The infant was evidently sinking and could not be examined closely during the last six days of her life. She died on the 23d. The autopsy revealed a recent suppurative pleurisy of the right side, surely a few days old only, and absolutely no other abscess or ulceration. The cause of the pyemic fever is unknown to me. But the subject of greatest interest to me was the heart. Here was an infant with sepsis, with a marked systolic murmur that took a few days to become quite loud; then it gradually diminished and was absolutely lost during the last six days of life. A close examination of the heart by the pathologist of Roosevelt Hospital, one of the gentlemen connected with the Pathological Department of Columbia University, revealed positively nothing abnormal in the heart. So here was a functional mitral murmur in a baby of thirteen months of age.

Neither it nor an organic murmur should, however, be mistaken for extracardial murmurs. I have seen that error committed. Extracardial murmurs in children, mostly

systolic, are very infrequent in infants below two years, because at that early time the heart is larger in proportion and less covered by the lungs. When these grow, however, and in the presence of a tumor or of adhesions between the pleura and the pericardium, the murmur appears, soft or grating; is mostly heard anteriorly only; is arhythmic, not synchronous with the contraction of the heart; is strong in deep inspiration; disappears when there is no breathing, and is less audible in a recumbent than in an erect posture.

Hochsinger terms extracardial those murmurs which are now and then observed in grave anemia, mainly leucocythemia, and not infrequently with rachitic deformities of the heart. It will not do, however, to be overconsistent. In grave anemia we might well think of the myocardial structure-changes which result in irregular contraction; and in rachitis the more extensive contact of the heart with the ill-shaped chest annoys the heart-muscle sufficiently to impede symmetrical contraction.

If murmurs mean organic valvular disease in most cases, the latter does not necessitate the presence of a murmur. Mitral stenosis need have no murmurs at all. Osler long ago emphasized the fact that ulcerous endocarditis may not exhibit any murmur, and that the diagnosis of the condition is thereby rendered difficult. I have seen proofs of that statement in autopsies. When the deposits take place at the insertion and not at the edge of the valves, there is, or need be, no murmur. Two months ago I lost a child two years of age who was under close observation six weeks for pneumonia, endocarditis, and, finally, meningitis, of which he died. This endocarditis was diagnosticated by the usual symptoms and was marked by a loud systolic mitral murmur. The patient was in a fair way to recover from his endocarditis (pneumonia having disappeared before the heart was affected), when meningitis developed. During that recovery the murmur became gradually less from day to day until it disappeared entirely. There was certainly an apparently complete recovery from endocarditis. The specimen which I shall exhibit to you before the end of the session shows still a

slight thickening of the edge of the mitral valve and isolated small thickenings at a little distance. But for these findings the murmur might have been classed as functional; as it is, there is merely a proof that a partial, probably also a complete, recovery from endocarditis may take place. That happens, perhaps, more frequently in the very young than in advanced years. For although endocarditis is very frequent at an early age, valvular lesions are mostly—but mostly only—milder than in the adult, and compensation is easier. Moreover, murmurs are not so apt to be loud because the vessels are relatively wide compared with the heart. At about puberty the relation of the width of the blood-vessels to the volume of the heart is 61 : 290, while in the newly-born it is 20:25, viz., almost identical.

What I said of the possibility of a bona fide recovery from endocarditis is mainly due to the changes I alluded to last year. I spoke of Bouchut's proliferating endocarditis (*endocardite végétante*), called valvular nodes by Albini, blood-cysts by Luschka and Parrot and lately (1898) blood-nodules by Berti. They are small elevations, principally on the lower side of the valves, and give rise to a systolic mitral murmur in the newly-born, which may either last a lifetime or disappear in time with the growth of the organ, or with increasing absorption, or with progressing compensation.

Endocarditis is not always easily diagnosticated. That there may be valvular lesions without a murmur, I think I have shown. However, endocarditis does not necessarily mean valvular lesion, nor does it necessarily imply dilatation and accentuated pulmonary sound; nor is it followed, at least for years, by obstructions and disturbance of compensation, for in the very young the right ventricle is more muscular, expels its contents more readily into the blood-vessels, which are still disproportionately wide, and thus protects the auricles against dilatation. But what endocarditis does accomplish in many innocent-looking cases is through its complication with myocarditis.

Most murmurs mean organic lesions either in the valves or in the myocardium. In that respect all ages are alike.

But there are possibilities in the infant which modify the explanation of the usual observations; and there are conditions in which the diagnosis may be very difficult. For instance, besides the frequent mitral systolic murmurs that result from infectious diseases, most commonly from rheumatic invasion, there are those that originate in contraction, or more or less obliteration of the mitral orifice, or adhesion of the valve. These conditions are not always complicated. There is, for instance, the case of Gerhardt, that of a baby who died at the age of four months. Still, they are very rare, very much more so than in the pulmonary artery, or even in the aorta where some have been noticed and ascribed to syphilis.

In persistence of the ductus arteriosus Botalli there is a loud systolic murmur over the sternal end of the second left intercostal space. It extends upward into the vessels of the neck mainly of the left side and is audible posteriorly in the left interscapular space. It is connected with a characteristic dulness nearly oblong, extending along the left margin of the sternum to the clavicle. Within a few months lately I have seen two cases in which the diagnosis was obvious. But uncertainty may arise when there are complications with valvular anomalies (either rudimentary development or excrescences) or with interauricular communications, or with stenosis or atresia of the aorta or of the pulmonary artery, or with a narrow bicuspid orifice. These complications are more dangerous than the patency of the channel itself, because the number and degree of accompanying conditions, such as extensive murmurs, cyanosis, and hypertrophy of the right ventricle, depend on them. When not so complicated, patency of the duct is compatible with a fairly long life.

In congenital stenosis of the pulmonary artery there is in the sternal part of the second left intercostal space a systolic murmur which is not transmitted into the carotid, except when there is a complication with defects of the ventricular septum. It may be mentioned that the second pulmonary sound is feeble, that there is cyanosis with clubbed fingers and hypertrophy and dilatation of the right ventricle. These are not present when, instead of

stenosis, there is a complete atresia of the artery. In that case the right heart is small or rudimentary.

Absence of the ventricle I have never seen or diagnosticated unless complicated with stenosis of the pulmonary artery. In these latter cases there is a loud murmur over the sternum which extends far down and upward into the vessels of the neck. The secondary pulmonary sound is accentuated only when there is a hypertrophy of the right ventricle; when both ventricles are hypertrophied the second aortic and pulmonary sounds are of equal strength. The frequent statements in the books that pulmonary stenosis with defect of the septum is characterized by hypertrophy of the heart, I cannot verify. On the contrary, the absence of much hypertrophy I find to be characteristic of that condition; it has led me to a correct diagnosis which I could verify by the autopsy. The record of one such case may be found in the *Archives of Pediatrics* of a number of years ago.

Another class of cyanotic cases owes its origin to an arrest of development of the common arterial trunk which did not separate into the aorta and pulmonary artery. In these cases, contrary to many statements, I found but little hypertrophy or dilatation, sometimes none at all. The loud murmur is heard over the sternum a little to the right and to the left, about the insertion of the second and third ribs; it is very audible posteriorly, but much less than anteriorly.

Very loud murmurs, audible at a distance, without the ear touching the chest, I have heard more in adults than in children, without having an opportunity to make an autopsy. They are always systolic and are mostly attributed to hypertrophy and believed to be muscular only. In a few cases, however, I am certain that no increase of percussion dulness or of cardiac impulse corresponded with the loudness of the tone; so I was inclined to believe that the peculiar phenomenon was due to torn and swinging papillary muscles. Not infrequently the general condition of the patient is vastly better than the formidable noise would appear to suggest.

Organic murmurs, when present, are not always audible.

They may not be heard at all when the heart-beats increase in number. Then the blood-wave is small and the excursion of the valve short. Diminution of temperature, or a few doses of digitalis, therefore, restore a murmur which was temporarily absent; but under ordinary circumstances also, as I said before, an organic murmur may disappear for two reasons, one of which is recovery, the other compensation. I think I proved that the disappearance of a murmur, as, for instance, in Case III. and Case IV., described by Starck in *Arch. f. Kind.*, 1900, p. 200, does not prove it to be functional. Nor is there any reason why an endocarditic thickening should not be absorbed as well as those on other tissues.

A few words only on myocardial changes. About middle-age myocardial changes are mainly caused by everything that gives rise to hypertrophy and dilatation. We find mostly a diffuse increase of the intermuscular connective tissue with atrophy of the muscular tissue which first was hypertrophic. The senile heart is very apt to exhibit hypertrophy and dilatation of a peculiar type. There is atheromatous degeneration of the coronary and the minute nutrient arteries. There is consequently an annoyance or destruction of the lymph interstices and channels in and on the myocardium, and of the two large trunks that carry the myocardial lymph to the mediastinal lobes, and, finally, degeneration of the myocardium resulting in either macroscopic, more or less local, thickening or in atrophy. That is why the contraction of the organ is liable to be irregular, and partial, in instalments, as it were, although there be no accompanying sclerotic alteration of the pericardium, or thickening of the valves and of the endocardium.

What we call debility of the heart is a symptom of a great many different conditions. There is a congenital atrophy which is liable to lead to lipomatosis, there are intoxications by infectious diseases, alcohol, syphilis, malaria, and tuberculosis; nutritive disorders, such as rachitis and scrofula, overexertion and premature schooling with constipation, and subacute and chronic nephritis, one of the most frequent and most frequently overlooked dis-

eases of early infancy. I mention only those causes of myocardial acute, subacute or chronic changes that are most common in the young, but should emphasize that what is called debility or failure at any age is in all the cases so occasioned not functional, but the result of organic lesions. Two most interesting cases of heart debility I found connected with purpura. Only in one could I obtain an autopsy. There were numerous blood-points in the walls of both ventricles and a livid appearance of the muscle.

In infants and children myocarditis is mostly parenchymatous.

Most intense and persistent myocardial changes are found after influenza and after diphtheria; they are most injurious at about puberty—fortunately, however, diphtheria is not so frequent at that age—when the heart is no longer disproportionately strong and large, than in earlier years. Schmalz reports 81 cases of chronic cardiac disorder originating in 500 cases of diphtheria. In some seasons—for instance, in the severe New York epidemics of 1870 and 1874—the proportion was much larger. In many arhythmia and murmurs last for life; they may be modified by a protracted recumbent position during convalescence, and by resorting to absolute rest extending over weeks whenever increased cardiac disturbance is observed. The systolic murmur is *extensive,* but mostly heard in the mitral and pulmonary regions, at the same time that now and then there is an increase of transverse dulness. But more characteristic than the extensive murmur, which often by the absence of localization facilitates the differential diagnosis, is the irregularity of the contraction of the heart. The condition of the heart-muscle changed by myocarditis (parenchymatous or hyperplastic, it makes no difference) is not uniform. Neither a kidney nor the myocardium is equally affected and changed in all its parts. That is why arhythmia is so frequent. No matter how many causes, either in the heart or nerves or distant organs, are charged with causing it, the most frequent cause is chronic myocarditis.

A peculiar form of arhythmia mostly complicated with a murmur is the duplication of one of the heart-sounds.

It is not always easy to distinguish which of the sounds it is that is so affected. Now and then we hear a dactylus— uu, in other cases or at other times an anapestus uu—. The cause of this gallop-rhythm must be either in the myocardium or in the valves. From careful and long observation of individual cases, and from the improvement that rest alone is able to work on the case in regard to the annoying symptoms, there is no doubt in my mind that it is the former. The first sound appears to slit up when the two atrioventricular valves are not working simultaneously, the second, when the aortic and the pulmonary valves do not act together. This lack of synchronicity, however, depends on the lack of muscular myocardial coaptation. A similar symptom may be had in mitral stenosis, particularly after a slight exertion, and in hypertrophy and dilatation of the right ventricle when the valves close in different times.

The gallop-rhythm is a suspicious symptom inasmuch as it proves the exhaustibility of the heart-muscle. I kept the children in bed for months, and a single exertion sufficed to renew or to increase the duplication. Thus, a long rest is required and attention to general hygiene, food in small and digestible quantities, and regulation of the bowels. In most cases iodide of potassium is indicated and strychnine or some other cardiac stimulant. Strychnine should not be feared, because it should not be forgotten that parts of the heart are probably in an intact or nearly intact condition, and permit of stimulation. If that be done carefully, the galloping rhythm ceases to be such a bad omen as some declare it to be.

Clara R. was discharged June 8, 1899, after having been in the hospital for chorea. This returned about the end of January, 1900, she then had pneumonia, from which she recovered. She was readmitted March 3, 1900, with chorea mostly of the right upper extremity, very irregular heart-action, dulness reaching more than one centimeter beyond the right margin of the sternum, while in an erect position, and marked duplication of the second sound at the apex and to the right of it. The impulse was feeble. Radial pulse small. Muscular power generally feeble, with costiveness and at one time incontinence of

urine resulting therefrom. The latter was almost suddenly relieved by increasing the doses of $^1/_{100}$ of a grain of strychnine to $^1/_{50}$ of a grain, three times a day. When her general strength improved and her color brightened, the duplication disappeared gradually; but whenever her condition appeared worse, under the influence of a low barometer, for instance, it would reappear. She was kept in bed and was discharged April 16th without her duplication, and with her heart not reaching beyond the median line of the sternum when in a sitting posture.

This Association fills a place peculiarly its own. Its aims and objects appear sympathetic to every physician who is more than merely an anatomist or pathologist, and better than a mere prescription-writer. The class of philosophic doctors whom Hippocrates calls "godlike" because he says they strive to learn the connection of things, belongs here. The climatic and atmospheric influences of Nature on man, mainly as they affect the human creature through the respiratory and circulatory organs, is the object of your study. That is why there is, and should be, a peculiar incentive to become a member and why the applications for admission were always very numerous, and the roll of the membership has become large. We have been very fortunate in not losing by death any of our members, except Dr. J. C. Mulhall of St. Louis, whose loss we have to deplore.

The danger of swelling the ranks too rapidly is very great indeed. This year, however, we are singularly fortunate in the character and standing of our candidates. In connection with this matter, it is hardly necessary to point to and to emphasize the established policy of the Association to admit only men whose position is established or who through at least a few publications connected with our study have proved their right to apply.

Feeling as I do that the contributions should be spontaneous unless there be a preparation for a set discussion, I felt a few months ago that there might not be a sufficiency of material for your meetings. I was happily mistaken, for there is ample work for you. The American democratic spirit has prevailed again.

TREATMENT OF INFANT DIARRHEA AND DYSENTERY

Of all the deaths in the first year of life forty per cent., in round number, are due to disease of the digestive organs, and half as many to such of the respiratory organs. In the second year, the main cause of death changes completely, for of all the forty-five deaths taking place in that year, but nine are due to digestive, and thirty-six per cent. to respiratory disorders. Thus in the first year, stomach and intestines, in the second, bronchi and lungs, are the sources of high death-rates. The respiratory organs are better protected, usually, in the first year, and the digestive organs treated more improperly. Such infants as survive the first are exposed to the same parental ignorance and carelessness concerning the requirements of the respiratory organs during the second.

Mortality diminishes with every day of advancing life. Every additional hour improves the baby's chances for preservation. Almost one-half of the infants dead before the end of the first year, die before they are one month old. Thus the causes of disease are the more active the earlier they are brought to bear upon the young with their defective vitality.

Two grave conclusions are to be drawn from this fact. The first is, that the diminution of early mortality depends on avoiding diseases of the digestive organs by insisting upon normal alimentation. This is principally important in the first few months. While breast-milk has been shown to lower infant mortality through the whole first year, it does so more in the first few months. Thus, though an infant may not be fed on breast-milk through the whole normal period of nursing, a great gain, indeed, is accomplished by insisting on nursing, though for a limited time, perhaps two months only. There are but few mothers but will be capable of nursing during that brief time, and

none who ought to be spared the accusation of causing ill-health or death to her baby if she refuses to nurse it at least through the first dangerous months. The second conclusion, resulting from many figures, is this, that the dietetic problems and rules for the infant concern the digestive organs mainly, so much so, indeed, that infant dietetics and the dietetics of the infant digestive organs appear nearly identical.

It is true that in this city we meet with a high mortality, even in children of more than a year. The second summer is regarded with awe and fear amounting to superstition. In fact, public opinion looks for a higher mortality in the second than in the first summer. The fallacy of this assumption can be easily corrected by the statistical reports; and the high mortality rate itself could be easily reduced by such parents as would feel convinced that it is external causes which kill their children, and not the natural course of development. The second summer is the period of danger in part only because of the heat of the season, but mainly of the errors in feeding. Conscientious and intelligent families in good circumstances are not apt to lose their infants in their second summer.

Nor is it necessary that here, and on this occasion, I should insist upon the danger incurred by the belief that diarrhea—a pathological condition—is a normal attendant on and a relief of a physiological process such as dentition. This much is certain, that very few, if any, popular beliefs have been more destructive than this, that an intestinal catarrh must be left alone, no matter from what source it originated.

Healthy infants have a normal tendency to loose, liquid, or semi-fluid evacuations from the bowels. The causes lie partly in the condition of the intestinal tract, and partly in the nature of the normal food, viz., breast-milk. The peristaltic movements are very active; the young blood-vessels are very permeable; the transformations of surface cells very rapid; the peripheric nerves are superficial, more so than in the adult, whose mucous membrane and submucous tissue have undergone thickening by both nor-

mal development and morbid processes. In the young infant, the peripheric ends of the nerves are larger in proportion than in the adult, the anterior horns of the nerve centres are more developed than the posterior ones. Thus the greater reflex irritability of the young, particularly in regard to intestinal influences, is easily explained. Besides, the action of the sphincter ani is not quite powerful, the feces are not retained in the colon and rectum, and no time is afforded for the reabsorption of the liquid or dissolved constituents of the feces. Moreover, the frequency of acids, sometimes normal, in the small intestines gives rise to the formation of alkaline salts with purgative properties. Hoppe-Seyler found free acids in the feces of dogs and adults. Wegscheider met them in nurslings who received nothing but mother's milk. An explanation of this occurrence may be this, that the quantity of food is often too large, but it is just as probable that the amount of digestive fluid is too small. For the diastatic effect of the pancreas is limited at that as at any other age.

The nature of breast-milk, even when absolutely normal, is such as to facilitate frequent, large, and fluid evacuations.

First, as to its fat. Careful investigations led Wegscheider to the following important results: *fats are not completely absorbed; one part leaves the intestine in a saponified condition; a second part, as free, fatty acid; a third, as fat in an unchanged condition.*

Where no food is given but mother's milk, which contains fat in proportionately smaller quantities than cow's milk, and finely suspended and easily absorbed, *a good deal of fat is eliminated* without any change.

What has been called detritus in the feces is not all undigested casein, but, on the contrary, it is mostly fat, and very probably remnants of intestinal epithelium. This milk detritus, so-called casein, and mainly consisting of olein, margarin, and stearin, is not soluble in water, acids, or alkalies, but very soluble in alcohol and ether.

Practically this *fact* is of the very greatest importance. Fat is not completely absorbed under the most normal cir-

cumstances. Fat-acids are easily formed, and accumulate to such an extent that they are found in moderate quantities in even the healthiest nurslings. Superabundance of fat-acid is a common derangement of digestion and assimilation, and it impedes the previously normal secretion of other digestive fluids. Thus there is a *plus* of fat, even in the normal food of the nursling, the breast-milk.

The conclusion, then, which I will record here at once, is that we have to be *very careful in the preparation of artificial food. It is almost certain that we give too much fat; it is scarcely ever probable that there is too little.* Therefore the addition of cream is reprehensible, no matter in what shape. Whenever cream and cream mixtures have been recommended, inventors and backers have always made the statement that such mixtures are, "as a rule," well tolerated. It is a doubtful praise, however, that food should be simply well tolerated, "as a rule." The fact alluded to has probably been the cause why Liebig has, in his artificial food, only *forty* per cent. of the fat contained in mother's milk.

Thus in the most normal milk there is more fat than required. Whenever changes set in, the disproportion can be greater yet. For milk is no stable article, its chemical composition permits of a great latitude indeed. Normally it is the result of transformed glandular substance.[1]

The mammary gland is no filter, through which the serum of the blood, or the solutions of salts, or the transformed foods are rendered accessible to the hungry young. The quality and quantity of milk depend upon the development of the gland. Milk is not the product of the action of the cells; it is the transformed cells, the very organ. Thus the nursling is the veriest carnivorous animal. As long as the epithelium has not undergone a total change, the secretion is not milk, but colostrum, with its large globules. The character of the gland influences the milk, much more than food. The latter influences milk only by

[1] Compare "The Influence of Menstruation, Pregnancy, and Medicines on Lactation," in Vol. IV, page 297.

building up the gland, the cells of which receive materials of different kinds, the principal of which is albumen.

In accordance with this, the nature of milk is beautifully illustrated by its chemical composition. Its ashes are tissue ashes, not those of plasma, for they contain much potassa and phosphate of lime, but little chloride of sodium.

In the first period of lactation the glandular transformation is not yet accomplished. The secretion is of a different nature. It requires days to exhibit casein. Until then the protein shows the nature of albumen. At the same time the percentage of butter and salts is very high indeed, both of which explain the *laxative* character of colostrum. No less do macroscopic and microscopic observation convey the impression of its being incomplete. It is yellowish, thickish, the fat globules are large, unequal, sticky, and mixed with epithelium almost unchanged. There is less potassa and more soda than in normal milk, approximating it to the chemical character of plasma. Besides, colostrum of the cow has not unfrequently been found to contain blood and to coagulate when being boiled. Thus colostrum is more like a transudation than a glandular secretion. Such colostrum is not only met with in the first week after confinement, but in disturbances of the general health, in anæmia, fevers, pregnancy, or advanced age of mother or nurse. Also when the gland itself is insufficient, or the woman too young, or slowly convalescent, or neurotic and liable to vasomotor disturbances. The administration of such milk disturbs the health of the infant through the bringing on of gastric or *intestinal catarrh.*

Thus there is no stability in the nature of breast-milk, and very much less in the human than in the animal female, for obvious reasons. Its constituents and effects may even change from hour to hour, from day to day, sometimes it will be milk, sometimes milk with transuded serum.

That a mere transudation should contain all sorts of material circulating in the blood-plasma is evident. Therefore colostrum is apt to transfer to the nursling the liquid constituents of the mother's blood, no matter whether normal or abnormal, beneficial, or injurious, organic or inorganic.

The reports of infants harmed by the mother's opiate, influenced by her taking mercury, belong, therefore, mostly to the earliest period of lactation, or to a period of sickness or debility on the part of the woman. The more normal the mammary secretion the less the danger in this respect. Very few persons, however, are always in undisturbed health.

Thirdly as to sugar. It is abnormally plentiful in colostrum, and in some milks, at times, its percentage is lower than normal. In the former it is purgative, in the latter its absence one of the causes of constipation. Thus the addition of a piece of sugar—which need not be milk-sugar—to breast-milk is apt to heal constipation in the infant. I dissolve it in the smallest possible quantity of water, say a teaspoonful, and let the baby take it before each nursing.

Fourthly as to casein. When present in an abnormally high percentage, it may act in two ways. It will either constipate, particularly as the high percentage of casein and a low one of sugar go hand in hand, mostly—or by remaining undigested, and acting as a local irritant, thereby producing diarrhea. In these cases of diarrhea the stools are mixed with white flocculi, small or large, sometimes in astonishing quantities and for a long period. The treatment of such diarrhea is by no means very simple, unless the breast-milk is changed. When such a change cannot take place, I add oat-meal gruel or barley-water in such a manner, that a few teaspoonfuls of it are administered to the baby before each nursing. I shall return to the consideration of this proceeding.

The natural food of the infant being sometimes a cause of tendency to diarrhea, and of actual diarrhea, the administration of artificial foods must necessarily be inferred to threaten a real danger. Let us examine some of the articles of food mostly used for the young.

Goat's milk ought to be rejected because of its large percentage of fat, not to speak of its odor, which at times is very disagreeable.

Cow's milk contains more butter than human milk. If the latter, as stated above, is not entirely digested, cow's

milk butter will certainly leave even more remnants to encumber the intestinal canal.

The reaction of human milk is alkaline, that of cow's milk rarely to the same degree. It is apt to become acid soon after milking, and has been found to exhibit acid reaction while still in the udder.

But the main difficulty lies in the large percentage and in the nature of the casein of cow's milk.

The casein of cow's milk and the casein of woman's milk are two different substances. When isolated by alcohol, by which both are thrown out of their combinations to a certain extent, the chemical properties are found to differ widely. Thus obtained, cow's casein, when moist, is white; when dry, yellowish. It reddens litmus-paper, and acidulates water, in which it is soluble in the proportion of 1-20. Woman's casein, however, in its moist condition, is yellowish, alkaline, or neutral, and dissolves almost entirely in water, the solution being of neutral reaction. Vierordt and Biedert found the quantity in the two milks to differ, there being less in woman s milk than in cow's milk.

When exposed to artificial gastric juice they also act differently. In a surplus of it woman's casein is dissolved in a short time; cow's casein in twenty-four hours. Mineral acids, lactic acid, acetic acid, tartaric acid, Epsom salts, phosphate of lime in solution, coagulate cow's milk in hard and dense masses; not so human milk. Solutions of both kinds of casein in alkalies show many similar properties; but the sediment produced by the addition of lactic acid can yield essential differences. Thus there is a chemical as well as a physical difference between the two species of casein. Although their relation to artificial gastric juice has not been found to differ to that extent by Dr. C. P. Putnam, of Boston, it is upheld by a number of other observers, and the fact is beyond a doubt that pure cow's milk is very much less digestible than human casein. At all events, it should be so considered, and infants should have only as much casein as proves digestible. One of the alleged means of combating the improper effect of casein is to increase the relative amount of fat by adding it

to the food. It is true that in this way a more proper relation of the two can be obtained, but certainly no more proper relation of the two to the insufficient condition of the infant digestive organs.

Besides, the addition of cream to either casein or fresh milk has something very doubtful about it, as at the time when cream has formed upon milk, by simply allowing it to stand, the formation of lactic acid is going on all the time. At all events, no addition we know of can render cow's casein more digestible than Nature made it, and the only thing which can be obtained by any sort of manipulation of the milk is to make it less injurious. Perhaps, however, the plan upon which Dr. J. Rudisch has acted may recommend itself to the attention of the practitioner. In order to make cow's milk more digestible, he has introduced into my practice a mixture which promises to be of great value in all those cases in which coagulability of the milk is the prominent obstacle to its usefulness. The mixture suggested by him, and used by us up to this time mainly in diseases of adults, such as anæmia, gastric catarrh, ulcer of the stomach, slow convalescence, etc., is the following: to one pint of water, one-half teaspoonful of officinal dilute muriatic acid is to be added. To this mixture add one quart of raw cold milk; mix the two liquids thoroughly and then boil for ten or fifteen minutes. I have found this preparation to be very digestible, and well tolerated by very feeble digestive organs. Not only clinical experience favors this preparation, but direct experiments also. When "liquid pepsine" is added to common milk, coagulation takes place very rapidly, and in thick coherent masses. The same liquid pepsine, when added to the above mixture, produces so slight a coagulation that it can scarcely be observed. The coagula also are small, and do not adhere firmly to each other. Essence of rennet coagulates common milk speedily and completely; the above mixture more slowly and not so completely. The coagulation of common milk exhibits, after a certain time, thick, dense, and firmly coherent masses. The coagula produced by the above mixture are fine, loose, and are easily separated when the liquid is shaken.

Valuable as this preparation of cow's milk may prove in future, there is one method for making cow's milk more available, which is at once simple and effective. No cow's milk ought to be administered without the addition of chloride of sodium. Not only cow's milk, but also—and even much more so—farinaceous admixtures to cow's milk require its presence in the food.

The method of preparing condensed milk with the admixture of such great quantities of sugar as to yield from thirty-nine to forty-eight per cent. of sugar in its solid ingredients is a well-known process. With regard to this preparation, Kehrer says that when sufficiently diluted it readily induces the formation of lactic acid, and that delicate children will not thrive on it. In such cases he deems it necessary to add barley-water or oat-meal gruel as well as antacids. Fleischmann also accuses it of causing a predisposition to thrush and diarrhea. He lays stress upon the fact that, even when it has been properly diluted, the proportion of the protein compounds to the carbohydrates is diminished, and thereby its nutritive value impaired. My own experience with condensed milk, which has been rather extensive, even though to the proper degree, it is apt to be followed by disagreeable results; although the influence of the large amount of sugar does not operate in the manner as above alleged. For the sugar which is added to condensed milk is not the easily decomposed milk-sugar. Yet catarrh of the stomach and bowels is a frequent result of its use. I have seen few children enjoy undisturbed health who were fed exclusively upon condensed milk. Those, however, who take it mixed with a certain proportion of barley-water, either regularly, as I recommend, or in cases of temporary necessity, as advised by Kehrer, thrive quite well. I cannot say that I have been able to discover any material difference, whether condensed milk, or good ordinary city milk, was given in this way. But it should not be forgotten that barley-water is a more desirable addition to the mixture than oat-meal gruel, because of the laxative effect which the latter may have. If the condensed milk be given in this way, we need not fear a repetition of Daly's experiences. He found that children

took condensed milk readily, and grew fat; but in case they fell sick, they showed but slight endurance; they began to walk late; their fontanelles were slow in closing, and other signs of rhachitis showed themselves.

The preventive treatment of diarrhea, depending on defective alimentation, consists in so changing and arranging the milk used for babies that the casein will not coagulate in large lumps, and thus become more digestible. That object can be obtained by adding such farinaceous food as does not contain much starch. Some little starch is digested from the first days of life, the parotid having diastatic effect; in a few months after birth such vegetables as contain starch in moderate, but not overwhelming percentage, may be used as additional infant food. Still, it is not absolutely necessary that every particle of ingesta should, in all instances, be digested and assimilated. That is impossible; the very breast-milk contains such amounts of fat that it cannot all be digested and absorbed. The requirement is only that not enough should remain undigested to encumber and irritate the intestinal tract.

The principle on which I base the theory of this treatment is simple enough. It has appeared in previous papers of mine, and also been published by a former clinical assistant of mine, in the *Journal of Obstetrics*, a number of years ago. It consists in diluting the boiled and skimmed milk with barley-water or oat-meal gruel. It must be boiled to check its tendency to become sour, to remove a portion, though small, of its casein and fat, and to expel the gas contained in the raw milk to the amount of three per cent.

Of the two, as may be known, I prefer barley for general use.

The prepared commercial barley is characterized by its fineness and whiteness. But these qualities are suspicious characteristics; the less the quantity of the yellowish outer layers of the barley, the less is it to be recommended. The prices of the grain, though low, vary in such a manner that adulteration by refining pays very well. I would, therefore, recommend that the barley-corn which is employed for infant diet should be ground as thoroughly

as possible in a coffee-mill, both in order to diminish the period necessary for cooking it, and also in order to retain the gluten. *It is even preferable, for very young infants, to cook the barley whole for hours,* thereby to burst the outer layers of cells, empty their contents, and then, by straining, to get rid of the larger part of the starch which is found toward the centre. The next best method consists in crushing the whole grains of barley, and not to employ the so-called pearl barley, which is barley minus husk. At a more advanced period of life the latter preparation, with its greater amount of starch, will suffice, however, because oat-meal, on account of its larger percentage of fat and mucin, is more liable to relax the bowels. In other respects the chemical composition of the two is so nearly alike that it would be immaterial whether we choose one or the other.

But there is no danger to which little children are so liable as that which arises from their tendency to diarrhea. My advice, therefore, is to administer barley to children who manifest a tendency to diarrhea, and oat-meal to those having a tendency to constipation, and, whenever a change occurs in the intestinal functions, to give one or the other, according as constipation or diarrhea predominates.

I hold this mixture to be the *conditio sine quâ non* of the thorough digestion of the milk. It, only, will insure the proper nourishment of the infant. With this food alone I have seen children endure the heat of summer without any attack of illness whatever. It is because I am so deeply convinced of its importance that I return to the subject here. In this climate, so perilous to infant health, where severe derangements of digestion belong to the most common of the daily experiences of the practitioner, I have had occasion again and again to be convinced of the reliability of my mixture. It has this advantage, too, that it necessitates no dependence upon the honesty or competence of the apothecary or manufacturer, but this mixture can be prepared by any one, however poorly situated. I conceived it to be necessary to discover a kind of food, suitable to the infantile age, which *could not be spoiled through ignorance and fraud, nor be liable to have its price*

enhanced by trade dealers. All of these indications have been fully met in the preparation which I have described.

The object I desire to attain is to insure a slow action of the gastric juice, or of the excess of acid in the stomach upon the casein of the milk, and this object I attain under all circumstances. Should a slight diarrhea occur, or a little casein be vomited (a rare accident, to be sure), or casein occur in the stools, then all that is necessary is to diminish the proportion of milk. It may sometimes be necessary, though very seldom, to withdraw the milk entirely for a time, but only in cases of real illness. If the physician or attendants have properly apportioned the ingredients of the mixture, we may be rather sure that the child's digestion and assimilation will be regular and normal. Infants that are partly nourished at the breast almost invariably thrive well with the addition of my mixture. Children, from their fourth or fifth month and upward, may often be fed with it exclusively, and not unfrequently nothing else is given from the day of the birth. I can positively affirm that in all these cases assimilation and increase in weight have proceeded quite normally. Altogether, the brief form in which I laid down the above principles, years ago, and in which they have been published several summers by the New York Health Board (See Infant Diet, 2d Ed., 1876, p. 118) for the benefit of the general public, rich and poor, has always been found satisfactory.

The addition of barley or oat-meal for the purpose of rendering milk digestible is not, however, absolutely indispensable, though I have learned to prefer them. For gum-arabic and gelatine are also very valuable ingredients, indeed, of infant foods.

As far as the former is concerned, Frerichs, Lehmann, and Husemann did not admit its undergoing any change in the human body. Gorup-Besanez believes in its solubility, but not in its digestibility; hence if, in his opinion, gum-arabic is an important aid in digestion, it is so for one reason only, namely, that it acts mechanically, and renders the coagulation of milk less dense. Of late, however, Uffelmann has made some experiments with a solution of gum-arabic of the strength of *eighteen* parts of the gum to

two hundred of water. His experiments were made upon a boy upon whom gastrotomy had been performed, thus affording opportunity for making direct observations. When he introduced this solution into the boy's stomach, he found grape-sugar after some time, no saliva being present. The same transformation has been observed in the Munich laboratory.

Fifteen grammes of the above solution yielded *five* centigrammes of grape-sugar after forty-five minutes; *thirty* grammes gave *twenty-eight* centigrammes after *sixty* minutes. The liquid taken from the stomach in the latter case was very acid indeed. It matters not whether this acid was inside the stomach previously, or was developed during the presence of the gum-arabic solution; in both instances it appears that the development of muriatic acid and the transformation into grape-sugar go hand in hand. It is possible, then, that it will be found practical, in those cases in which the object is not simply to mix milk with gum-arabic, but also to derive benefit from the digestion of the gum, to add a small quantity of muriatic acid.

Gelatine, in the opinion of many, when combined with milk, fulfills two indications. The one is the same as that obtained by the mechanical effect of gum-arabic and farinaceous articles; the other is found in its usefulness as a tissue-building material. Guérard quotes Jean de Lery, who speaks as follows: "Ayant expérimenté que cela (skins, parchemin) vaut au besoin, tant que j'aurais des collets de buffles, habits de chamois, et telles choses où il y a suc et humidité, si j'estois enfermé dans une place pour une bonne cause, je ne me voudrois pas rendre pour crainte de la famine." Papin is reported to have made the offer to Charles II. of England to furnish for the use of poor-houses and hospitals "un quintal et demi de gelée" with "onze livres de charbon." This offer was refused because a dog was paraded before Charles wearing a sign-board containing said dog's request not to be deprived of his mess of bones.

The French Academy of Medicine has taken great pains to discover the properties of gelatine. After Magendie in 1848, Vrolik in 1844, Bérard in 1850, and Edwards and

Balzac, had published their reports upon the subject, Guérard comes to the following conclusions: 1. That gelatine is very nutritious; 2. That very probably it is of great importance in the process of building up cellular tissue, therefore absolutely necessary for the preservation of life. Frerichs, Metzger and De Barry, Schroeder, Kuehne, and Etzinger, found that gastric juice changes gelatine in such a manner that it loses the property of gelatinizing. This effect was not produced when it was treated with muriatic acid only. On the other hand, Imthurn also attributes the effect to the influence of muriatic acid. It is true that Meissner and Kirchner have entirely denied the changeability of gelatine by means of gastric juice. But Gorup-Besanez is of the opinion that gelatine is peptonized in a manner similar to the albuminates. It seems that Uffelmann has also settled this question. He found, in the gastrotomized boy, *first*, that while he was feverish, and again without fever, the gelatine was speedily dissolved in the gastric juice. It was so modified at the end of one hour that it would no longer coagulate, and was easily diffused. To produce this change by means of artificial gastric juice, he found, however, that from eighteen to twenty-four hours were necessary, and in both instances there was no offensive odor. When the experiment was performed within the stomach, he occasionally observed the presence of grape-sugar. When that occurred, the temperature of the body was elevated. No grape-sugar was ever found when the gelatine was exposed to the action of artificial gastric juice. Gelatine digested in gastric juice retains its essential chemical properties. It resembles peptone, inasmuch as it is not precipitated by acids. It differs from peptone, inasmuch as its diffusibility is less, and, when dissolved in acetic acid, it can be precipitated by ferrocyanide of potassium. It is so much like peptone that its digestibility can hardly be doubted, not to speak of the direct observations made by Uffelmann. There is one point, however, not to be lost sight of, viz., that it is apt to putrefy, and therefore requires the addition of a small quantity of muriatic acid. The latter point is of great practical importance; for, in acute diseases, in slow

convalescence, in anæmia, the secretion of pepsine and muriatic acid is very much limited. For that reason muriatic acid should be added whenever gelatine is administered.

When it is to be mixed with milk, in such cases, the plan as recommended by Dr. Rudisch, and specified above, will perhaps be found most useful.

Curative Treatment.—So far as nutriment is concerned, the amount of food should not be larger than we have reason to expect can be easily digested. At all events, either lengthen the intervals between the meals or reduce the quantity of food given at one time, or both. When diarrhea makes its appearance in infants who have been weaned, it is desirable to return them to the breast. Those who never had breast-milk may be given the breast if they can be induced to take it, but only rarely will this be found possible. Whenever a child at the breast is taken with diarrhea, the passages from the bowels should be studied as to their contents. If a certain amount of curd is found in them, the least that is to be done is to mix the breast-milk with barley-water. This may be done in such a manner that, each time before nursing, one or two teaspoonfuls of barley-water is given the child, so that the farinaceous food and the breast-milk will mix in the stomach. Or, it may be found advisable to alternate breast-milk and barley-water. In bad cases, particularly when the milk is found to be white and heavy and contains a great deal of casein, it will be found necessary to deprive the child *altogether* of its usual food. In such cases, the child will do better on barley-water alone (this to be continued for one or two days), than to expose it to the injury which will certainly follow the continuation of the casein food.

When diarrhea occurs in children who have been fed alone upon cow's milk, unmixed or mixed, it is necessary to reduce the quantity of cow's milk in the mixture. As a rule, we have to remember that cow's milk alone is apt to produce diarrhea, and it should be considered as a maxim that, whenever diarrhea makes its appearance, the amount of cow's milk given to the child should be reduced. When a mere reduction of the quantity does not suffice, it is very much better to deprive the child of milk food altogether.

Not infrequently the removal of milk from the bill of fare is the only thing which will restore the child to health. It is possible that a mixture, such as recommended by Dr. Rudisch, of which I have spoken before, will be found digestible, even in such cases. My experience, however, is not sufficient to decide that point. In many cases, as a dietetic measure, it will be found advisable to add one or two tablespoonfuls of lime-water to each bottle of food with which the child is supplied.

In those cases in which barley-water does not seem to suffice as a nutriment, or where it would be dangerous to allow children to lose strength, a mixture which I have used to great advantage is the following: Mix the white of one egg with four or six ounces of barley-water, and add a small quantity of table-salt and sugar, just sufficient to make the mixture palatable. The child can take this either in large or small quantities, according to the cases.

In such cases in which the stomach is irritable and vomiting has occurred, it is now and then better to give a small quantity, even one or two teaspoonfuls, and repeat the dose every ten, fifteen, or twenty minutes, than to give larger quantities at longer intervals.

In those in which the strength of the child has suffered greatly, it is necessary to add brandy to the mixture in such quantity that the child will take from one drachm to one ounce (grammes 4.0 to 30.0), more or less, in the course of twenty-four hours.

In those extreme cases in which the intestinal catarrh is complicated with gastric catarrh, where the passages are numerous and copious, and vomiting constant, where both medicines and food are rejected, there is frequently but one way to save the patients, and that is to deprive them *absolutely* of everything in the form of either drink or food or medicine. It is true that such babies will suffer greatly from thirst for an hour or two, but it is a fact that, after two or three hours, these children will look better than before the abstemious treatment was commenced. Not infrequently four or five hours of total abstinence will suffice to quiet the stomach and diminish both the secretion and the peristaltic movement of the intestinal tract. In some

cases *six* or *eight* hours of complete abstinence will be required; or such children may be starved for even *twelve* or *sixteen* hours, with final good results. The first meals afterwards must be quite small, and they will be retained, and, as a rule, such children will subsequently do well.

I need not say here that, in addition to the dietetics for the digestive organs, it is necessary to supply the patient with as much cool, fresh air as possible. The worst outdoor air, when cooler, is better than close in-door air. The undeveloped condition of the nerve-centre in the normal infant, the relaxation of the inhibitory nerves by heat, the absence of radiation from the surface, the lacking stimulus —during hot weather—of the cutaneous sensitive nerves, the diminished metamorphosis of tissue, the diminution of the powers of digestion, not only by shortening nutrition, but by directly lowering the secreting powers of digestive glands in the stomach and intestines, are just as many factors in the production of the very worst forms of infant diarrhea.[2] I have kept very bad, desperate cases out all night upon the bluffs over the East River. The windows must not be closed. If possible, the children should be sent immediately to the country and into the mountain air.

The second indication consists in the removal of undigested masses retained in the intestinal tract. Not only in cases in which the diarrhea has resulted from previous errors in diet of the child, but also in those cases dependent upon sudden changes of temperature and exposure, it is desirable to empty the intestinal tract of its ballast. For that purpose castor oil, calcined magnesia, or calomel may be used. So far as the latter is concerned, the discrepancy of opinion with regard to its efficiency will probably be found to depend upon the variation in the size of the doses recommended by different authors. When a purgative effect is desired it should not be given in small doses, and, according to age, from *two* to *six* (0.1-0.4) grains should be administered.

[2] Compare: "Infant Diet," second ed., 1876, pp. 101-116.

Third. Nothing should be given that contains salts in any sort of concentration. Thus, beef-tea should be avoided. It has come very largely into use in practice among children both in this country and in Great Britain. In Germany, too, it has found very many advocates, and among some who have abandoned the obsolete notion that when prepared in the customary way it contains a large proportion of protein in its composition. It must be remembered that this form of meat-extract contains a very large amount of salts, and that the direct effect of these upon the intestinal canal may be productive of very unpleasant consequences. It is a mistake to give it when the intestines are irritated or very susceptible of irritation, for the reason that diarrhea is apt to directly follow its use. Nevertheless, I have often seen beef-tea given under these very circumstances for no other object than the vain one of furnishing the child with a great amount of nourishing food. This is very commonly done during the obstinate and exhausting diarrhea of summer. If people insist upon giving it, and there is no special contraindication to its use, in a given case, it should be administered only in connection with some well-cooked farinaceous vehicle, and the best of all for this purpose is barley-water; or it may be mixed with beaten white of egg, but no more chloride of sodium should be added. For the main danger in beef-tea is the concentrated form in which its salts are given.

Fourth. Everything should be avoided that increases peristaltic motion. Thus, carbonic acid and ice internally.

Fifth. Avoid whatever threatens to increase the amount of acid in the stomach and intestinal tract. There is so much acid in the normal, and still more in the abnormal stomach and intestinal tract, that it is absolutely necessary to *neutralize* it. For that purpose any alkali, perhaps, will suffice, but it is safer to resort to preparations of calcium than of sodium or magnesium. Soda and magnesia, when introduced into the stomach and duodenum, will find a number of acids and form laxative salts. Frequently I use carbonate of lime; not infrequently phosphate of lime. Both of these will act as antacids, but the latter prepara-

tion is to be preferred in those cases in which free phosphoric acid is deemed of importance for the purpose of facilitating pancreatic digestion.

So far as lime-water is concerned, its administration, certainly, is correct chemically. But we should not place too much reliance upon this popular remedy. We should not forget that it contains about one part of lime to eight hundred of water, and that it is necessary to swallow at least *two* ounces of the fluid in order to obtain a single grain of lime.

A further indication is, *the necessity of destroying ferments.* For that purpose most metallic preparations will do fair service. One of these, that has been extensively used, is *calomel,* and now in *small doses* frequently repeated: $\frac{1}{10}$, $\frac{1}{4}$, or $\frac{1}{2}$ a grain (0.1-0.15-0.03), every *two* or *three* hours. As to its effect as an antifermentative, there can be no doubt. It is very uncertain, however, as to how it produces this effect. It is possible that it acts by a portion of the drug being changed very slowly to the bichloride of mercury, which is known to be a very powerful agent in the prevention of fermentation. It is certain that one portion, at least, of the mercury is used to bind sulphide of hydrogen, which often acts in a poisonous manner. Infants will bear calomel very well, perhaps for the reason that elimination is so much more rapid in them than in adults.

Nitrate of Silver, when given for the same purpose, should be largely diluted. From $\frac{1}{40}$ to $\frac{1}{16}$ of a grain (0.0015-0.004), dissolved in a teaspoonful or tablespoonful of water, may be given every *two* or *three* hours, and not infrequently with fair result. At all events, it does not answer to use a concentrated solution. Whenever it is concentrated, it acts more as a caustic than as an astringent. This remark is especially important with regard to injections of nitrate of silver into the rectum, where it is apt to do as much harm as good. Even a mild solution—one or two grains to the ounce of water ((1 : 500 or 250)—when injected into the rectum is apt to give rise to tenesmus and soreness about the anus; whenever it is to be given in that way, the solution should be mild and largely diluted, or

the anus and its neighborhood should be washed with salt water before the injection is administered.

Bismuth acts very favorably. Moderate cases of diarrhea will usually show its effect very soon. Doses of from ½ to 2 or 3 grains (0.03-0.20), given every *two* or *three* hours will act very favorably indeed. In those cases in which the diarrhea has lasted for a long time, and a large surface of the intestinal tract is certainly implicated, the doses of bismuth should be large in order to be certain of immediate contact of the drug with the sore surface.

A final indication is the depression of the hyperesthesia of the general system and of the intestinal tract in particular. The effect of opium is very probably an anatomical one, and brought about in such a manner that a combination takes place with the nerve plasma. As this is so much softer and succulent in the child than in the adult, the effect is so much stronger. There have been authors who condemned the use of opium altogether, which, certainly, is incorrect. The doses should be small, and they may be repeated frequently. Administered in this manner, opium can be used with perfect safety both internally and in an anæmia. For, when the doses are small, it is possible to stop before an overdose has been given. One of the rules for giving opium is this—the child should not be waked up for the purpose of taking the medicine. Opium does not always act as a depressant, but sometimes as an excitant. This difference in the effects produced by the drug is well known. Very small doses will act as an excitant, while relatively large ones will act as a depressant. The exciting doses will, when accumulated, also show their constipating effect, and whenever there is fear of collapse, it is safer to give $\frac{1}{200}$ of a grain (0.0003) every half-hour or hour, than to administer $\frac{1}{50}$ of a grain (0.0012) every two hours.

Alcohol.—Small and frequent doses will certainly stimulate the nervous system, digestion, and circulation, and they also stimulate the skin and increase perspiration. Alcohol, given in this manner, certainly arrests fermentation. Moreover, it takes the place of food, and will act favorably as food when no solid carbohydrates are toler-

ated by the intestinal tract. As it is absorbed in the stomach, so does it protect the intestinal tract. It has been found that, when only small quantities of milk and pure alcohol and water are given as food, the body increases in weight. But it is absolutely necessary that the alcohol or the alcoholic preparation should be pure. Fusel oil will dilate blood-vessels, produce and increase congestion, and prove dangerous. Where no good brandy or whiskey can be procured, it is better to use alcohol in substance diluted with water.

Finally, it is necessary to reduce the amount of secretion taking place from the surface of the intestinal tract. For that purpose astringents may be used, such as alum, lead, tannic acid, pernitrate of iron, and, what has already been spoken of, nitrate of silver. In all those cases in which the stomach participates in the process to any considerable extent, almost any astringent will prove ineffective. Neither alum nor lead nor tannic acid may do otherwise than irritate the stomach, and it will be necessary to depend altogether upon nitrate of silver, or, better, upon bismuth, for the purpose of meeting *two* indications. To fulfill several indications at the same time, it is often good practice to combine remedies.

The main indications are to neutralize acids, to reduce nervous irritability, to arrest secretion, and to change the condition of the surface of the catarrhal mucous membrane.

For that purpose, in the generality of cases, I combine bismuth, opium, and chalk according to the following formula:

℞ Bismuth subnit.....gr. i. (0.05)
Prepared chalk.....grs. ij. (0.10-0.20)
Dover's powder.....gr. ½ (0.02)

This combination is suitable for a baby *ten* or *twelve* months of age, and the dose can be repeated every two hours. In all those cases in which acid is very abundant, it is necessary to increase the doses of antacids without necessarily giving large doses of opium.

Whenever it is necessary to stimulate, and alcohol alone does not meet the requirements, resort may be had to hot bathing. This is especially serviceable in those cases in which the surface is cool and the temperature of the body, measured in the rectum, is pretty high. A hot bath in which the child may be kept for *two* or *three* minutes will restore some warmth to the surface, dilate blood-vessels, reduce temperature, and act as a nervous stimulant. To relieve intestinal pain, plain warm fomentations; to relieve heat, cold applications are sufficient.

Camphor stimulates the heart, and reduces temperature, and may be used internally or subcutaneously according to the necessities in the case. For subcutaneous injections camphor may be dissolved in either oil or alcohol. The effect derived from camphor as a stimulant is not permanent, but still very much more permanent and steady than that produced by carbonate of ammonia.

The dose may be from $\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.015-0.03) every hour or two, when only a moderate stimulation is required. In urgent cases it may be given in doses of from *five* to *ten* grains (0.3-0.6) in the course of an hour, and usually the effect will be favorable.

It is, however, only in cases in which real collapse is present that doses of five or ten grains will be required, and it may then be administered dissolved in alcohol, and with or without musk.

There is no remedy that will act more favorably in conditions of great debility and collapse—collapse with or without spasmodic symptoms—than *musk*. It is true it is scarce, very frequently spurious, is expensive, and must be given in larger doses than usually recommended. But in cases of collapse, doses of five or ten grains (0.3-0.6) should be given at once, and should be repeated every half-hour or hour. More than two or three such doses will not be required to yield a result.

The dysenteric miasma[3] being unknown, the rules commonly obeyed in the hygienic management of all miasmatic

[3] Compare the author's essay on Dysentery in Gerhardt, Handb. d. Kinder-Krankheiten, Vol. II, 1878.

and infectious diseases are valid in an epidemic of dysentery as well. Streets, water-closets, and sewers must be disinfected effectively, dwellings and hospital wards vacated from time to time, and individuals protected by frequent and careful ablution and the disinfection of clothing. Special care ought to be taken lest many dysenteric patients be admitted to children's or, in fact, all hospitals. Their number ought to be limited when they are admitted to special wards, and smaller than that of typhoid fever patients when received in general hospitals. Dysenteric evacuations are to be disinfected and removed, soiled bed-linen disinfected and washed.

Those in relative health are to give the greatest possible care to their digestive organs. Indigestible food must be avoided rigorously during an epidemic. Vegetables containing a large percentage of cellulose, salads, cabbages must be refused to children of even advanced age, and even ripe fruit ought to be refused as a rule. Even healthy children of three or five years will, now and then, without apparent cause, under normal circumstances pass soft peas or whortleberries, though well prepared, while there is no apparent change along the whole length of their alimentary canals. Animal milk, too, requires great care when given to younger children, nay, common cases of diarrhea require that the amount of milk given them should be rescinded. Cow's milk, when unmixed or mixed with water only, acts in part as an irritant during an epidemic or individual disposition to diarrhea. In regard to that, I have heretofore laid down the rules according to which cow's milk, unless there are positive indications for total abstinence, can be rendered digestible. More: great care ought to be taken lest the physiological constipation resulting from the unusual length of the colon descendens and the doubling and even trebling of the sigmoid flexure should act as a cause of disease. At all events, one or two enemata must be given daily. They are also, and even more so, required where habitual constipation depends upon rhachitical debility of the muscular layers of the intestinal tract. When there is an actual indigestion from either alimentary or atmospheric causes, a purgative is required.

I prefer a single effective dose to small refracted administrations, but no drastic to a child of one or two years. Five or ten grains (0.3-0.6) of calcined magnesia, three or six grains (0.2-0.4) of calomel, with an alkaline addition, one or two teaspoons of castor oil, half a teaspoonful or less of the fluid extract of rhamnus frangula, act both effectively and agreeably. Pain and tenesmus may be prevented by the addition of codein, or extract of opium, both of which have less of the constipating effect of the gum, or by extract of hyoscyamus. I need not add that in times like these the usual care is to be taken of the general health. Woolen or canton flannel undergarments ought to be changed every morning or night, so that they have ample time to get rid of the accumulated moisture. The stockings also ought to be of wool or thick cotton, must cover the entire leg and part of the thigh, and be changed frequently.

When the disease has made its actual appearance, the diet requires great attention. Altogether it would be wrong to force nourishment into a patient whose appetite is impaired and fever high in the very beginning of the disease. But there is hardly another disease in which consumption and emaciation are so rapid by both actual expulsion of substance and nervous exhaustion as in dysentery. Therefore, the little patients ought to be supplied soon with a certain amount of food. Barley-water with milk, or barley-water with milk and the whites of eggs, will suffice for a long time, and will prove digestible; if not, small doses of pepsin with muriatic acid, or lactopeptin, or bismuth, or pancreatin, or milk prepared according to the plan of Dr. Rudisch, will enhance their digestibility. In some cases, broiled or raw beef, in small quantities, but frequent doses, is well tolerated, provided that the stomach and small intestines have not participated in the actual morbid process from the commencement. This happens very often indeed. In every feverish disease, and mainly such of the abdominal organs, saliva is reduced in quantity, and the stomach less liable to digest. Besides, a large tract of mucous membrane is sore or inflamed, and liable to be irritated by passing solids, meat fibre, casein,

cellulose. Whenever the tongue is coated, the region of the stomach irritable, it is best to refuse even raw beef and milk, until the tongue begins to be more normal. Nay, even Leube's beef solution, one of the sheet-anchors during recovery, ought to be dispensed with, except in conditions of great urgency. Beef-tea is contraindicated. I emphasize that fact, as one of the first general advices in the practice of many of us is the administration of beef-tea, in regard to which, I refer to such remarks as I made before. All nourishment ought to be tepid. Ice increases peristaltic motion and gives rise to pain and tenesmus. So do effervescent beverages, Selters, Apollinaris. In mild cases, particularly in the beginning, stimulants, either alcoholic or other, are not required. But I do not share the opinion of such as forbid them absolutely; on the contrary, they will prove both pleasant and effective during the periods of increasing debility and convalescence. In these conditions, from half an ounce to two ounces (15.0-60.0) of brandy or whiskey daily, in small and frequent doses, and largely diluted with mucilaginous or farinaceous fluid, are very salutary, not to speak of the cases of great debility and actual collapse. In such conditions, there is hardly a dose of alcoholic or other stimulants which, where temporarily required, ought to be considered too large. Ten grains of camphor and four ounces of brandy administered to a child of two years in such a condition, during a single hour, I know to have saved its life. It is better for children to take in the course of one day three or six ounces of brandy, ten or twelve grains of camphor, or twenty or thirty grains of musk, than it is for parents to bury them on the next.

The regulation of the surrounding temperature is of great importance, even in the mildest cases. What appears a mild case to-day may be a serious one to-morrow. The temperature of the room need not be above 70° F., but the little patient ought to be in bed and well covered. His linen must be warmed before being put on, changed frequently, the body often washed, particularly the anus; bed-pan and evacuations disinfected, windows opened. The feet have a constant tendency to get cool and ought to be

warmed constantly. One tepid bath at least ought to be taken daily; for no other purpose the patient must leave his bed. Tepid fomentations will alleviate colic, warm injections tenesmus. Of these latter I shall have to say more.

In many mild or moderate cases, this dietetic treatment of an attack of dysentery may suffice, but its effect is not to be relied upon solely, for at any moment medicinal treatment may become urgently indicated. Personally, I almost feel like counting the administration of a mild purgative in the first commencement of a dysenteric attack among the dietetic indications. A copious evacuation from the bowels appears to be an essential aid in procuring a mild course for the incipient morbid process. When, after all, a rapid recovery can no longer be expected, after these dietetic measures, the indications for treatment are plain. The local morbid process is to be inhibited, the peristalsis to be moderated, the irritability of the intestines to be reduced to a minimum, and the morbid products removed both as quickly and gently as possible.

As I said before, I like to begin the treatment with a purgative. Calcined magnesia (with or without some salicylate of soda, according to the condition of the stomach), castor oil with opium, the fluid extract of senna or rhamnus frangula, or from three to eight grains of calomel, to be followed by a dose of Dover's powder. I am well aware of the objections to mercury, and know of but few indications for its administration except in syphilis. Its protracted use, although it is not so apt to give rise to stomatitis as it is in adults, may still prove so deleterious in its effect upon the general system that this application has been greatly rescinded in the last twenty years of my practice. The objection alluded to is, however, more valid in regard to small and frequent doses than to single larger ones, and cannot contradict, therefore, the warm recommendations of calomel on the part of, particularly, English physicians. Still, purgatives are indicated in the *commencement only* of dysentery, not through its whole course, as has been advised in the dysentery of adults. In the latter, accumulations of fœces of old date are not at

all rare, in fact, there are very few adults where they may not be met with. In children the intestines are smaller, the contents more liquid, relaxations and diverticles rare, and accumulations less frequent and less copious. Thus, though adults may require purgatives in the course of a dysenteric attack, children, as a rule, do not require such a repetition. But lately a young friend was, by the advice of a consulting physician, awed into giving a purgative in the third week of a dysentery doing well on bismuth and opium; to some disadvantage. Where, however, an indication appears to arise, the purgative ought to be castor oil or magnesia, no longer calomel or a drastic.

We know of many recommendations of emetics. Their effect was described as revulsive; their general and principally their diaphoretic powers were praised. Still I think that a warm bath and warm beverages, while they are just as effective, are less violent. Ipecacuanha has been recommended more than any other remedy of that class, but not for its emetic effect. On the contrary, McLean, Woodhull, and others insist upon avoiding the nauseating effect. McLean administers a hot bath, and a dose of opium or chloroform. This is followed by a dose of twenty-five or forty grains of ipecac; he allows his patient to suck ice, but no drink for two or three hours, and uses sinapism or oil of turpentine as derivants. A smaller dose of ipecac is given after eight or ten hours. Sometimes another dose of eight or twelve grains is required on the following day. Recovery is said to set in soon. This ipecac treatment is reported to have resulted amongst the military in England, where it was first introduced, as "radix antidysenterica," in better statistics than the former routine treatment with mercury and depletion. The latter I cannot recommend. Except the anus, no tangible locality has blood-vessels connected with those of the diseased mucous membrane. There is no indication for leeching the abdominal surface as long as there is no complication with peritonitis. Generally the consumption of blood is so large in dysentery that saving blood is more advisable than taking.

Great sensibility of the left hypogastric region and heat

will be alleviated, however, by the application of ice. But it must not be forgotten that very young infants bear ice but a short time, whether applied to head or abdomen. I advise to watch the effect of the application either of the ice bladder or the ice-cold cloth. Now and then, even in adults, we meet with an idiosyncratic incompatibility with cold. It has to be taken into account. Sometimes warm applications of either water or poultices prove more efficient in regard to the two indications, which consist in alleviating irritation and reducing temperature. Sometimes a simple warm application, which may be changed every few hours, or a cold application which is permitted to get warm on the skin, will result in reducing both pain and temperature, as both physiological laws and therapeutical experience may lead us to expect.

Opium (and its alkaloids, morphia and codeia) is invaluable in dysentery, notwithstanding the contrary opinion of a number of authors. The objection to its use is decidedly exaggerated. Such accidents as have been reported in the journals to result from its administration must be attributed to the fact that either the dose was absolutely or relatively too large compared with the idiosynerasy of the little patient. Dysentery both requires and tolerates larger doses of opium than an average diarrhea. In this respect this disease stands abreast with peritonitis. The main indications are to relieve pain, reduce peristalsis, and diminish the copious serous secretion; no other remedy fulfills all of them so well. For this purpose it ought to be given internally; for enemata containing opium may act favorably, but the more intense the tenesmus the less reliance can be placed on its effect, and the amount of the opiate thus brought into real action cannot be estimated. From amongst the opiates I prefer a tincture, or the wine, or opium in substance, or Dover's powder; but rarely have I injected morphia under the skin. The effect of the drug is easily watched and controlled, by commencing with moderate doses, not repeating them too often, and being guided by the effect obtained. If opium is to be replaced, opium with hyoscyamus, or with belladonna, or hyoscyamus or belladonna alone, may take its place temporarily.

After the purgative administered in the first stage of the disease has proved efficient, astringents ought to be resorted to at once. They may either be given in combination with opium separately. They are expected to pass wholly or partly through the entire length of the intestinal canal, thus coming in contact with the inflamed and ulcerous mucous membrane. Amongst those eligible are tannin, gallic acid, and vegetables containing the same (ratanhia, cinchona, catechu), besides subacetate of lead, nitrate of silver, and pernitrate of iron.

The daily doses of tannin range from eight to fifteen grains, (0.5 to 1.0) with opium or Dover's powder, lead in doses somewhat smaller, nitrate of silver one-sixth of a grain to one grain (0.01 to 0.06) in plenty of water, liquor ferri pernitratis fifteen to fifty minims, in a mucilaginous or farinaceous vehicle. The single doses ought to be but small, but their administration frequent. There is another remedy which, in my estimation, stands very high, viz., the subnitrate or subcarbonate of bismuth. Not only does it cover and protect the mucous membrane, but it also has a decided antifermentative effect. Thus it is surely indicated in irritated conditions of the mucous membrane; it seldom fails when given in sufficient doses. There is no harm in sometimes giving it in such doses that part of the introduced material will pass through the entire length of the intestinal tract without undergoing decomposition. As its taste is not disagreeable, it may be given together with tannin and opium; the daily dose ought not to be less than one drachm or a drachm and a half (4.0 to 6.0). At the same time the passages ought to be examined as to their reaction. Abundant acid, so frequently found in the slightest intestinal anomalies, requires the additional administration of alkalies. In most cases carbonate of lime is preferable to either magnesia or the carbonate or bicarbonate of soda, the salts of both of which are apt to increase diarrhœa. Sometimes, particularly when the stomach can be relied upon, the salicylate of soda may be added to the internal treatment. Besides the favorable effect of the soda in the intestinal tract, the salicylic acid may prove beneficial both by its anti-febrile and disinfectant

action. In regard to the use of lime-water, I refer to some previous statements.

At the same time accidental complications may yield their own indications. McLean reports many cases of complications with malaria, necessitating the use of quinine; others cite scurvy requiring antiscorbutic treatment.

When the catarrhal or inflammatory form of dysentery is complicated with diphtheritic deposits or degenerations, either superficial or deep-seated, or when large portions of mucous membrane are expelled and ulcerations are developed, the indications for energetic treatment become more and more urgent. Local treatment is required to astringe, to disinfect, to produce new granulations. For that purpose astringents, carbolic and salicylic acid may be resorted to. To what extent local treatment can be useful, G. Thomas has proved but lately in a very tedious and protracted case. A lady suffering from chronic dysentery through many years, and reduced to the lowest possible degree, recovered within a short time under the repeated applications of a small amount of concentrated nitric acid made to the surface of the ulcerated rectum through a speculum.

The local treatment requires the use of enemata. Their indications vary. They are to evacuate the bowels, or to reduce the irritability of the diseased intestine, or to accomplish an actual cure. These indications cannot always be fulfilled separately; sometimes two, sometimes all three can be fulfilled at the same time. The nature and quantity and the temperature of the liquid to be injected depend in part on the end aimed at, in part on the irritability of the individual intestine. Sometimes the bowel objects to the introduction of small amounts; sometimes, however, large quantities are tolerated very easily indeed. To introduce small amounts, the selection of the syringe is a matter of indifference. To inject large quantities, however, undue pressure and local irritation must be avoided. Thus the fountain syringe alone will answer; it ought to hang but a trifle above the level of the anus, say from six to twenty inches. The temperature of the liquid is not always a matter of great importance. Some

recommend the injections to be ice-cold, some, however, tepid; both are frequently recommended as panaceas. But the practitioner will soon ascertain that some bear and require the one, some the other, some indeed very hot ones.

In my experience, for the large majority of patients tepid injections answered best. Not seldom is the intestine in such a condition of irritation that even small quantities of a very cold fluid are expelled at once. And again, there are cases in which enormous amounts of either cold or warm water are readily received. To accomplish the purpose of evacuating the bowel, plain water will often suffice, but one-per-cent. solutions of salt in water will usually prove more acceptable. Additions of bitartrate of potassa, or castor oil, have proved so uncomfortable in my hands that I have discarded them long ago. However, when the secretion of mucus on the rectal mucous membrane was very large, one or two-per-cent. solutions of bicarbonate of soda answered very well indeed. For the purpose of clearing the intestines, either of feces or the morbid products, a single enema is insufficient. It ought to be repeated several times daily. When much mucus is secreted and tenesmus intense, it may be applied after every evacuation. In many cases the substitution of flaxseed tea or mucilage of gum acacia will prove advantageous. I had to continue them for weeks for both their evacuating and alleviating effect. When, however, the latter effect alone is aimed at, small quantities will usually suffice. An ounce or two of thin mucilage, or starch-water, or flaxseed tea, with tincture of opium, or better, extract of opium, prove very comforting. Glycerine in water has been recommended for the same purpose. The former alone, or but slightly diluted, irritates, nay, cauterizes. It will require close judgment and individual experience to ascertain the degree of dilution.

When a local curative effect is aimed at, injections of small quantities will be found deficient. As the local lesions are often extensive, the amount to be injected must be pretty large. Almost always astringents are required. Sulphate of zinc, of alumina, subacetate of lead,

nitrate of silver, tannin, chlorate of potassa, ergotin, salicylic and carbolic acids, and creasote have been recommended. Of the more common astringents I prefer alumina or tannin in one-per-cent. solutions. Creasote answered well in solutions of one-half of a per cent. Salicylic acid resulted more frequently in pain than in benefit. Carbolic acid in solutions of one-half of a per cent. has proved very beneficial, but I have learned long ago to be very careful in regard to its administration when I observed a case of poisoning with that substance. A young man suffering from chronic dysentery was to be treated with injections of carbolic acid in a one-per-cent. solution. As it was expected that but a limited quantity would be tolerated before expulsion, no amount was specified. The intestine, however, being in a paralytic condition, received enormous quantities, until finally ten drachms (40.0) of crystallized carbolic acid disappeared in his bowels. That want of caution came near destroying the patient.

Injections of nitrate of silver may prove very useful in cases not quite acute. Before the solutions of a quarter of a per cent., or one, or two per cent. are injected, the intestine ought to be washed out with warm water without salt. After the injection has been made, it ought to be neutralized with a solution of chloride of sodium; it is still better to wash the anus and the portion of the rectum within easy reach with that solution before the medicinal injection be made. For even the mildest solutions are liable to give rise to intense tenesmus, when no such care has been taken.

In chronic cases, where the ulcerations are but few, or in the lower portion of the bowels only, small quantities suffice. But more acute cases and extensive lesions require large injections, the patient being on his side, or in the knee-elbow position. In a number of cases, both mild and severe, where neither the usual astringents nor nitrate of silver appeared to answer, I have been very successful when resorting to injections of subnitrate of bismuth. The drug is mixed with six or ten times its amount of water; of this mixture from one to three ounces

(30.0-100.0) are injected into the bowel which has been washed out previously, twice or three times daily. The success was satisfactory, though a large portion of the injected mixture was soon expelled.

Suppositories containing the above substances may prove beneficial. But in order not to irritate they must be so soft as to melt readily. They may always contain some opium. But its admixture is not always sufficient to relieve the irritability of the rectum. For to accomplish this end, opium must at least begin to liquefy and to be absorbed, and absorption cannot be relied upon except where a part, at least, of the mucous surface is in a tolerable state of integrity.

SOME IMPORTANT CAUSES OF CONSTIPATION IN INFANTS

Constipation is by no means a rare affection in very young infants. However, as in old age also, it has so frequently been taken as an almost physiological occurrence of but little importance, that its prognostical meaning and its pathological nature have often been underestimated. It is true that many cases are attended with but little danger, but no less true, also, that the simple statement of an infant's bowels being costive ought not to be considered as a valid diagnosis of the causes which give rise to such a condition.

The causes of costiveness in early infantile age do not differ, in many cases, from those prevalent in adults. They may be classed under a few heads, according to whether they are referable to the contents of the intestines, or their motory power and secretions, or local obstructions, or deficient innervation. Many of the serious diseases of adult age complicated with constipation are not often met with in infants, nor are the most dangerous forms of ailments of the nervous system—for instance, acute hydrocephalus—frequent occurrences in the very tender age to which our attention is here directed. Still, there are a great many hygienic, pathological, and anatomical influences which will have the result of rendering the alvine evacuations dry, scanty, or rare. It is the more important of these we mean to discuss, leaving out the symptomatology and therapeutics of the generality of cases as described in almost every text-book on theory and practice, or diseases of children.

Before turning to this task we may, however, state at once, that there are cases of temporary constipation which do not belong to any one of the classes alluded to. For instance, almost every feverish disease has a greater tend-

ency to result in costiveness in infants than in adults, no matter whether the intestinal tract is the seat of the affection or not. We need only allude to this fact, known to every pathologist and practitioner, in order to distinguish these cases of temporary constipation from the chronic disorder.

A common cause of constipation in infants is improper food. The more bulky such food, the more tendency to constipation, with the exception of those cases in which the irritation of the alimentary canal, by the unusual volume and nature of the contents, results in catarrhal discharges from the mucous membrane. Thus, infants fed, on amylaceous food principally, especially potatoes, rice, or arrowroot, instead of breast-milk or a proper substitute, are liable to suffer from constipation. The appropriate change in the baby's diet will in all probability be all that is required to mend this abnormal condition.

But breast-milk, or its apparently proper substitute, is also apt to yield the same results. We meet with a number of babies of two or four months who empty their bowels once a day only, or once in two or three days. The consecutive disorders of general nutrition may not be very great in the beginning, but even the occasional attacks of colic, the straining (sometimes inefficient) in passing fæces, the congestion to the head and brain, and perspiration, in their efforts to procure an evacuation, are always noticeable facts which are but the precursors of more urgent symptoms. The fæces are hard, pass in small lumps, and are of a white color and cheesy appearance; now and then they are covered or mixed with a viscid mucus, the result of intestinal irritation, or even with streaks of blood, the result of straining and local lesion. The above condition and appearance are due to a large quantity of firmly coagulated casein admixed with the fæces in a certain proportion, sometimes, however, to such an extent that the evacuation appears to consist of casein only.

The presence of casein in the passages in this hard and firmly coagulated condition depends on one of two causes. There is either, in the gastric secretion, too

much acid for a normal digestion, or there is too much casein in the milk.

When milk is introduced into a normally digesting stomach, it undergoes a speedy but loose and soft coagulation, which is very easily overcome by the action of the rapidly secreted pepsine. When, however, the gastric secretion is abnormally acid,—a very frequent occurrence in young infants,—the coagulation of the milk will take place more rapidly than normal, and at the same time the coagulated mass will be hard and solid. The differences of these two conditions can be easily appreciated on noticing the masses thrown up a few minutes after nursing or feeding; loose, and with no apparent effort, or solid, in large lumps, and often with a great struggle. Whenever these masses will not be thrown up from the stomach they will pass down the intestinal tract, not at all or but little changed by the digestive process. Their size will obstruct the canal, and their dryness will keep them from being readily expelled.

We are not unfrequently in a position to recognize the cause of this condition in the color and taste of the mother's, or the mixture of the cow's milk. It is deficient in sugar, but more defective by its too large amount of casein The mere change of a wet-nurse or a different dilution of the cow's milk is often sufficient to change the infant's digestion and evacuations at once; but the former is not always possible or expedient, and the latter must be understood. We have frequently found that a simple addition of sugar to the breast-milk would suffice to procure the necessary change, or the mere addition of sugar and water to the former dilution of cow's milk would have a similar result. Our plan is, in the former case, simply this: to give the infant, every time, and just before being laid to the breast, from half a drachm to a drachm of loaf sugar, dissolved in a teaspoonful of tepid water; very often, a few days will exhibit a marked improvement. But in many instances this plan does not work to entire satisfaction, inasmuch as the proportion of the gastric acid to the coagulable casein is not sufficiently influenced. What we want further is a more gradual or slower effect

of the may be otherwise normal acid on the casein. For the purpose of obtaining this end, we mix the cow's milk, if the infant be fed on such, with some thin mucilage instead of water, with the expectation that the effect of the acid will be rendered less rapid, and the coagulation less hard. Gum-arabic water will often do good service, gum being a completely indifferent substance; as a general rule, however, we prefer a decoction of barley or oatmeal, well strained, with the addition of salt and sugar, as the proper vehicle of milk. This plan holds good for breast-milk as well as for prepared cow's milk. Where the breast-milk contains too large a proportion of casein, we replace sometimes the solution of sugar by a tablespoonful of sweetened barley-water, or strained oatmeal gruel, which is to be administered just before nursing; the latter being the preferable substance, on account of its more laxative effect.

In all such cases, however, in which the fault is more on the side of the gastric secretion than of the superabundance of casein, it is necessary to neutralize the surplus of acid. In many we have to continue the treatment for a long period. The antacids mostly in use are magnesia (calcined of the carbonate), bicarbonate of soda, and carbonate of lime. If the antacid effect of the three agents be considered equal, we find the bicarbonate of soda the most convenient addition, particularly to artificial food, because of its gentle laxative effect, and of its solubility. A few grains may be admixed to every meal, with happy results. We add here, that wherever antacids are indicated, the selection of the remedy will depend on the presence of either diarrhœa or constipation; the former requiring the carbonate of lime, the latter magnesia or soda.

Besides, the condition of the gastric juice and the milk, or rather the disproportion between them, resulting in solid and insoluble coagulation of the casein, we have to recognize as a frequent and important cause of constipation in infants, a certain condition of the intestinal tract. We do not mean the deficient action of the muciparous follicles of the intestines, but an insufficient degree

of muscular power and action, depending on general rachitis. We understand by rachitis, by no means the well-known affection of the bones resulting in their lack of phosphates and surplus of water and fat, but consider this character of the osseous tissue as but a partial illustration of the whole morbid process. Rachitis is the condition of general malnutrition which results in the above peculiar softening of the bones during their physiological development, in the deficient formation of muscular tissue, in the abundant deposits or non-absorption of fat, together with all the symptoms attending on these and other anomalies. In fact, there is hardly an organ, scarcely any part of the body, which is not affected to a certain degree, before the series of changes which will take place in the long bones, viz., swelled epiphyses and curved shafts, have exhibited themselves to such a degree as to be recognizable to even an untrained eye. Amongst the first symptoms which will become perceptible we count muscular debility.

The principal organs on which rachitis shows itself are: the thymus gland, which remains large beyond its normal time; the bronchial glands, which become enlarged; the thorax, with its two longitudinal grooves along the costo-cartilaginous junctures and its horizontal groove above the insertion of the diaphragm, its consecutive raising of the sternum and ensiform process, its flat dorsal and angular lateral portions, its triangular shape and general shortness, with all its consequences on the position and character of the thoracic and abdominal viscera; the cranium, with its baldness (especially posteriorly), perspiration, square shape, and local softening on the parietal and occipital bones, and with its general hyperæmia; the brain, with its congestion and tendency to effusion; the copious subcutaneous tissue, the pale surface, the muscular debility, the swelling of the epiphyses, and the curvature of the long bones. Of all the symptoms which have been enumerated, the latter is most alluded to as important, and still it is the least important, inasmuch as when it is noticed the injurious effects of the whole process have already had too much chance to exhibit themselves.

It would be out of place here to prove to what extent general and local diseases, hereditary and acquired tendencies, are apt to generate rachitis, or in which manner rachitis is liable to give rise to consecutive diseases. But this much is evident to every pathologist, that the early recognition of rachitis amounts to a great saving of health or life. Now, there is no symptom which will show itself in its full development sooner than muscular debility in general, and muscular incompetency of the intestinal tract in particular. It is true that a trained eye will appreciate the first sign of the longitudinal thoracic groove, and the contemporaneous pain on taking hold of an infant's trunk; or that an educated finger will recognize the first beginning of local rachitic softening on the cranial bones as early as in the second or third month, sometimes; but fully as early as these symptoms, the rachitical constipation of the baby will be perceptible. An infant may be born in good condition, meconium will pass off normally, all the functions will appear normal for some time. It will look healthy, round, fat, but pale; hair is but scanty, and constipation will set in despite of there being no apparent surplus of casein in the milk, or of acid in the gastric juice. There must be a physical cause for every abnormal function; where there is no local obstruction, no faulty secretion, apparently no improper food, the locomotive power of the intestinal tract must be looked after. It is more frequently at fault than the rest of the parts concerned in digesting. When such a constipation is found in an infant at that early period, it may be that some other cause can be found; but when at the same time or a little later the scalp, covered with scanty hair, begins to perspire freely, and the thorax begins to look short, or respiration appears to become more abdominal than can be explained by any known morbid condition of the thoracic viscera, the diagnosis of rachitical incompetency of the intestine is tolerably safe. There can be no doubt that there are other symptoms of rachitis which, when fully developed, render the diagnosis of the disease more positive; but there is no symptom in the whole series which directs our attention so much and at such an early period

to the imminent danger as this constipation. We seldom fail in being correct, when we attribute protracted constipation in an apparently healthy but fat and pale baby of two or three months, whose bowels have been in tolerable order during the first month of life, to rachitis. Thus, while we recognize the disease thus early, we shall not only be enabled to treat the annoying symptom rationally, but also to ward off the further development of the other threatening symptoms.

Nothing would be more incorrect than to try the effect of laxatives, on constipation depending on rachitical incompetency of the intestinal muscle. They would act momentarily, and leave the muscle more powerless than before; their place is to be taken by injections of cold water. The indications are: such a change in the food as will contribute to keeping the bowels moist and slippery, but principally such modification of food, and such medical treatment, as are known to benefit where all the symptoms of rachitis are fully developed. The mother will, according to circumstances, have to be replaced by a good nurse, where the cause of rachitis in the baby can be traced back to the mother, or to an insufficient condition of her milk; or the nurse must be changed, for similar reasons. Very often artificial feeding is still better than either mother or wet nurse, when these cannot be found of first order. Iron and phosphates are important ingredients of any food the baby is to have; extracts or infusions of beef, boiled barley or oatmeal mixed with milk, are the principal requirements as far as food is concerned. Oatmeal, carefully strained, is to be preferred as long as the gentle laxative effect of the additional mucilage is still desirable. Iron may be given in addition, either as syr. phosphat. compos., 10 to 15 drops, or as syr. iodid. ferri, 4 to 10 drops, three times a day; and no dietetic rule known to favor a healthy general development ought to be lost sight of. As in general rachitis, cod-liver oil will prove very satisfactory, both through its general qualities and its local effect on the mucous membrane of the intestine. The principal part of the laxative effect of colostrum is not due to its large proportion of salts, but to its amount

of fat, which favors speedy locomotion of the contents of the bowels. Thus a teaspoonful or less of cod-liver oil mixed with the iron will favor the same purpose in rachitically constipated infants, while it at the same time improves their general condition. Now and then a very obstinate case may require for a week or two the one-hundredth part of a grain of strychnia, twice a day, in addition, or such other improvements on the above detailed plan as the individual judgment of the attending physician may direct. At all events, the diagnosis of a case is, to a well-educated and balanced mind, of infinitely greater value than any number of detailed rules and prescriptions.

Besides the abnormal condition of the milk, and the insufficient development and function of the muscular layers of the intestines, there exists a cause for constipation in infants which has not, to my knowledge, been touched at all in medical literature. And still it is frequent and constant, dates from the first hour of life, and for this very reason will often be recognizable in its difference from rachitical constipation, which in the large majority of cases takes its commencement in the second or third month only. This frequent and important cause I allude to, depends on the normal anatomy of the intestine, particularly the colon, of the fœtus and newborn.

The length of the intestinal tract is much greater (in proportion) in the later periods of fœtal life than in the adult, while it is but inconsiderable in the early months of utero-gestation. The small intestines of a fœtus of eight months are twelve times as long as its body, while the proportion in the adult is but eight to one. The colon has a length two and two-third times as great as the body in a fœtus at full term, while the same proportion in the adult is that of two to one. Now the ascending and transverse cola are very short in the fœtus and newborn; thus the descending colon, having to make up for the difference, is the longer in proportion. While, then, the whole intestinal tract grows but slowly in the young fœtus, it increases rapidly in the maturing fœtus, and diminishes in proportion some time after birth. Mean-

while the pelvis grows very slowly in the latter period of utero-gestation, and the long colon descendens, with the sigmoid flexure and rectum, finds no space for comfortable accommodation, as in later life. This disproportion remains intact, as we have had scores of opportunities to convince ourselves at the dissecting table, for several, sometimes for six or ten, years.

The consequence of the long colon being crowded downwards, by a narrow abdomen, large liver, etc., into a narrow pelvis, is a number of curvatures instead of the one sigmoid flexure. Thus it happens, that in its place there is a curvature of the gut, permitting it to escape to the right; thus it happens, further, that the real sigmoid flexure is found either in the median line, or still more frequently on the right side. Thus, since this anatomical condition of the fœtal and infantile colon has been appreciated, particularly since the memorable discussion of the subject in the French Academy of Medicine, in January and February, 1859, the proposition has been made to establish artificial anus in infants in the right instead of the left side, and a number of operations have been made at this place accordingly. From this point the colon turns down into the pelvis, forming the rectum, which, in accordance with the above facts, is very rarely found in infants on the left side exclusively, but almost always steps beyond the median line, and very frequently is met with mostly in the right side of the pelvis. The exact measurements and facts may be easily reached in the literary records; suffice it here to allude to these, and to state the anatomical fact in our researches on its clinical bearing to be this: that the colon descendens in the newborn and young infant is very long in proportion; that the space to which it is confined is too narrow; that, therefore,—not to speak of other reasons leading to the same result,—it will bend; that folds and curvatures will form, and that the locomotion of the contents of such multifariously bent and curved intestines must necessarily be impeded to a greater or less extent.

Two cases, in which the flexures of the descending colon were unusually numerous, and developed in the highest

degree possible, are, while they elicit a painful interest, uncommonly fitting to illustrate the physiological obstruction which may take place in the intestines at an early age. A finely developed boy was born in a family of healthy and robust parents, some five years ago. No constitutional or acquired diseases of any importance could be traced in either of them, or in the two older children; no malformation of any kind had ever occurred in either of their two families. The newborn baby did well for some twelve or fourteen hours, but no passage of meconium made its appearance, and vomiting set in about the end of eighteen or twenty hours. The finger detected no obstruction of the rectum, sphincters acted normally, and above them the finger entered what appeared to be a pouch, beyond which neither the finger nor bougie could be introduced. Frequent attempts at pushing up bougies failed, nor did injections of water forcibly made into the bowels prove any more successful. Injection of air or gas was not resorted to. The diagnosis of mechanical obstruction at a part of the rectum or colon beyond reach was made, and confirmed by all the symptoms of such a condition—violent vomiting, etc., the prognosis of the case expressly stated to the relatives, and Littre's operation for artificial anus held out as the only means of saving the infant's life, and accepted. On the third day the left iliac region, in front and a little above the spina anterior superior, appeared to fill up, and yielded a somewhat duller percussion sound. The operation was therefore performed at this spot, in the presence of Drs. James R. Wood, L. Voss, and some other professional gentlemen; it resulted in our finding a pouch of the descending colon filled with a large amount of meconium, which was readily discharged through the artificial opening. The patient did well for a short period, but died of peritonitis on the fifth day after the operation. The post-mortem examination yielded the following results: The part of the colon fastened to the abdominal wall was no longer dilated. Besides the consequences of peritoneal inflammation nothing was abnormal in the immediate neighborhood. All the parts above the incision, and all the other viscera were not

diseased. Below the point of incision lay the colon, turned three times upon itself, three flexures covering each other in such a manner that the subjacent one was always about half an inch longer than the one above it. The lowest of the three, crowded down into the pelvis, was entirely compressed, contracted, and contained nothing but a little hardened mucus; the middle flexure contained the same mucus, and a small amount of meconium; the upper one was filled with meconium as far as the contracted lumen of the bowel would allow, and its outer left portion was the one which had appeared dilated by the meconium crowding down from above. The inferior flexure reached beyond the median line, stretched upwards to nearly the spina anterior superior of the right side, and from there the intestine turned back in an acute angle into the pelvic cavity, doubled upon itself, reached the median line on the right of the empty bladder, and terminated as rectum in its normal place. When the bowel was removed, it measured from the point of incision in the left hypogastrium to the anus nearly fourteen inches. The ascending colon was of normal length; the transverse colon was not in its normal position, but stretched from the right hypogastrium to the left spina anterior superior, diagonally, in an almost straight line, forming an acute angle with the uppermost curvature we have described, and giving rise to the pouch we found dilated before and during the operation.

We have, then, a case of mechanical obstruction, brought about by the abnormally long descending colon, which may be taken as an arrest of development only, inasmuch as its relation to the length of the colon ascendens and transversum agrees with their fœtal condition about the fourth or fifth month of utero-gestation; by the diagonal position of the transverse colon forming an acute angle with what ought to have been the descending colon; by the compression of the bowel by its own flexures, which were much more numerous than normally; by the narrowness of the newborn pelvis, the space of which was still getting more narrow by the bladder filling up more than before; by the infant's crying, and crowding the thoracic

and abdominal viscera downwards upon the intestine, and by the tract filling up with food, fæces, air, and gas. Thus the very acts of crying and nursing, which will bring on evacuations of the bowels of the newborn, were the cause of increasing the obstruction by compressing the guts, more than three times doubled upon themselves.

We hardly know what the result would have been if, instead of the injections of water, those of air should have been made, with sufficient force and in sufficient numbers.

Not long after this case, Dr. L. called us to see a case of mechanical obstruction of the intestine, also beyond reach, with exactly the same results of examination, and the same symptoms. Our local examination by means of finger and bougies failed, as in the above-mentioned case, with the exception of our seeing a little blood oozing from the rectum after repeated attempts at pushing our examination upwards. This blood was in our opinion the proof of our tearing a thin membrane or soft mass, which we thought was but the lower portion of inflammatory conglutination. Despairing of the case, we still forced our bougie up, without having much reason to congratulate ourselves on any favorable result, and forced as large quantities of water upwards as the gut would hold this side the obstruction. We did not succeed, however; proposed the formation of an artificial anus; were refused, and left. Meanwhile the injections were now and then repeated by the attendants, and towards the end of the third day, twelve hours after our visit, a large quantity of meconium was evacuated, vomiting ceased, and the baby was saved.

We have no reasonable doubt but that this latter case of intestinal obstruction was of the same nature as in the first described instance. We consider the two cases, and have therefore described them with some minuteness, as valuable contributions to the doctrine of congenital obstructions, and have no hesitation in expressing our belief that many a case of supposed imperforate colon may have been of the character we have tried to describe. Thus, the indications for inflating, and by inflating turning, and thereby opening the guts, and for all such means as the ingenuity and knowledge of the practitioner will command,

ought not to be set aside until the case is really hopeless. Besides, not many parents will consent to the operation for artificial anus; and to what extent, and at what late period a desperate-looking case may be relieved, our second case is amply competent to show.

But let us not forget that it was no point of the chapter on imperforate rectum or colon we meant to elucidate, but that we spoke of infantile constipation. The object, however, of our reports is obvious enough. The cases we have narrated suffice to show to what extent the normal anatomy of the fœtal guts when arrested in their development to but a slight degree, can prove injurious in the born infant; and the few facts set forth by us concerning this anatomical condition are of such a nature that every medical man will be able to verify them in post-mortem examinations.

If we have succeeded in showing that such cases of constipation in very young infants, which date from birth (not, as in rachitis, from the second or third month), occur in otherwise healthy individuals, and in which the evacuations of the bowels are normal enough, with the exception of the fæces being somewhat dry, in consequence of the absorption of water being facilitated by the extensive surface of the mucous membrane of the long and curved colon descendens—will result from the simple fact of the length and curvatures of the colon, we have at the same time succeeded in pointing out the treatment. For it is of just as much importance to learn which cases ought to be left alone, as it is to find the indications for the medicinal treatment of those requiring it. The cases we have alluded to require no treatment except the proper diet, and cold-water injections, until the growth of the pelvis and the increase in size of the abdominal and pelvic cavities give a natural and favorable termination to a condition which must be understood, to avoid mistakes in its appreciation and treatment.

ACUTE RHEUMATISM IN INFANCY AND CHILDHOOD

GENTLEMEN:—This little girl, three years old, was presented to you last Saturday, the day after her admission. She came with a history of a pharyngitis, for which she had been treated with so much success, that the mucous membrane of the fauces exhibited but few remnants of that disorder. Still, you remember, the child appeared to suffer. There was dyspnœa, respiration about forty in a minute, temperature 104°, pulse 160 and more, respiration over the upper lobe of left lung diminished, in some places harsh, approaching the bronchial, some little bronchophony, and corresponding dullness on percussion. At the same time, we were told that there was slight œdema of the feet. From these symptoms pneumonia in the left upper lobe was diagnosed. One peculiarity, however, required further study, viz., that although the number of respirations and of pulsations were both increased, the proportion between the two was normal; whereas, with pneumonia, there should be an excessive number of respirations. We looked farther for an explanation of the undue frequency of the pulse. It was found, as we thought, in the previous history of the child. When nine months old, she had whooping-cough, which lasted a long time, was complicated with fever, and succeeded by frequent and protracted attacks of coughing. Thus we explained the frequency of the pulse by the presence of a chronic pulmonary infiltration, in consequence of which the heart had to overcome the obstacles in the pulmonary circulation by accelerated contractions. Besides, the long-continued venous obstruction, and the general hydræmia of the patient appeared to explain the œdematous swelling of the feet. The treatment was to consist of a daily dose, or two, according to circumstances, of five grains of quinia, with a sufficient number of doses

of digitalis to reduce the pulse; for we feared that the heart might be exhausted by its over-exertion. There was still another reason for this medication. In the hasty examination we were permitted to make, the child being very sick and the amphitheatre cold, I noticed that the mitral systolic sound was rather prolonged and muffled. Still, no diagnosis was based upon that fact at the time, although that of endocarditis suggested itself. I ordered the digitalis to enable us to make a diagnosis of the cardiac disorder, if any there were; for a murmur will frequently be heard when the heart's action is rendered slower. The blood-wave being smaller, when the heart moves fast, irregularities of the valves may not be detected, while as soon as a larger amount of blood passes over the diseased surface, the morbid sounds become distinct. On the next day, the general condition of the child was much improved; temperature 101-102½, dyspnœa not so marked, but a distinct murmur was heard over the mitral valve, taking the place of the first sound. *Endocarditis,* with *incompetency of the mitral valve,* suspected on the previous day, was then diagnosticated in addition to the *pneumonia.* Greater attention was then paid to the œdema of the feet. We learned, as part of the child's history, that not only had the œdema existed before the dyspnœa set in, but also that the patient had been unable to walk for a number of days, and passive motion had been painful, both in the ankle and knee-joints. This important fact finally completed our diagnosis. We had to deal with acute articular rheumatism, rheumatic endocarditis and pneumonia occurring contemporaneously or in quick succession. To-day the child appears much more comfortable than last week. Temperature averages 101-102, reached 104 but once all the week. The symptoms of acute pneumonia have nearly disappeared, and no new attack has taken place, dyspnœa is moderate, but the bellows murmur is very loud, both anteriorly and posteriorly, both right and left. As there is no unusual amount of venous obstruction, the external veins not being much dilated, and no general œdema exists, we have reason to believe that this loud murmur results from friction

of blood, not only over the mitral valve, but over the roughened surface of the entire endocardium, also involved in the morbid process.

Look at this other patient. She is a girl of ten years, well built and robust. She denies ever having had pulmonary disease, but reports that for six weeks past she has suffered from severe pains in her limbs, particularly in the knee and ankle joints; has been confined to her bed for a fortnight, and now cannot walk without pain; has had a slight, short cough for weeks, which has been harder and more protracted during the last week; finally, during the last five or six days, has raised blood: yesterday as much as a cupful. Altogether, she feels very ill. Upon examination, we find considerable dullness over the upper lobe of the right lung, both anteriorly and posteriorly, with some bronchial respiration above, greatly diminished vesicular murmur, and some fine râles; large, moist râles are disseminated over the left lung. Finally, and most noticeably, we discover at the heart roughness of the first sound at the pulmonary orifice, and prolonged to the left, in the course of the pulmonary artery. The diagnosis is clear; *acute articular rheumatism, endocarditis at the orifice of the pulmonary artery, solidification of the right lung, and pulmonary hemorrhage.* Now an affection of the pulmonary artery is extremely rare in rheumatic endocarditis, particularly when no other locality of the heart is affected. We ought, therefore, to inquire whether, in our case, this stenosis be not perhaps congenital. The age of the patient renders this question more pertinent than would be the case were she more advanced in years. For in congenital disease of the heart, it is precisely the pulmonary artery which is most often affected, and the lesion may persist later in life,—causing symptoms of heart disease with or without cyanosis. In order to decide the question, whether the existing lesion be congenital or acquired, I offer the following considerations:

In congenital stenosis of the pulmonary artery, either the foramen ovale or the ventricular septum must be found patent. In neither case is considerable hypertrophy of

the heart a necessary consequence. If, however, a considerable hypertrophy of the right heart is found, with the usual change of the position of the heart in such cases, you may conclude that the anomaly is acquired, and thus it is here. The heart, as measured by percussion, is twice its normal size, and this hypertrophy is confined to the right ventricle;—the percussion sound is dull to about a half inch beyond the right margin of the sternum, but not beyond the line of the nipple towards the left; and from the pencil-marks made while I am percussing, you will perceive that the heart is in an oblique position. Our case then is one of the exceedingly rare ones of endocarditis, wholly or mostly confined to the right side, and to the pulmonary orifice exclusively.

But its interesting features are not yet exhausted. Is pulmonary hemorrhage such as our patient describes a frequent occurrence in a recent case of pneumonia? Is it frequent in childhood? Neither the one nor the other. What then does it mean here? It means that some of the deposits in the pulmonary orifice have been torn off, once or repeatedly, that the mass was carried into the lungs, and that both the pneumonia and the hemorrhage are the results of an embolic process and infarctus. Thus, the second exceptional circumstance is in close dependence upon the first, and both render the case one of rare interest.

Third case: This little girl is four years old. She has been well until four weeks ago. At that time she refused to walk or stand. The ankle-joints were swollen and painful to the touch, and the knee-joints and wrists were in the same condition. The history is not very clear, as we have no other report but that of the mother, and that only contains the fact that the ankle-joints were first affected, the wrists next in order. Both are still swelled and painful. A rather loud bellows murmur replaces the first sound of the heart over the mitral region. These details suffice already for the diagnosis, *Rheumatic Polyarthritis*[1] *and Endocarditis.* The patient has a short hacking cough, and is said to suffer from frequent at-

[1] πολυς numerous, αρθρον joint.

tacks of nose-bleeding. In the lungs no abnormal respiratory sound is heard except some mucous râles. You know that slight pulmonary œdema and bronchial catarrh accompanied by this peculiar short cough, are frequent, indeed, almost inevitable consequences of mitral incompetency. To the same lesion is due the epistaxis, which never occurred before this sickness. It is the result of the retardation of venous circulation in the copious and loose connective tissues of the nares, than which there is none more richly supplied with blood-vessels. In this connection, take it for granted, as a general experience, that large numbers of cases of epistaxis in infancy and childhood are the results of mitral insufficiency, mostly attended by general hydræmia.

What are the elements common to all these cases? In all exist synovitis of a number of joints, and endocarditis, while other symptoms or complications vary. The membranous connective tissue is inflamed and secreting over many and large surfaces. The peculiarity common to both the synovial and the serous membranes is the large number of blood-vessels, and the absence of glands. Their difference consists in the absence, on the interior of the synovial membrane, of the dense layer of epithelium which covers both the serous and mucous membranes. Therefore, the capillaries of the interior of the synovial membrane flow not below, but between the cells, a large number of which are mixed with the connective tissue. The intima secretes synovia, not from glands, not from transformed epithelium, not from blood-serum, but from the nutritive lymph pervading the connective tissue cells and interstitial spaces. Its secretion is easily induced; motion of the joint is sufficient to increase it. Local irritation is a ready cause for hyperæmia, hyperplasia, loss of superficial cells, and increased liquid secretion similar to that on the serous membrane. Such local irritation may be simply confined to one joint, as in traumatism, or multiple, and extending over a number of joints at the same time. In the first case we speak of a monarthritis,[2] in the last polyarthritis. Polyarthritis—in-

[2] μονος single

flammation of many joints—cannot result from an injury, it must be attributed to some general and diseased condition, which, from its very generality, must be sought either in the vascular or nervous systems.

In regard to the first, it is remarkable how various are the specific blood diseases that may be accompanied by multiple joint-disease. Scarlatina, variola, pyæmia, and puerperal fever are the best known. In the first, an erythematous inflammation seems to be determined by an elimination of the poison upon the surface of the synovial, analogous to that taking place upon the skin and digestive mucous membrane. In variola, where endocarditis has been recently described, articular swellings are either due to hemorrhage (analogous to those in hæmophilia), or to an effusion of pus, and these are identical with the arthritis of traumatic or puerperal pyæmia. Arthritis is well known to be one of the most dangerous symptoms of pyæmia, and in the purulent effusion which it determines, is in striking contrast with the serous or serofibrinous effusion of a rheumatic polyarthritis. This effusion, which sometimes precedes pain, need not be inflammatory in the beginning; that is, there need not be in the beginning the characteristic process in the cell elements. Thus far it may be compared with the rapid effusion of pus in generalized purulent peritonitis, where the blood is overcharged with white blood-corpuscles, and the process is accompanied with paralysis of blood-vessels. It appears, therefore, that the presence of foreign matter in the blood constitutes a powerful predisposition to polyarthritis. This fact, derived from observation of diseases other than rheumatism, has been taken as a strong support to the theory that in rheumatism some foreign material does circulate in the blood, be that lithic acid, lactic acid, or something else.

Still, the matter is not so easily settled. There is a great difference between pyæmia, scarlatina, and rheumatism, in their nature, and in their results on secreting surfaces. In pyæmia we know pus to be present, and pus is passed through the blood-vessels. In scarlatina we presume, almost know, that there is a foreign

body in the blood, although Recklinghausen's bacteria theory is neither proven by him nor confirmed by others. This foreign material is not visible as yet; at all events it cannot be compared to that in pyæmia in size or character. What do we see as the result of this material irritation in its synovial and serous eliminations? The rheumatic effusions of scarlatina are not always purulent; on the contrary, they are mostly serous; somewhat thicker and darker in many instances, it is true, but purulent in but few instances. Still, pus is found sometimes in the synovitis and periostitis of scarlatina. But where is pus not found? Is it not the legitimate result of any obstruction of the circulation, as soon as leucocytes have a chance to escape? and are they not found in almost all and any effusions? Besides them, and pretty normal effusion of the surfaces, nothing is known as yet to exist in scarlatinous eliminations. Where then is its peculiar foreign material? If we assume it to be present in the effusion, let us not forget that such assumption cannot yet rank as a fact in the building up of a theory.

And now, of what nature is the effusion in rheumatism? Purulent? By no means. Additional leucocytes may be found in the serum of any effusion, as stated before; but the consistent character of the synovial and serous effusion in rheumatism is markedly watery and deprived of solid admixtures. It compares somewhat with copious effusions from large surfaces of mucous membranes. The mucous membrane of the intestinal tract will secrete a similar liquid by the gallon; that of the vagina even by the ounce or pound.

Thus, while the act of pouring out depends on the condition of the surface, which acts as a sieve, the nature of the morbid process underlying it cannot be explained by its result, particularly as long as the constituents of the discharge, though changed in proportion, are given off by the normal organism. The fact of purulent discharges taking place in pyæmia never solved the problem of its nature, and what we know of the nature of scarlatinous effusion never taught us the essence and origin

of scarlatina; and it is equally certain that the nature of rheumatic effusions never exhibited its causes. And as to changes in the blood in rheumatism? Neither the lactic acid nor the lithic acid has ever been shown to exist; not even in the liquids effused by the effect of vesicatories have they ever been found.

It is much more rational to assume that some changes in the blood-vessels must coexist with the multiple fluxions which constitute the fundamental phenomena of the disease. I have already alluded to that form of arthritis —if it can be claimed as an arthritis—which occurs in hæmophilia, a disease in which the coats of the blood-vessels are congenitally altered or imperfect. It has been suggested that an alteration in the lining membrane of the vascular system was itself the original cause of the changes which almost certainly take place in the course of the disease. Thus, in rheumatism also, the cause of the various effusions would lie, no matter what its original source will be found to be, on the whole surface of the intima of the blood-vessels, from the endocardium to the smallest artery or vein, even the vasa vasorum. Endocarditis, then, would not be the complication of rheumatism, but its highest and most developed expression. I shall return to that question, and then you will see why it is that principally the left side of the heart, and principally the left vertricle, and principally again the atrio-ventricular orifice and mitral valve are affected.

The influence of the nervous system upon the condition of joint effusions is seen both in acute and chronic diseases. Hysterical arthralgia, however, described by Brodie, Stromeyer, Esmarch and others, does not fairly belong here. But recently Charcot discovered profound organic lesions of the articulations as a consequence of various diseases of the spinal cord. Besides, fatigue and exhaustion, prolonged lactation and an irritable nervous system, are just as many sources of predisposition to rheumatism. And the fact that warm bathing, tonics and nervines exert frequently a wholesome influence in rheumatism, appears to point in the same direction.

There is no proof, however, for the assumption that

rheumatism is nothing but a neurosis. Dr. F. Lente (The Neurotic Origin of Disease, New York, 1875) says of J. K. Mitchell's tendency in that regard: "All of his cases are such of organic disease of the spine, or injury to the medulla, except one" (p. 9). This one case, however, claims only that it got well after bleeding, cupping over the spine repeated twice, and the administration of salts and magnesia; nor does Dr. Lente's own case appear more conclusive, for the lady of eighty-three whose case he reports (p. 14), appears to have suffered from general thrombosis. She had senile gangrene, inflammation of both wrists, and cerebral symptoms.

If, then, the general nervous system be not called upon for a direct explanation of facts, what would you expect to take place when a sudden change of temperature affects the surface of the body? The irritated cutaneous nerves exert their reflex action upon the vaso-motor nerves, the superficial blood-vessels become contracted, their contents are suddenly driven below the surface into the vascular system of the large viscera, or of the serous and mucous membranes. Voluntary muscles and lungs are in constant expansion and contraction, and are, therefore, not very apt to be inundated. But the surfaces of mucous and serous membranes, offering less resistance, are the receptacles into which the blood chased from the surface of the skin is suddenly crowded together. The lymph contents are disturbed, epithelial cells softened and darkened, and secretion of lymph and serum, and, in some cases, migration of white blood-corpuscles may take place. It depends on circumstances, previous disease, or vulnerability, whether the result will be a "catarrh" of a mucous membrane or a "rheumatic" secretion of synovial membranes, just as it depends on individual disposition whether the mucous membrane of pharynx or intestine, or bronchi, suffer most after wetting of the feet, or similar occurrences.

This is not the only mode by which sudden contraction of the blood-vessels proves dangerous. The surface of the body, fourteen square feet in the adult, less absolutely, but more in proportion to height and weight,

in the child, is the principal road through which the system gets rid of its heat. The cooling process is dependent upon a normal and sufficient cutaneous circulation. Sudden contraction of the blood-vessels means accumulation of heat in the body; that is, "fever," with its consequences on the structure of tissue. As early as 1852, Virchow described, as the result of fever, parenchymatous inflammation with increase of nuclei, and indistinctness of cell contents. In 1864, Zenker described in the muscles of persons suffering from typhoid fever, a waxy degeneration, beginning in the connective tissue of the muscles, of simply degenerative, non-inflammatory character. His observations are correct, his explanation of the process is insufficient. For the term "degenerative" process does not necessarily involve a result from, or complication with, inflammation. Thus, traumatisms and trichinosis determine waxy degeneration and cell proliferation at the same time. In accordance with this, Waldeyer looked upon fever as a constant cause of both passive changes and cell proliferation, and Popoff has but lately (1874) described, as the results of increased temperatures, all the above changes. They are principally found in the diaphragm, recti abdominis, and arteries, in all feverish diseases, such as scarlatina, variola, measles, typhoid fever—and principally in those which exhibit the highest temperatures, such as scarlatina. They are probably a principal cause of chronic endocarditis, and may be also of chronic inflammation of almost any organ. At all events, we have good reason to believe that organs like the synovial and serous intimæ, immensely stocked with cells, and swimming in blood and lymph, are very apt to be affected by heat alone so produced, or rather accumulated, by the sudden contracting of the surface circulation.

A third cause of polyarthritis may not be general, but is frequent, viz., previously contracted endocarditis, with soft fibrinous masses deposited on any part of the endocardium. These, detached and swimming along in the circulation, may form emboli. In the muscles, they may remain undiscovered; in the brain, they may produce paralysis or chorea; in the joints, attacks of arthritis; in

the lungs, infarctus and hemorrhage; and in the skin, ecchymoses in the shape of either purpura, or peliosis.

Thus you have a clue to many of the points of interest in acute rheumatism, both of adults and children. Children! Is rheumatism a frequent affection in childhood? Most books say No, the age of five or seven years is considered by many the earliest period of its occurrence, and a large number of them admit these only as rare exceptions in infancy. Two cases at a very early age, nine weeks and seven months, both by Staeger, have been reported in the journals. As a rule, however, you will find that the frequent occurrence of rheumatism in infancy and childhood is resolutely denied, although every practitioner will have plenty of opportunity to come across non-congenital heart diseases at an early age. You have to-day seen three cases of the disease, two of which came here with a different diagnosis, and several have recently passed under your notice, while numerous old cases of endocarditis have presented themselves in the course of a short time. Thus, you are prepared to disbelieve the axiom that rheumatism is rare in infancy and childhood, and, on the contrary, suspect its rather frequent occurrence.[3]

While, however, it is frequent, it is rather different in many respects from the symptomatology of the same affection in the adult. I shall not occupy our time with a recapitulation of what you know from your lectures and other clinics. For this clinic has been established for the purpose of exhibiting the differences in the symptomatology, eitology, pathology, and therapeutics of the diseases of

[3] In this connection I may, however, add that uncomplicated, muscular rheumatism is rare in young children. In most cases, where it appears to be present, the muscular pain can be easily explained. In torticollis, there is often an affection of the spinal column, or a hemorrhage in the sterno-cleido mastoid muscle. Roger compares the torticollis of infants with the lumbago of adults, which is often traumatic, or the result of rupture of muscular fibres. Gubler found articular rheumatism, endocarditis, and chorea some time after muscular rheumatism. "Growing pains" are probably of rheumatic origin, in not a few instances.

infancy and childhood from the same class of disorders at an advanced age, and so of forming a sort of comparative pathology and therapeutics. There are several peculiarities, which I shall enumerate briefly: In the rheumatism of children, the swelling of the joints is often but trifling, and sometimes disappears after a short time. The pain corresponds with the rapidity and quantity of effusion, and is, therefore, not always excessive; it is even trifling, and easily overlooked in rachitical individuals in whom flabbiness of synovial membranes and ligamentous apparatus are two permanent characteristics. Redness is but slight, or does not exist. Temperature is but rarely very high, as long as polyarthritis is the only symptom, and sometimes even low, after the first attack of an acute endocarditis has set in. Increase of temperature may often appear suddenly, and can sometimes be traced to an embolic process.[4] Unless there is endocarditis, respiration is in proportion to the fever; perspiration is not copious, urine not scanty, not often loaded with uric acid. On the contrary, it is frequently copious (particularly in early complication with mitral incompetency and venous obstruction), and pale. The course of the disease is perhaps still less regular than in the adult. It may last a few days, or many weeks or months. It may depend on hereditary peculiarities in the structure of the synovial intima or it may be induced by neglect of skin, diet, etc. The relation of the sexes to each other as met with in adult rheumatism does not hold good in the infant or child. Exposure being a frequent cause, men will suffer more frequently than women. Of children, however, I have, I believe, met with more female than male patients. Our patients to-day are all of that sex, and the larger number of our heart diseases are also in girls.

[4] The child presented at the head of the list, had, on the 14th, P. M., a sudden increase of temperature to 104¾. At my visit the 15th, we found the systolic murmurs less, the first sound setting in in a normal manner, but terminating in a murmur. Evidently a segment was torn off, and deposited somewhere as an embolus, as yet we do not know where.

Visceral so-called "complications" are as frequent in young as in the old, indeed much more so. Pneumonia and Bright's disease are rare; the tendency is rather in the direction of the mucous and serous membranes. Pharyngitis, laryngitis, bronchitis, peritonitis, are met with, pericarditis and pleuritis are not at all rare. But you will find, that as well in these "complications" as in the original synovitis the secretion is more serous than fibrinous. Therefore, friction sound is exceedingly rare in both rheumatic pleuritis and pericarditis of infancy and childhood.

After this rapid review, let us look into some special facts. I said the urine is not so red, not so scanty, as in adults. This corresponds somewhat with the physiological conditions of the renal secretion in the young. In a child of three years the proportion of the weight of the kidneys to that of the whole body is 1:146; in the adult, 1:230. Lecanu found the whole amount of urine, in a child of three or four years, in twenty-four hours, 225-325 grammes (gr. = 16 grains). Scherer, in one of three and a half, 755; Rummel, in a boy of three, 885-904; in a girl of five, 698-722.

A kilogramme (two pounds) of the adult's body discharges 29.5 grammes of urine, 0.420 urea, 1.101 solids, 28.4 water; of the child's body, 47.4 grammes of urine, 0.810 urea, 1.515 solids, 45.9 water, in twenty-four hours. Salts are also increased in the child; mucus, extractive materials and uric acid are less by about one-half. The younger the child, the larger the proportion of urine and water, the smaller that of uric acid. According to Uhle the secretion of urine, urea and chloride of sodium, is treble that of the adult, uric acid being less in proportion. The urine of the newly born has a specific gravity of but 1,005 or 1,007. The amount of uric acid is in an inverse ratio to that of urea. Fever increases urea, according to Bartels, but not uric acid, as long as respiration is unimpeded. Therefore, copious deposits in the straight lobules of the newly-born, so commonly met with up to an age of three weeks, are the result of insufficient supply of oxygen, and diminish rapidly

where respiration is speedily and thoroughly established. They are found more in babies who have died of, or with asphyxia (Gerhardt, Dis. of Children, p. 4). The urine is particularly pale and light where mitral insufficiency is an early symptom of rheumatism, or where hydræmia is an early complication. This is to be feared because, as I have stated before, salts and nitrogen are rapidly eliminated through the kidneys, and besides, even in normal conditions, the amount of carbon eliminated through lungs and skin is almost twice as large in the child as in the adult (Scharling). Moreover, the fever, which would increase the amount of eliminated solids, is generally not excessive, and if high, seldom of long duration. The lesions required for effusion, and corresponding diminution of temperature, are generally not so thorough in the child as in the adult.

One more remark on the inflammation of joints in the child. Both traumatic and idiopathic inflammations are frequent. In infancy and early childhood there is less exposure, and therefore one great cause of rheumatism is eliminated. At that period of life the mucous membranes are more apt to suffer. The smaller joints are not so easily or so frequently affected as the larger ones; thus, those of the maxilla, sternum and vertebræ are seldom the seat of inflammations. At any age the joints of the lower extremities are more liable to disease than any other, because their synovial membranes are larger, and because morbid materials circulating in the blood are more easily deposited in the extensive network of blood-vessels covering the intima. Thus it is that the pyæmia of the newly-born is so very apt to cause suppurative arthritis of the knee-joint. Finally, the rapid growth of the synovial membranes, and of osseous tissue at the epiphyseal line of the bones, inside the joint, constitutes an important predisposition to pathological changes.

The cardiac manifestations of acute rheumatism exhibit in children a number of peculiarities. Their anatomical condition must necessarily be similar to that in adults. In both adults and children the mitral valve is most commonly affected; pericarditis comes next in frequency,

lesions of the aorta next, and myocarditis last. That endocarditis of the right heart is very rare indeed, I have stated before. In all ages the origin of the valvular affection is the same. The valves are simply duplicatures of the endocardium covered with one or two layers of pavement epithelium, and joined to each other by elastic and connective tissue. The incipient stage of valvular inflammation consists in the production of a nucleated blastema with elongation and new formation of blood-vessels and hyperplasia of the connective tissue. Later, the epithelium exfoliates, and fibrine is deposited on the abraded surface. The valve may thus harden and retract, or else in certain cases soften, yield to blood pressure, and permit the formation of aneurysms, or even perforation. Similar changes may occur over the whole, or part, of the endocardium.

What is the relative frequency of heart disease in rheumatism in infancy and children? Most authors agree upon one fact, viz.: that in early age the large majority of cases, rare though they be reputed to be, exhibit localizations in the heart. For instance, Picot finds these in 37 cases out of 47, Claisse in 14 out of 18. As far as my own experience goes, I can say that I look upon the absence of heart complication in rheumatism, at that age, as very exceptional. Further, I know cases in which endocarditis was for some time the only manifestation of the disease, this preceding all articular affections, and many writers on diseases of children have made the same observation. At the present time I am in attendance on an intelligent and delicate little boy of four years, who, with the exception of slight pain in the knee-joint through one or two days, which, but for the unusual care and attention of the family, might easily have been overlooked, has had no symptoms of rheumatism, except well-marked endocarditis, resulting in mitral incompetency. The large number of cases in which the final results of endocarditis—venous stagnation, bronchial catarrh, epistaxis, chorea, dropsy—are the first subjects of complaint, bear out this observation to its full extent. In many of these the history of the first rheumatic affection will

be remembered, in others it has never been noticed, or has been forgotten. This may happen so much the more frequently, as endocarditis itself may set in without much fever, or other symptoms; a fact which ought to be carefully kept in mind, and induce us to examine day after day, even the slightest case of joint affection, for its heart complication. Murmurs, in the beginning, when indicating serious lesions, will be accompanied with more or less rise of temperature. But when they are the result of mere congestion of the surface, and functional incompetency of the valves, no variation of the thermometer may be observed. Such a condition exists as well on the endocardium as on the intima of the synovial membranes. Or a murmur may be a temporary symptom of irregular contraction of the heart, the consequence of a true muscular rheumatism of its walls. For this, although rare, may coincide with acute articular rheumatism. In both of these instances the murmur is likely to disappear, after some time, in the same manner as it will cease with the cessation of functional anæmia in advanced age, or even after certain slight inflammation occurring in febrile diseases, as variola. In children, however, anæmic murmurs are very rare indeed. Yet the diagnosis of endocarditis is by no means beyond the reach of a doubt, for, although a genuine inflammatory murmur *may* disappear, the majority of temporary murmurs are of a non-inflammatory character.

As the frequency of endocarditis in the rheumatism of infants and children is indubitable, is there an explanation of the fact? I look for it first, in the anatomical and physiological peculiarities of the young heart. In the newborn child the heart weighs from eight to thirteen drachms, while that of the adult weighs eight ounces. Thus the adult heart has but six times the weight of that of the newborn. But the weight of the whole adult body is twenty-five times that of the newborn. Thus, the newly-born heart is four times as heavy, in proportion, as that of the adult. With this relative increase in muscular substance, increased activity of its function goes hand in hand. Again, the manner of circulation of the

blood-current must be emphasized. The circulation of blood, even in the large arteries, does not depend solely upon the action of the heart-muscle and the elasticity of the artery walls, but also upon the activity of the voluntary muscles. When these contract, the small blood-vessels are emptied; when they relax, these are filled by aspiration. This important factor contributing to rapid circulation is not so active in the infant, where the muscular system is but inadequately developed. Thus, the heart-muscle has to perform part of the labor which in advanced years is borne by the voluntary muscles. Nor is this all. From its ventricular orifice to the insertion of the ductus arteriosis Botalli the aorta is narrow in early age; the young heart has to overcome this narrowness, in fact, has to dilate the aorta to its later norm. With its labor corresponds its size, as the size of a voluntary muscle with its exertion. Thus, the heart of a baby of fifteen months is about as large as that of a child of five years. But not only will its size grow with its labor, but also its danger. Any organ with a rapid physiological action—be this action nutritive, that of growth, or dynamic exertion—is liable to become the seat of pathological changes. A fine illustration of this point is yielded by the statistics of heart diseases in the fœtal and post-natal periods. Before birth, the function of the heart is principally performed by its right half, after birth by the left. In consequence, the diseases of the fœtal heart are met with on the right side in ninety or ninety-five per cent. of all the cases, while the large majority of heart diseases after birth, in any period of life, are found on the left side.

While I laid these facts before you merely for the sake of proving that the danger of an organ grows with its work, and that the frequency of heart-complications in general rheumatism of the young is the result of its physiological dignity and labor, they prove something besides. You have heard that the large number of heart diseases in the newly-born and very young infant are confined to the right side; they are congenital. The large majority of heart diseases in the child of five years and upwards are found in the left side; they are acquired. What

does that mean? It means the statistical fact that the congenital heart disease seldom lasts into childhood; it destroys life. It means, further, that almost all the numerous heart diseases of childhood up to puberty do not date from birth, but are the result of the most common cause of cardiac disease—rheumatism. And with this consideration in view, I know you will never forget that the doctrine of the rare occurrence of rheumatism in the young is an illusion, and be prepared to look for and meet with this grave disorder in many instances.

The long list of manifestations of rheumatism in childhood is not yet closed, however. The anatomical equality of serous membranes, and the nature of the meninges of the cerebro-spinal cavities, render the effusion into these parts an *a priori* probability. But theoretical conclusions are not required where facts are frequent. For no complex of organs is so liable to rheumatic disorders as those constituting the nervous system. Not even peripheric nerves appear to be exempt, since Rigal observed the occurrence of a severe neuralgia of both face and abdomen, in a boy of fourteen, before the joints became the seat of the manifestation of the disease.

The attention of authors has been principally directed to the brain and its meninges. Symptoms of both irritation and depression have been noted. Hyperæsthesia, contraction of the pupils, hallucinations, oppression, melancholia and physical diseases in general, and coma, have been met with in many instances. Where and as long as the symptoms of irritation prevailed, the prognosis was generally favorable, symptoms of depression, such as coma, were invariably considered fatal. For it is a peculiarity of rheumatism, that its cerebral manifestations are more steady, less changeable, than are the symptoms of a common non-rheumatic meningitis or encephalitis. In post-mortem examinations a number of anatomical lesions were found in both brain and meninges. Anæmia, hyperæmia, meningitis, with œdema into the arachnoid, with effusion into the space between dura mater and pia, fibrinous deposits, thickening and adhesions of the pia, dilatations of the sinuses, fatty degeneration of blood-vessels, encephali-

tis in its different stages, softening of the gray substance of the large ganglia, emboli, and apoplectic deposits have been found. Over this array of conditions I pass so cursorily because I mean to add, at once, an important statement, viz., that they are principally based upon observations made on the adult. As a general rule, the symptoms resulting from affections of the nervous centers differ greatly in the young and old. Where you have delirium in the adult, you have convulsions in the child. The symptoms enumerated before belong principally to the sensitive sphere; the same effusions in the child affect the motory powers principally. Besides, there is a peculiarity in the rheumatism of the young already alluded to, which I think is mostly explained by the rapidity with which effusions take place in that period of life, viz., that fever is generally less in the rheumatism of the young, and consequently its anatomical results, of which I have spoken before, and which are very marked in the nervous system, are less pronounced. A further difference is this, that a fatal termination is less frequent in the young than in the adult. Thus, very few post-mortem examinations are on record. Such as are mentioned, however, and the nature of the disease, and its essential equality with the same affection in the adult, facilitate our conclusion that the local lesions must be of a similar character, though not of the same gravity.

I have said that the nervous disorder manifested in rheumatism is of the motory order. All of you have seen, in the course of your studies, a number of cases of St. Vitus' dance, or chorea minor. You remember that the principal symptom was the inability of the will to control the voluntary muscles, to adapt and coördinate them to a certain purpose. The children twist and twitch while sitting, contort their limbs, stumble in walking, stutter in speaking, and drop knife and fork, or use them inappropriately. This symptom is not developed at once. Now and then you learn a preliminary history—pain, restlessness, nervousness and disturbed sleep. The first appearance of the motor disorder is mostly observed in the right upper extremity; after a while the lower extremity of the

same side participates, and the rest of the voluntary muscles follow suit. In a large number of cases the affection follows this course; it is apt to be unilateral in the beginning. The sphincters remain unaffected. Not always, however, is the affection so general; frequently but a few muscles of the face, or face and neck, are disturbed. During sleep the contortions will stop. In some severe cases they may, however, continue. In these the contact with the bed, and involuntary contractions of the muscles suffice to result in choreic movements. Muscular efforts during dreams will have the same effect. Most patients are between five and fourteen years old. While, however, adults, such as pregnant women, are liable occasionally to chorea, the very young are by no means exempt. E. H. Richter reports a case of chorea in the newly-born; at the age of a few months it has been observed a number of times, and I remember a few cases at two and three years. The majority of patients belong to the female sex; they are mostly anæmic and thin, seldom in previous good health. Complications with nervous disorders of different kinds are not unusual; some of them are of a hyperæsthetic, some of a paretic, or paralytic, character. Both physical and intellectual efforts result in speedy fatigue. The intellect is sometimes impaired. Neuralgias, especially of the intercostal nerves, with distinct points of Valleix, are not infrequent. In a few cases I have noticed herpes zoster. In others there is unilateral paresis or paralysis, either contemporaneous with, or subsequent to, chorea; in others, epilepsy. Grisolle relates a case of chorea complicated with paraplegia, which terminated favorably in a few days; Trousseau, a similar one of chorea, paraplegia and rhachialgia; Picot, one of rheumatism, chorea, endocarditis and paraplegia.

Some of the patients have a hereditary tendency to nervous disorders. In their families runs insanity, epilepsy, hysteria or diabetes. Other etiological facts are, injuries, mental emotions, irritation, or exposure to sudden changes of temperature. Some cases are of reflex origin. Pharyngeal, intestinal and sexual irritations play a prom-

inent part in the etiology of chorea. Chronic pharyngeal catarrh, through its irritation of the trigeminus nerve, is a frequent cause of local chorea confined to face and neck. But the presence of worms in the intestinal tract is not so frequent a cause of disturbance in the young, with us, as in Europe. The prevailing belief in their influence is communicated to us from transatlantic countries, where the food of the working classes is very coarse, and worms are more frequent. This influence is exaggerated, no doubt; but sexual irritation is probably not estimated at its full importance. Masturbation is too common a habit amongst little ones to be overlooked; and still I know that the fact of its frequent existence is not sufficiently appreciated by my professional brethren. Bad habits and wickedness on the part of nurses, vesical catarrh and gravel, narrow prepuce and accumulation of smegma around the glans penis, vaginal catarrh and oxyurides in the rectum are just as many determining causes. But the main cause of chorea is rheumatism. The connection between the two was known, amongst older writers, to Stoll and Bouteille, later to Copeland and Bright, until in 1850 Lee and Botrel, and in 1866-68, in the *Archives Générales,* Roger made chorea and rheumatism the subject of elaborate and successful treatises. For a long time it was assumed that chorea depended on rheumatism through the intermediate link of endocarditis. Now, it is true that endocarditis is found in chorea; thus, Olge reports its existence ten times in sixteen fatal cases. But you have heard that endocarditis is but seldom absent in acute rheumatism of the young. Thus it appears, that chorea, endocarditis and polyarthritis are but the coordinate symptoms of one and the same affection. If acute rheumatism was the cause of endocarditis, and endocarditis or rheumatism the cause of chorea, we should always find those symptoms in the same order. The effusion of the joint would lead, endocarditis would follow, and chorea finish the series. It is, however, not so. You have heard that endocardical rheumatism may precede the inflammation of the joint; and in the same manner chorea may precede either endocarditis or polyarthritis. In a

boy of three years, I have observed general chorea four or five days before the slightest symptom of rheumatism was perceptible in the joints. When the joints became affected the choreic movements grew less. After a week the articular swelling receding, chorea became more prominent again. In this manner nerve and joint rheumatism alternated three times in the course of two months, until finally the case wound up with a mild endocarditis, terminating in insufficiency of the mitral valve.

There must be some lesion either in the organ of the will (Klebs), or the center of coördination (Cyon), or some other part of the nervous center which causes the peculiar symptoms of chorea. The readiness with which the majority of cases get well, either temporarily or permanently, appears to prove that in this majority of cases the anatomical change can certainly not be very great. But an alteration in the nutrition of the parts we shall have to assume, leaving out of sight the few reported cases of cerebral tubercle, hypertrophy of the odontoid process, cerebral hypertrophy, and softening, which, resulted amongst others, in choreic symptoms. The alterations effected by fever alone vary with the height of temperature. Any long-continued change in the blood-vessels must result in serious changes of nerve tissue, probably of an anæmic character. Whatever changes take place, are probably most perceptible on the left side of brain. For the left carotid is the more direct route to the brain; its size is greater, the nutrition of the left brain more active; consequently the right side of the body more thoroughly innervated. In the same manner, and according to the principle that pathological action is liable to be in proportion to the degree of physiological function, the left brain is the seat of pathological lesions. A lesion in the left side of the brain is the principal cause of aphasia (complicated with right hemiplegia). So chorea begins on the right side, and there also are found some of its complications, such as paralysis. Of all the lesions, from simple hyperæmia to inflammatory changes and embolic infarctuses, each can lead to chorea, and such cases as are observed with long duration and great severity,

fatal termination, or complication with paralysis, belong to the latter class. As the majority of cases are, however, temporary and mild, it is to be assumed that slight nutritive changes in the nerve centers are frequently the only causes. Restitution of these to their normal condition, would, in a month or two, relieve chorea. Thus the ready action of arsenic in most cases would be explained by its effect on nutrition and assimilation in general.

Hitherto, I have spoken of chorea as principally connected with lesions, or nutritive disorders, within the cranial cavity. There is one form, however, which is by no means very rare, and still has not been described, as far as I know, as fully as it deserves, viz., that class which depends on hyperæmia or inflammation of the spinal meninges. Brown-Séquard observed that dogs suffering from chorea would still remain choreic after the spinal cord had been separated by a cross-section in its upper part. Onimus and Legros have rendered dogs choreic by injuries to the posterior roots of cervical spinal nerves and posterior gray column of this part of the cord. They place the seat of chorea here. In my own experience, spinal meningitis of the upper part is a frequent cause of chorea. Fifteen years ago, I reported the case of a girl of nine years who was presented with a violent form of chorea, the contortions of which exceeded anything I had ever seen before. The attack had come on very suddenly; the child had been perfectly well before. It struck me that the face was less affected than the rest of the body, and thus my attention was at once directed to the upper part of the spinal cord. Pressure on the cervical portion, especially the spinal processes was exceedingly painful, and increased the spasmodic actions.—Was the pain simply neuralgic? or was it inflammatory? The thermometer answered the question very readily: The temperature was 104, and remained in that vicinity for another day. Ice, ergot, with purgatives, relieved both the meningitis and chorea within a week, confirming the theory of the etiology by the result of the treatment. This case is by no means a solitary one. I have seen a number which were just

as marked as this one, and a great many besides in which fever and the extent of the inflammation were not so well marked. One of this kind was presented to you a fortnight ago; you remember a choreic girl of nine years, in whom pain, on slight pressure upon the cervical portion of the vertebral column, was very perceptible. In this case also the thermometer had to decide the character of the pain, whether neuralgic or inflammatory, and the etiology of the disease. The temperature ranged from 101 to 102, on several days, without any other symptoms to explain this rise of the temperature but the spinal affection. Mark the slightness of the increase, in that case, and remember that in the large majority of cases of subacute spinal meningitis the thermometer does not rise so high. For that reason it is important to avoid every possible source of mistake in your measurement. We have, therefore, preferred to measure in the rectum, rather than the axilla.

The differential diagnosis of acute rheumatism is but rarely difficult, though many of the symptoms belonging to the joints are not well pronounced in the young. Still, mistakes are possible. Inflammation of the tendons, or the subcutaneous tissue in the neighborhood of a joint, may mislead the careless practitioner. Foreign bodies in the joint, contractions of tendons, ought not to deceive a careful observer. "Growing pains" are not infrequently inflammatory rheumatism, and many an endocarditis of later years may be traced back to the "growing pains" which are but dimly remembered. In many instances, however, they are but the expression and result of muscular fatigue. Thus, sensitiveness and pain are the result of a chemical change taking place in the muscular tissue, in which phosphate of potassa and lactic acid are accumulated through over-exertion. When those products and their elimination are proportionate, no pain is felt; when the former is increased while the latter is retarded, the result is evident. Therefore, not only physical over-exertion, but insufficient circulation also results in the sensation of painful exhaustion. The latter acts through its tardiness in relieving the tissue of its cast-off material, and thus you under-

stand why " growing pains " (not rheumatic) are so often noticed in pale, anæmic children.

An occasional source of error may arise from swelling of a joint resulting from hemorrhage into its cavity, lesion characteristic of that singular congenital disease, hæmophilia. Some of you recollect a boy of five or six years presented a few days ago in my clinic at the College of Physicians and Surgeons. His history yielded nothing but this, that after he was six months old, a tendency to bleeding became apparent. A slight cut would not close, nose-bleeding was frequent, subcutaneous and cutaneous hemorrhages took place on the slightest provocation, and when we saw him there were blue, black, yellow, green discolorations on several parts of the body, viz., both forearms, glutæal regions, left scapula, left knee, etc. The left knee, besides being discolored, was considerably distended. The swelling had begun, two days previously, quite suddenly, without any fever, and at the commencement without pain. There was no fever when presented, but considerable pain both spontaneous and on pressure, the result of the sudden lesion of the synovial membranes. Look out, then, for enlargement and inflammation of the joint, in cases of purpura, scurvy, and hæmophilia. When you take the accompanying symptoms into due consideration, you ought not to be mistaken, however, in your diagnosis.

Not quite so easy, sometimes, will you find, at your first visit, the diagnosis from some affections of the bones. In infants and children, the bones, before their final ossification, which is not entirely completed before the twentieth year, are more succulent, softer, and endowed with a more extensive circulation than in advanced years. Osteomyelitis, however, can hardly be mistaken for joint disease, as it is confined to the diaphysis and reaches the epiphysis only through participation in the morbid process of the periosteum. In these cases a serious suppuration extending up to the joint may complicate the diagnosis. But such affections are, happily, rare, except, perhaps, in syphilitic tuberculous, or scorbutic individuals. But the very neighborhood of the joint, or rather the epiphysis of the

bones, and the intermediate cartilages between the epiphysis and diaphysis, are occasionally the seats of perplexing processes. You know there is always a lively physiological action going on at the boundary line between the two, which is restricted by increasing ossification only. This latter takes place in different bones at different periods of life. The direction of the nutritive arteries determine its period. Where they converge, as at the elbow joints, ossification takes place early; where they diverge, later. Therefore the knee-joint is exposed to osteochondritis more than any other, as well for pathological reasons as for mechanical ones. The intermediate cartilage is very apt to be destroyed by an inflammatory process. Suppuration may take place, the epiphysis secede from the diaphysis, and the joint get filled with pus. Thus, many an acute case of arthritis may puzzle you as to its original source. In the hip-joint especially, the determination of an only or principal cause of coxitis, and its original seat, may be rather difficult. For at birth, the upper epiphysis of the os femoris comprehends head, neck, and both trochanters. A few years afterwards, by progressive ossification, the neck forms part of the diaphysis, while head and trochanter major constitute each a separate epiphysis. Finally, however, the trochanter also undergoes the process of ossification, and the head alone remains, for many years, in its epiphyseal condition.

In conclusion, I have to speak, from a diagnostic point of view, of disorders of a nervous character which are the more perplexing to many medical men, the more they have been accustomed to look upon nervous (hysterical) symptoms as the privilege of the adult female. But the male sex may become hysterical, and the child certainly will in many instances. Now, I cannot here go into the question to what extent hysteria is found in childhood. Remember but this, until we shall find an opportunity to return to the subject, that nervous symptoms of the most serious types are not excessively rare in children, and are more than simply indicative of what will occur in future. Well-developed neuroses of the motory, sensitive and vasomotory nerves are by no means exceptional in child-

hood. A girl of about eight years was under my treatment for some time, for a neuralgia of the right ulnar nerve, without fever or spinal complication. After some time a moderate swelling of the subcutaneous tissue of the carpus, and in the neighborhood of the shoulder-joint, was added to her difficulties. They disappeared, to be replaced only by a very severe neuralgic pain of the toes of her right foot. Her sufferings were intense for a long time; they appeared to be mitigated when an œdematous swelling of her right foot made its appearance. A protracted tonic and galvanic treatment was required to restore her. Another girl of five years was presented for acute rheumatism of the right shoulder joint, which was said to have lasted several weeks, and to be very painful. There was excessive sensitiveness to the slightest touch, and some swelling. But it struck me that since the commencement of the attack neither the heart nor another joint were attacked, that there was no fever, that deep pressure produced no more pain than superficial, that the pain extended over the n. thoracicus longus as well as the shoulder and upper arm; and finally, that the swelling was not exactly in the shoulder-joint, but above, nearer to, and to the rear of the acromial end of the scapula. Thus my diagnosis was secured. I had to deal with a neuralgia of the cervical plexus, and not with rheumatism. Just at present I have under observation a boy of eight years, who has a slight mitral incompetency, contracted while suffering from chorea some years ago. Two months ago he was attacked with rheumatism of both wrists, knees, and ankle-joints. A number of the joints of the feet took part in the process. There was moderate fever and distinct swelling of wrists, knees, and ankles. After some weeks his fever was gone, and swelling very moderate indeed. Still his complaints grew no less; he was taken with sudden attacks of excessive pains, gave rise to screams and yells, commencing about dark, and lasting all night; was very sensitive even in daytime to the gentlest touch, and exhibited such a disproportion between his objective and subjective symptoms that my suspicion was directed to other quarters than before. Then I recollected that in periods of great men-

tal anxiety, his father, many years ago, suffered from very severe and well-pronounced attacks of hysterical convulsions, and that his mother, a refined, intellectual and neurotic woman, while the subject of oöphoritis, had been disturbed by neuroses both peripheric (mostly neuralgic) and cerebral. My little patient had no more fever for some time; there was hardly any swelling left; he was quite comfortable at certain times, screamed fearfully—without tears—on the slightest touch on certain points, and got frequently quiet under protracted and deep pressure, particularly when his attention was diverted to other quarters. The pain was, and is, not confined to those points mostly sensitive in sciatica; in fact there is no pain about the hip-joints or the sciatic notches. A number of cutaneous branches of the crurals are affected, as also the ramifications of the synovial membranes. At the same time, neither heart nor spinal cord participates in the process. The inflammation of the joint has been the cause of irritation in the sensitive nerves of both synovial membranes and skin. In accordance with the diagnosis of neurosis (neuralgic only, no vasomotor complication being present), the treatment has been changed long ago. Iron and galvanism, with roborant diet and warm bathing, are the remedies on which I am at present relying, with a satisfactory, though slow, result. In all these cases I have, while I related them to you, pointed out the pathognomonic symptoms of importance, and, therefore, do not repeat them. Nor can I, at this occasion, relate cases of the same nature, though with different symptoms. However, I desire to impress upon your minds again the variety of forms and seats of a neurosis of this kind. It may be mixed in character—motor, sensitive, and vasomotor. Paralysis or paresis, neuralgia, local eruptions and redness in certain territories of blood-vessels, local chills, perspiration, œdema, are thus explained. If not so mixed, neuralgic only for instance, this neurosis is very puzzling in the selection of its locality. The styloid process, the internal condyle of the femur are pet places. But any cutaneous branch, no matter whether near a joint, or on the general surface, of the sciatic, crural, obturator, saphenus, tibial nerves may prove the source

of annoyance and suffering. In the adult, the "spinal irritation" of the public (formerly of the profession also) is mostly but a cutaneous or meningeal neuralgia.

The indications for treatment of acute rheumatism vary according to the character of the affection and the affected locality. Inflamed joints must be rested, local and general heat reduced, hyperæmia removed, exudation and internal pressure diminished, and pain relieved. A few remarks will probably suffice to point out the means of obtaining the required results as far as possible.

The inflamed joint, or joints, can be rested on wire, wood or plaster splints, lined with cotton. In what position? An experimental injection into the knee-joint of the dead body determines moderate flexion. (Bonnet.) Thus it appears that this slight curvature is the easiest position for the diseased joint; it is that in which the cavity is the largest. But when the disease appears to last long, another consideration comes up. For some time after recovery the joint will not be available when flexed, although the result may not at all be an anchylosis. Thus it depends on individual cases whether the joint is to be fastened in either extension or flexion.

Local and general depletion have been recommended. The latter diminishes the temperature, but does not prevent it from speedily rising again. Besides, it increases hydræmia and the amount of fibrine in the blood; both of these conditions facilitate effusion. Thus, you will hardly meet with a case in which general depletion will appear required. Local depletion has no such lasting ill-effect. But still its indications are limited; for there is but a limited vascular connection between the skin and joint. Besides, the intima which is hyperæmic is separated from the surface by the mass of the synovial membrane, which has but a scanty supply of blood-vessels. Moreover, the vessels of the surface and the synovial intima belong sometimes to different vascular territories. On the knee-joint only matters are a little more favorable, and, therefore, now and then a small number of leeches will prove beneficial, at least temporarily.

A better effect on the dilated blood-vessels is observed

by the application of ice. It contracts blood-vessels, reduces the temperature, and prevents effusion and suppuration. For all of these purposes it is more reliable than any other application. Thus we are, as for other beneficent innovations, under great obligation to Esmarch, who has introduced ice into the treatment of arthritis. It is indicated in the acute stage, where swelling is considerable, and temperature high. While, however, it renders the inflamed parts anæmic and prevents effusion from taking place, it also prevents absorption of the effusion. Thus, after the swelling and temperature have been reduced, the indication for ice has passed. Then it becomes necessary to increase vascular pressure and stimulate the lymphatics by warm applications. Poultices, warm water, cold applications which remain long enough to become warm, and warm baths take the place of ice.

Thus the internal pressure is relieved. Now and then, where this pressure is felt to a disagreeable degree, and the neighboring muscles are affected with reflex spasms, distraction of the joint, by extension, is recommended on the plan which is followed in chronic coxitis. In most cases, however, this method is inappropriate, because too painful. A frequent method consists in local derivation. For that purpose both vesicatories and tincture of iodine are recommended. The former may either be kept on until vesication has taken place, or removed when the skin has become hyperæmic, and their application repeated. The latter acts favorably by causing dilatation of external blood-vessels, over a number of joints, and by thus relieving the internal congestion. Theoretical reasoning, more than actual proof, relies on the presumed stimulation of the vasomotor nerves of the interior by the external irritant. From these several points of view, the use of stimulating embrocations may be considered. In chronic cases they may do good (friction only will oftentimes)—in acute cases they will prove injurious.

When, after the reduction of fever, a sufficient time has elapsed for us to believe that no further absorption of effusion will take place, or where a fibrinous exudation in the joint remains stationary, with or without the compli-

cation of subcutaneous œdema, gentle compression is required. Collodium, flannel bandages, cotton with linen bandages, elastic bandages, plaster of Paris will be found serviceable. Puncture of the joint cannot be objected to when the contents are purulent. Extravasations of blood contraindicate puncture; and serous effusions will require it in those rare cases only in which the effusion is very copious, of very old date, and the synovial membranes greatly expanded and in an abnormal condition. In a few such cases I have opened the joint with a fine trocar, always taking care that neither the cartilage was hurt nor air admitted. Dieulafay's aspirator has been successfully used for this purpose.

In this connection I ought to speak also of the galvanic current as a means of producing absorption. Mild currents passing through the joints from one to three times daily, and from five to ten minutes, each time, have a beneficial effect. When obtained, this may perhaps be attributed to a tonic influence exerted upon the walls of the blood-vessels and lymphatics; in virtue of which the rate of circulation is increased.

Finally, the indication for directly relieving pain may require the application of chloroform, belladonna, opium, or veratria, according to circumstances, in lotions or ointments. Severe pain may necessitate a subcutaneous injection of morphia. Atrophine has been used in the same way.

Hitherto, gentlemen, I have spoken of external applications only. Internal medication is resorted to upon the same indications which have been set forth. To relieve vascular pressure, aconite, digitalis, veratrum, colchicum, or quinia, are administered. Whichever you may select, do not forget that all of them require larger doses than the usual proportion-tables in your text-books on materia medica appear to justify, and further, that whatever effect is to be obtained, must be secured speedily. The inflammatory process is a very rapid one, and the prevention of its spreading and resulting in copious effusion is worth while accomplishing. On veratrum I rely where the reduction of the pulse is a principal object; aconite and

digitalis are slower in their action, but may be continued for a longer period. The beneficial effect of these different cardiac sedatives is more perceptible in the quality of the pulse—which becomes softer—than upon its rapidity. The general rule is to push the dose until the pulse has fallen considerably, but not to the norm, then to maintain the dose for two or three days; then cautiously diminish. At any rise in the pulse, the dose must be increased, for a recrudescence of the articular affection is threatened. This rule holds especially for quinia. Veratrum is, in careless hands, the most dangerous of the cardiac sedatives, and cannot be handled so freely. The dose must often be diminished more rapidly, lest the vascular sedation become excessive.

The effects of quinia have been studied extensively in the last seven or eight years, and a vast amount of literature has been accumulated through the combined efforts of investigators of all countries. Although their results have been meagre, they are still positive enough to justify its intelligent administration. Several facts appear to be estabished: First, that in spite of Briquet's apparently conclusive results, quinia has no direct effect upon the nervous system, either cerebral or peripheric. No effect on the sympathetic and pneumogastric nerves has been produced, and the effects upon circulation are not brought about by any direct action of its own on the vasomotor nerves or the cerebrum. For when the medulla is cut, quinia will reduce fever, although the connection between blood-vessels and brain is destroyed. Secondly, it reduces the amount of uric acid in the renal secretion, also the number of white corpuscles in the blood, and, when given in sufficient doses, depresses pulse and arterial pressure, and reduces the temperature. In frogs, it reduces reflex irritability also. Besides, it acts as an antifermentative by interfering with the chemical decomposition of animal material. Now the qualities enumerated above render quinia the principal antiphlogistic. Amongst the prominent symptoms of inflammation we count the increase of white blood-cells, the dilatation of blood-vessels, the slowness of local circulation, and the accumulation, stoppage, amœboid

changes, and finally emigration of white blood-cells. (Serous effusion is a co-ordinate effect of the mechanical obstruction.) I can imagine that the increase of white blood-cells alone suffices to bring about all the other changes. Remember that in the capillaries circulation is two-fold: in the centre the rapid motion of the red blood-cells; along the wall the slow, easily retarded, pushing along of the leucocytes. The simple fact of their considerable increase obstructs circulation both of themselves and their comrades more advanced in the scale of animal perfection. They rest, crowd each other, become unwieldy, assume different amœboid shapes and motions, press on the thin walls of the capillaries, and force their way through the dilated interstices. The mechanical obstruction in and dilatation of the smallest vessels acts on those of larger size behind them, which, although of normal consistency and function, will also become dilated. Quinia, by reducing leucocytes permits the capillaries, which have no elasticity of their own, to resume their original size under the pressure of the outside tissue, and the larger blood-vessels, endowed with an elastic adventitia and muscular layer, to contract over the reduced sizes of their contents.

At all events, no matter whether this attempt at simplifying an apparently intricate subject covers the whole ground or not—(I believe it does)—this fact is sure, that quinia has conquered its place at the head of the antiphlogistic remedies. Do not forget, however, that small doses have no such effect. When indicated at all it ought to be given in a dose of five grains, once, twice, or three times daily, to a child of one or two years. What I taught more than fifteen years ago—that quinia and vascular sedatives in general are tolerated and required by the young in apparently disproportionate doses—is acknowledged as correct by the theory and practice of a large portion of the profession at the present time. I will only add, that you ought to be certain of the solubility of your preparation. The sulphate ought to be avoided. Select the bisulphate, or better, the muriate, and never forget that the stomach absorbs less under the influence of a feverish condition. The question of subcutaneous administration of

quinia in rheumatism, has, I believe, not yet been mooted. But it is as plausible as for intermittent fever. When the stomach rebels against the remedy, the rectum may take its place. But it will absorb nothing unless in solution.

The majority of the remedies which are recommended in apyretic rheumatism are either absorbents or derivants. Iodide of potassium (or sodium) acts as a diuretic, and, furthermore, appears to restrain the transformation of cells into connective tissue. Thus, it is effectually used, as soon as the acute stage of rheumatism is stayed, in pleuritis, pneumonia, glandular affection, and inflammations of the connective tissue in general. As soon as "organization" of exudations has taken place—that is, as soon as hyperplastic connective tissue has resulted from the nutritive disorder, the remedy proves unavailing. You know, for instance, from what I formerly said about the difficulty of reducing the size of tonsils or lymphatic glands in a chronic condition of enlargement, that in such cases the knife has to take the place of internal remedies. Thus, what effect you hope to obtain from the administration of iodide of potassium, ought to be looked for soon. No matter whether the rheumatic manifestation takes place in the joint, heart, or nervous centre, the iodide ought to be given early, immediately after the fever has been subdued, in doses of from fifteen grains to a drachm or more, according to age. Whether colchicum has any effect besides being an arterial sedative, and acting upon the mucous membrane of the intestine, is doubtful. The same may be said of colchicine. In three or four daily doses of $\frac{1}{150}$ of a grain each, which may be gently increased from day to day, to a child of four or five years, it is apt to produce vomiting and diarrhœa, with occasional relief to the general symptoms. Alkaline salts have been praised for their effect upon neutralizing supposed acids contained in the blood. You have heard that this acid condition is doubtful, and know that the amount of uric acid in the urine of children, no matter whether rheumatic or not, is not large. If it is an object, however, to neutralize uric acid, you will perceive at once, that potassa salts are better

suited than those of soda. The former combining more readily with uric acid than the latter, bitartrate of potassa, or citrate of potassa, would be preferable to Rochelle salts or Vichy water. Their principal effect is, probably, besides the increase of intestinal secretion, to be sought for in the larger amount of urine, the secretion of which increases with its alkaline condition.

The indications for therapeutical interference in the manifestations of rheumatism in heart, brain, and spinal cord, differ hardly from those in the joints. The application of ice, the use of digitalis, aconite, quinine, iodide of potassium, follows the general rules. Endocarditis, and particularly pericarditis, require the immediate and constant use of ice, which will prove the more beneficial, the nearer to the surface the affected locality. Hence its beautiful results in pleuritis and laryngitis. When the acute stage has passed by, you need not fear the use of warm bathing of about 90° in heart diseases any more than in other subacute or chronic inflammations. The atheromatous degeneration of advanced age may contraindicate them, but no excitement of the heart's action is to be feared in children, in whom atheromatous degeneration scarcely ever exists.

I shall conclude with a few remarks on the choreic manifestation of rheumatism. Of the large number of remedies which have been resorted to, I rely principally on arsenic. I have alluded to that before. Next in order I consider bromide of potassium; last, nitrate of silver, or atropia. Rest is secured by chloral-hydrate, or large doses of bromide of potassium; the muscular irritability soothed by subcutaneous injections of woorara. Very efficient in protracted and feverless cases, as also in chronic cases of rheumatism in general, is a daily bath containing from three to five ounces of the sulphide of potassium, and the galvanic current. In several instances a moderate current conducted through the whole length of the spine has moderated severe forms of chorea, after therapeutical agents have proved unsuccessful. Most of this may have been known to you. What is not so commonly known, is my treatment of those cases of acute chorea depending

upon meningeal or medullary congestion or inflammation, of the pathology and diagnosis of which I have spoken before. Antifebriles, mild purgatives, ice, sometimes tincture of iodine, and principally ergot, have been relied upon in my own practice. I conclude with a single remark upon the dose of the latter. I am positive that its failures are mostly due to insufficiency of doses. For some observers in this city have acknowledged that, after experiencing many failures with small doses, they know of no remedy the effects of which are more reliable than ergot since they have increased the quantity of the drug. Less than half a drachm of Squibb's Fluid Extract I rarely give. I repeat this dose three or four times daily. A child of four or five years may take from two to four drachms daily, for many weeks in succession. Bad results I have never seen. With the exception of a few cases recorded in the journals, the stories of poisoning, epidemic or otherwise, acute or chronic, concern individuals or communities whose constitutions were previously broken down by long-continued misery and starvation.

THE MEDICINAL, MAINLY MERCURIAL, TREATMENT OF PSEUDO-MEMBRANOUS CROUP

In 1868 I formulated the indication for the performance of tracheotomy in pseudo-membranous croup as follows: "There ought to be no contraindication when the prominent symptoms are dyspnœa and suffocation. I cannot imagine any complication of croup that would prevent me from opening the trachea when the child is dying of suffocation. This is so plain to my understanding that I should consider it even a cruelty, in many cases, to refuse tracheotomy, when I knew beforehand that the child was surely going to die from other causes. Whoever has seen children die of croup, fully conscious, gasping, raving for air until they are slowly strangled in your arms, under your eyes, will bless a proceeding the consequence of which will at least be an easier death in most cases. Nor do I acknowledge that tender age, that under two years, ought to be held up as contraindication to the performance of the operation" (*Journal of Obstetrics*, vol. i., May, 1868, p. 49). And on page 57: "While I admit that with symptoms of general diphtheria complicating a case of laryngeal diphtheritis, called membranous croup, the prognosis of the operation becomes more doubtful, I lay stress on the fact that even in such cases the only indication for the operation rests in the local obstruction. For it is easily understood that while general diphtheritic poisoning with insufficient obstruction does not indicate tracheotomy, it is just as plain common sense that suffocation from obstruction of the larynx complicated with a constitutional affection requires the only possible relief just as urgently as suffocation from obstruction of the larynx without such a complication. Seeing a person suspended by the neck and being strangled, we should

hardly investigate into the propriety of cutting the rope from the point of view that the sufferer might be, or is, effected at the same time with tuberculosis, carcinosis, or diabetes." Such are the principles which have guided most of those who have operated. The result has been that Monti could collect 12,736 cases of croup with general diphtheria, 3409 of which (26.7 per cent.) were saved by tracheotomy. Those indications for tracheotomy in croup are still valid. I did not discover them, but I understood them and acted in accordance with them almost ten years previous to my writing. At that time I was not at all in the fashion, just as little as those who frequently operated before me, viz., Drs. von Roth, Krackowizer, and Voss. On the contrary, the question was seriously asked if Dr. Jacobi did not cut *altogether too many* throats. I refer to that fact because it is always instructive to turn to the history of theories and facts in our science and art. Now, since that time the drift of public opinion has entirely changed. What I insisted upon as a necessity, viz., that amongst the few operations every general practitioner ought to know, and be prepared to perform any time, tracheotomy was the foremost, has been appreciated since to its full extent. I feel certain that hundreds of practitioners in this city have performed tracheotomy, or are capable, willing, and anxious to perform it. The extent of this change is very great indeed. One of the proofs is certainly the fact that renowned gentlemen, who are identified in the respectful opinion of the professional public with what has been called internal medicine, commenced and carried on an instructive and valuable discussion on the surgical treatment of croup, in this very hall. The unity of medicine cannot be better proven than by that fact, and in order to prove my appreciation of the same, and of the necessity of keeping together the disjointed members of the body medical, which threatens to be dissolved into soulless and spiritless specialties, I may be permitted, after having performed four hundred or more tracheotomies myself, and witnessed several hundred besides, to claim a little attention for the consideration of some points concerning the medicinal treatment of pseudo-membranous proc-

cases in the respiratory organs, which has been given up by very many as well-nigh hopeless.

Two cases of pseudo-membranous croup were treated in my service in Mount Sinai Hospital in the following manner: The patients, one less, the other more than two years old, were kept in a temperature of somewhat more than 70° F., under a tent which was filled with steam and the vapor of turpentine, as I shall detail afterward. They were given besides $\frac{1}{30}$ grain of pilocarpium muriate, according to the method of Guttman. Neither of the cases was or became severe, neither of them was septic. I make that statement because I believe it to be important in regard to the value to be placed upon the recommendations of Guttman in general. Altogether I have not modified my opinion on the efficiency of the drug expressed during the sessions of the American Medical Association of 1881, about eight months after the first article of Guttman, on the efficacy of pilocarpium in croup and diphtheria made its appearance. Its statements appeared exaggerated, the drug was recommended as a specific, no case ever so severe or septic was said to be inaccessible to its healing influence. My first experiments were, therefore, made with septic cases, both pharyngeal and laryngeal. In every one of them I fully believe I accelerated the fatal termination by hastening cardiac failure. But in a number of cases I do not hesitate to state that the softening, macerating, disintegrating effect of the copious secretion brought about by the jaborandi preparation was quite marked. One of the cases in the Mount Sinai Hospital got well. The other got better, but the pulse became frequent and small, the general strength failed, and the treatment had to be given up after three days. The same results I have obtained in private practice. A child of but a little over a year did not tolerate the debilitating effect of the pilocarpium more than two days, in spite of careful alcoholic stimulation. The final recovery I was always inclined to attribute to two factors, viz., 1, the macerating effect of the drug; 2, the timely withdrawal of the treatment with pilocarpium, while the rest of the treatment was continued. One case, three years old, I have seen recover

with a fair amount of strength after having been imprisoned in a tent four days. A few more had to be discharged from it for fear of fatal exhaustion. My final opinion is, therefore, that the effect of pilocarpium is certainly a powerful one, inasmuch as it increases the secretion of the mucous membranes of the respiratory tract and thereby facilitates the maceration of the pseudo-membranes, but that its debilitating effect must be watched and counteracted constantly and necessitates the interruption of its use in a great many cases.

In many, steam inhalations have been a powerful adjuvant in the treatment of croup. My opinions, as expressed in my "Treatise on Diphtheria," have not changed these four years. I then said, in regard to their administration:

"Quite remarkable effects have been expected of, and claimed for them. It is true that pseudo-membranes, like everything else, become softened by the warm vapors. It is also probable that steam increases the secretion of the mucous glands, and thereby possibly loosens the overlying membranes and favors their removal, but it must not be forgotten that it also softens the healthy tissues, and that this change in character enables the poison, whatever be its nature, to penetrate more deeply into them. These two hypotheses must be kept in mind when, in any case, the question of the employment of steam arises.

"Steam for the purpose of softening the tissues and of provoking the secretion of mucus and suppuration has been used to a considerable extent; in fact, in England and America it constitutes an important part of the treatment of diphtheria of the larynx. The patient must inhale it directly from a vessel, or in a tent which is more or less closed, or breathe the atmosphere of the room after it has been saturated therewith. For the latter purpose, water is kept constantly boiling, or lime slaked, or red-hot stones put in water from time to time. The results from this procedure in diphtheria of the larynx have not always been pleasant. I have repeatedly had the joy of seeing children with croup become less cyanotic after their removal from an atmosphere of vapor, and I can readily see that

pure atmospheric air would be more agreeable and wholesome to a child with stenosis of the larynx than an atmosphere laden with steam.

"I have seen cases of fibrinous bronchitis getting well, when I had every reason to attribute the recovery to the persistent use of steam. I have known a baby locked up in a small bath-room, with one window, the hot water running persistently for days, filling the room so as to produce a constant fog, and make every person in the room drip. The result was highly gratifying; the baby got well, and so did another, whom I had the good fortune to benefit by my experience in that case. Again I insist, steam will improve, steam will impair. Individualizing is a great art. In regard to the steam therapeutics, it is, however, not too difficult. Its object is to soften, but principally to increase the secretion from the mucous membrane, and thereby throw off the superjacent membrane. This can be done to advantage only where there is a natural tendency to it, that is, where there are a great many muciparous follicles under a cylindrical or fimbriated epithelium. This is the condition on part of the pharynx, but not on the tonsils; in a small portion of the larynx, in the trachea and bronchi, not on the vocal cords. Wherever there is pavement epithelium on the normal surface, and where the membrane is imbedded into the tissue, steam can hardly be expected to do good. In the other cases it will. Thus the locality of the diphtheric process determines to a great extent whether steam is indicated or not. If it be used, the necessity of a full supply of atmospheric air must not be disregarded. Steam, with an overheated room and without pure air, is liable to be as injurious as steam in pure air is beneficial in a number of cases." I may say in most cases; for though the number of muciparous glands may be small in some places, the macerating effect of vapor is always observed to a certain extent.

I may be also permitted here to refer, in regard to the inhalations of turpentine, to what I published on page 186 of the work alluded to.

"For years I was in the habit of using turpentine, either the oil or the rectified spirits, as an inhalation in

bad cases of pneumonia, where hepatization was very extensive, and expectoration and resolution did not commence, with very good results in children and adults. The vapors of turpentine are so volatile and penetrating (and certainly the procedure of Taube so disagreeable to the patient, if it be permitted at all by children) that the usual method of inhaling from an apparatus appeared to me to be very superfluous. I allow the patient to remain in his bed, and keep water boiling *constantly* on an alcohol lamp, on the stove, or over the gas. A tablespoonful of spir. rect. or ol. terebinth., more or less, is poured on the water, care being taken that nothing is spilled in the fire. Thus the room is constantly filled with a penetrating odor of turpentine, which is not at all disagreeable, even when in great concentration. The effects are very satisfactory indeed. Where circumstances allowed or required it, I raised a tent over the bed, large enough not to give inconvenience to the patient, and to admit either the whole apparatus or the tube containing the mixed vapor of water and turpentine. This plan I followed in many cases, also in the case of laryngeal diphtheria of a girl of two years, in the children's service of the Mount Sinai Hospital. The baby was in a room of her own with a nurse. A tent was raised over the bed. Four days and nights was she exposed to the water and turpentine treatment, awake or asleep; not only she, but also the nurse, whose presence under the tent was insisted upon by the patient whenever she was awake. It ought to be stated that the case was not (or was not allowed to become?) a very serious one. It was serious enough to be diagnosticable, to produce hoarseness, aphonia, dyspnœa, and to render the perception of pulmonary murmurs impossible; but there never was cyanosis, with the exception of a slight hue on the upper lip. She got well with no other treatment but by iron and pot. chlor. solution. As a practical addition, I may say that the nurse did not suffer much more than she would have done after the same time passed in a close room, and in constant attendance upon an exacting and whimsical patient."

Now, Mr. Chairman, I take it for granted that when

a number of practitioners give up part of an evening to listen to a fellow-member, they expect that he will not tell them what he copied from text-books for his benefit. I therefore abstain from enumerating the remedies in and out of the Pharmacopœia which have been recommended in the treatment of croup. With your permission I select one now for discussion, which is not new, it is true; but the historical view I deem necessary will prove that the consideration of mercury in its application to cases of pseudo-membranous croup is still advisable.

Samuel Bard administered calomel in doses of three or five grains daily. Rush also recommended calomel in his "Medical Inquiries." Bretonneau employed the same, and also inunctions of blue ointment. After their use he observed the cough get moist, the pseudo-membranes become looser, the sputa more copious and mucous. In his opinion the result of tracheotomy after mercurial treatment is rather more favorable. But Trousseau opposed it, and his authority was sufficient to suppress its use almost entirely. Autenrieth, in Germany (1807), gave from one to four grains of calomel every hour, never less than fifteen grains altogether. Joseph Frank, Stieglitz, Billard, Fahrner, Ruppius (1838), Benson, G. B. Wood (1847), in his "Treatise on the Practice of Medicine," Hein (1849), Bourgeois (1850), Brown (1850), Löwenhardt (1848), Burow (1864, *Journal f. Kinderk.*), Steppuhn (1864, *Journal f. Klinderk.*), Bartels (1867, *D. Arch. f. Klin. Med.*), are in favor of mercurial treatment. Burow used corrosive sublimate, gr. j.; white of one egg; distilled water, ℥ iv.; a teaspoonful every hour, until three or four grains were taken altogether. Eighteen undoubted cases of croup are reported by him, eleven of which recovered; of these eleven three only were tracheotomized.

Miquel (1848) administered one-sixth of a grain of calomel, and two and one-half grains of alum, either alternatively or together. By the administration of alum he hoped to prevent salivation. His method has been examined and partially adopted by Guersant, Blache, and Trousseau, also by Millet, who had five successes in seventeen cases of croup.

Oppolzer (1868) gave calomel and iodide of potassium, gr. j. of each every hour, after an emetic had been administered before.

Bohn and Monti have opposed the use of mercury in croup. The latter, however, modifies his opposition to a great extent in his latest book. Bohn gave calomel, twenty to forty grains in twenty-four or forty-eight hours, and up to an ounce and a half of blue ointment besides. He never saw any injury done by it except once, a mild exfoliation from the upper jaw, and of twenty cases thus treated eight recovered. Though he says that but two of these were very severe, the result is so favorable that Rauchfuss is correct in asking why, after all, Bohn should object to the use of a remedy which has rendered him such good services (Gerhardt's *Handbuch,* vol. iii., 2, 1878, p. 210,).

Guesant (art. " Croup " in " Dictionnaire de Medécine," in thirty volumes, 1832-1845) expresses himself as follows: " A class of remedies which ought not to be neglected in confirmed croup, when one is called in the beginning, and the symptoms are not too pressing and the patient too feeble already, are mercurials. Certainly they fail sometimes, but a great many successes are due to them. I have seen three cases of croup getting well under this treatment, and in one of them the symptoms ceased as by magic when salivation commenced. Seven recoveries are mentioned by Bretonneau. Inunctions into the neck, the gums, the inner sides of the arm and the axillæ must be made simultaneously, together with calomel internally. The latter must be given as an alterant, and not with purgative effect. To avoid this, it must be given in refracted doses, one-fourth or one-half grain every half hour or every hour, with gum powder, or sugar, or candy, and not swallowed. When no laxative effect at all is produced, the doses must be larger, but always given in the same manner. But we must not overlook the fact that mercurials, particularly when they produce salivation, throw the patient sometimes into such a state of debility as to prove fatal. Bretonneau quotes such instances. Thus it is prudent never to try this mode of

medication on subjects with a feeble constitution, or such as are debilitated by previous sickness, and to suspend the use of mercurials where injurious effects become visible, and give tonics instead. For this reason it is best to resort to that kind of medication in the summer only, and perhaps not to employ it at all in the cold or moist seasons."

Barrier ("Traite pratique des Mal. de l'Enfance," 3 ed., tome i., p. 394, 1861): "Mercurials have enjoyed, and are still enjoying, a great reputation in the treatment of croup. The preparations most in use are calomel and the blue ointment. Small doses would not obtain an effect in due time, and in croup a rapid result must be looked after. Thus, according to the age of the child, .02 or .05 grammes of calomel (gr. ⅓ to ⅚) must be given every half hour, with the addition of a small dose of opium to avoid the purgative effect, and three or four times daily one or two grammes of the blue ointment (in older children to be doubled) are used on different parts of the surface in inunction. This method is praised by Guersant."

Of forty-one cases of croup, observed by Bartels, and not treated with tracheotomy, five recovered with mercurial inunctions. They were all serious cases, laryngeal stenosis and constitutional diphtheria were fully developed in all. Within three days the main symptoms improved, the croup membranes disintegrating. According to Frerichs, who advises to introduce large amounts of mercury into the system within a short time, he rubbed into the surface, in different places, 1.25 grammes (℈j.) of the blue ointment every hour. Several times he used as much as 75 grammes (℥ ijss.). Anæmia and hemorrhages were observed in two cases, but still the patients recovered. The same treatment was used by him for the fibrinous tracheo-bronchitis succeeding tracheotomy.

Dr. C. Rauchfuss, in his elaborate paper on "Fibrinous Laryngotracheitis," printed in the third volume of C. Gerhardt's *Handb. der Kinderk.*, expresses himself in the following manner: "When Burrow published his remarkable cases, his accurate descriptions and his results

induced me to try the croup treatment with corrosive sublimate. Its results were so satisfactory, compared with other methods of treatment, that I have remained true to it since and joined to it the inunctions with blue ointment; or, if the condition of the gastro-intestinal mucous membrane forbade the internal administration, I limited the treatment to inunctions extensively. The remarkably satisfactory results of a very energetic mercurial treatment has been appreciated as well by many colleagues, both in and out of the hospital, as by myself. When tracheotomies were performed, or autopsies made, it was almost always noticed that the pseudo-membranes were in a condition of muco-purulent disintegration at an unusually early period. Also in bad cases of catarrhal laryngitis, with considerable subchordal tumefaction and stenosis without pseudo-membranes, have I noticed that tumefaction disappeared soon and a copious muco-purulent secretion followed. Thus I look upon the diminution of the phlegmonous process in the mucous membrane and the copious secretion from the muciparous glands as the main results of the mercurial treatment. I have a large experience, but am not aware of a single case in which an energetic but brief mercurial treatment was attended with evil consequences, with one exception. This is a very intense and diffuse erythema, of the surface, resembling scarlatina, which may give rise to increased temperature. It is met with after inunctions, when the skin is perspiring. When it occurs the external treatment must be stopped, the child bathed, and the medication restricted to the use of the bichloride. Some of my mercurialized patients are at the present time ten or twelve years old, and in good health. Constitutional diphtheria, in its intense form, I do not consider a contraindication; fibrinous tracheo-bronchitis is a direct and urgent indication. Thus the treatment is to be continued after tracheotomy has been performed. But it is self-evident that no astonishing results can be obtained in either form, and when I eulogize the mercurial treatment, if compared with other modes of treatment, I do so hoping that it may soon be replaced by a more successful one."

And in regard to inunctions in particular, he adds: "I never saw bad results of the inunctions with forty or fifty grammes (℥ jss.). Sometimes I have, not without fear, however, used seventy-five or one hundred grammes. In but one of the latter cases the medicinal results were bad; never since have I employed more than fifty grammes, but never less than forty."

My own experience in regard to mercury, up to the summer of 1880, when I finished my "Treatise on Diphtheria," is condensed on pages 188-190 in the following sentences:

"In regard to the action of mercurial remedies, I am no longer so sceptical as I was a quarter of a century ago. For a dozen years I hardly ever prescribed mercury, supposing that the harm it might do could be avoided by substituting other medicines, and that its effect, except in syphilis, could be obtained by other means. I admit that the experience of many subsequent years has changed my views to a certain extent. I known that in chronic inflammatory troubles, which I considered incurable in former times, a good many favorable results have been due, at my hands, to the protracted influence of mercurials; thus, for instance, in chronic inflammations of the nervous centers, particularly the spinal cord. I also know that when the constitutional effect of mercury could be obtained speedily, cases of fibrinous tracheo-bronchitis got well in an unexpected manner. To accomplish that it is necessary to give small doses very frequently. Calomel, .5 to .75 (grs. viij. to xij.), divided into thirty or forty doses, of which one is taken every half-hour, is apt to yield a constitutional effect very soon. Such doses, with minute ones, a milligramme or more (gr. $\frac{1}{60}$), of tartar emetic, or ten or twenty times that amount of oxysulphuret of antimony, have served me well in fibrinous tracheo-bronchitis. But the mucous membrane of the trachea and bronchi is more apt to submit to such liquefying and macerating treatment than the vocal cords. The latter have no muciparous glands like the former, in which they are very copious. And while the tracheal membrane is apt to be thrown out of a tracheal incision at once, though

of more recent date, the pseudo-membrane of the vocal cords, if not interfered with, takes from six to sixteen or more for complete removal. Still, a certain effect may even here be accomplished, for maceration does not depend only on the normal mucus of the muciparous glands, but on the total secretion of the surface, which will be in constant contact with the whole respiratory tract. Thus, either on theoretical principles, or on the ground of actual experience, men of learning and judgment have used mercury in such cases as I detailed above, with a certain confidence. The actual benefit derived therefrom cannot have been great, for the mortality from croup has nowhere been encouraging. Nor is it an enjoyable proof of its efficacy that Bartels is known to have lost confidence in it in his ripest old age, either for its general unsatisfactoriness, or for the reason that the general character of all the cases in the epidemics of his later years changed the nature of his cases from the inflammatory to the septic type.

"If ever mercury is expected to do any good in these cases of suffocation by membrane, it must be made to act promptly. That is what the blue ointment does not. In its place I recommend the oleate, of which ten or twelve minims may be rubbed into the skin, along the inside of the forearms or thighs (or anywhere, when their surface becomes irritated), every hour or two hours. Or refracted doses will be useful, such as given above; or hypodermic injections of corrosive bichloride in one-half (or one) per cent. solution in distilled water, four or five drops from four to six times a day, or more, either by itself or in combination with the extensive use of the oleate, or calomel internally. The hypodermic injections act very promptly and favorably, as I repeatedly convinced myself; for instance, in those cases of hereditary syphilis, which, from the presence of volar or palmar pemphigus and general cutaneous eruptions at birth yield, as a rule, an almost fatal prognosis under ordinary circumstances, and with the ordinary treatment."

Henoch (*Vorles. üb. Kinderk.*, 1881, page 306) is opposed to mercurial treatment: "It cannot be denied

that the vigorous antiphlogistic treatment employed against this dangerous malady, particularly formerly (such as leeches, frequent emetics, and mercurials), together with the lack of appetite and repugnance to food, produced debility and anæmia." And (page 642), "A few times I believe to have seen a favorable effect of blue ointment applied every two hours in doses of 1 gramme each; and thus felt induced to try it in a large number of cases. These trials, however, terminated so unfortunately as to make me despair of a favorable result. A boy, aged eighteen months, was undergoing inunctions for syphilis when he was taken with pharyngeal diphtheria. Of one hundred cases treated in this manner but one terminated favorably; of the rest thirty-three died without an operation, and sixty-six were tracheotomized."

E. Charon ("Contrib. á la Pathologie de l'Enfance," 1881, 2 ed., page 49) takes the same stand: "Is there a medicinal treatment of croup? None in my opinion which is deserving of any confidence. The best proof is the long list of methods of treatment recommended in all of the books in different periods. As soon as a valuable remedy will be discovered able to remove the pseudo-membrane or prevent it from descending into the respiratory organs, we shall all know it. Until then it is better to abstain from all sorts of medication, and more than any other, from emetics and local cauterizations."

On the other hand, H. C. Wood, in his "Treatise on Therapeutics," 1876, 2d ed., page 369, expresses himself as follows: "Calomel is useful in severe laryngitis, and especially in the pseudo-membranous variety where the type is sthenic; and no time should be lost in bringing the system under its influence."

In Reynolds' "System of Medicine," vol. i., however, mercurials are hardly mentioned amongst the remedies to be employed, and J. Lewis Smith is of the opinion that mercurial treatment in croup "has been properly discarded."

Bartholow ("A Practical Treatise on Materia Medica and Therapeutics," 1882, 4th ed., page 235): "Large doses of calomel—five grains every four hours—are said

to be very efficacious in *true* croup or membranous laryngitis. It is claimed that it allays spasm and checks the formation of the false membrane. The author is sceptical in regard to the utility of calomel in this affection. There is, however, no doubt as to the value of the subsulphate as an emetic in this disease. If given early, so high an authority as Dr. Fordyce Barker, of New York, claims that a fatal result will most certainly be averted."

The first to recommend cyanide of mercury in diphtheria was A. Erichsen (*St. Petersburg Woch.*, 1877, vol. ii., p. 14). He objects to the employment of the blue ointment, because of the uncertainty of the dose absorbed, and of other preparations, because of their actual or alleged disturbance of the digestion. His diphtheritic patients were from seven months to thirty years of age. The pseudo-membranes became thinner and loosened within a short time, not only in pharyngeal, but also in laryngeal affections. Three cases, seven months, two and a half, and three years of age, were treated exclusively with the drug, and a hot sponge externally. No lotions or gargles were used, only two daily applications of tincture of iodine were made for the purpose of circumscribing the morbid process. The dose was .0006 gramme up to the age of three years ($\frac{1}{100}$ gr.) every hour, and twice that amount for older children. Of twenty-five patients Erichsen lost one of cardiac paralysis, another of suppurative parotitis, and a third one of a complication with meningitis; in all, however, even in those last mentioned, the diphtheritic process became extinct.

Annusschat also recommends (*Berliner Klin. Woch.*, 1880, No. 43) the cyanide of mercury in diphtheria. Of one hundred and twenty patients fourteen died. They were from one to fifteen years of age. The dose was a teaspoonful of a mixture of cyanide of mercury 0.1 to 0.2 in 100 water every hour. Benzoate of sodium was blown into nose and pharynx. Stimulants were given besides. Some cases recovered after three or four days, some after six or eight. The more unfavorable or septic the cases, or the more the larynx was affected, the less favorable was the result of the medication.

H. Schulz (*Centr. f. Klin. Med.*) recommends the subcutaneous administration of mercury, mainly the cyanide, as recommended by C. G. Rothe. The latter ("Die Diphtherie," etc., Leipzig, 1884) reports the following: "A girl of three years, whose brother, four years old, had just died of diphtheria, appeared nearly moribund after an illness of a fortnight. Complete aphonia, stenotic respiration, and a high temperature rendered the prognosis very bad indeed. I then gave every hour a drachm of the following mixture: Hydrarg. bicyan., 0.01; aq. dest., 60; tr. aconiti, 1. When five or six doses had been taken respiration became moister, the cough looser, viscid mucus was expelled, and the night was less restless. The child finally recovered with several perforations of the soft palate, otitis media, and perforation of the drum membrane.

"Since that time (September, 1880), I have employed the same drug in ninety-eight cases, six of which were complicated with scarlatina, and the result was favorable, inasmuch as the duration of the cases appeared to be shorter, and the local process exhibited unmistakable modifications (*Allg. Central.*, 1880, No. 89; *Deutsche Med. Woch.*, 1881, No. 34). Of these ninety-eight cases, the first seventy-one terminated in recovery. In the seventy-second, a girl, three years old, the pharynx being nearly clear of membranes, the larynx was suddenly affected after an inhalation of lime-water, and the patient died within a short time, even before the completion of laryngeal stenosis. This was the first case in which the larynx became affected during the treatment. Two more cases in children of from two to three years terminated fatally. The treatment was not commenced before the fourth day; at that time croup had already commenced. These three cases, as also that of a boy of five years with 'genuine croup,' whom I was called to see a few hours before his death for the purpose of performing tracheotomy, have convinced me that no effect must be expected from the remedy when the larynx is already affected; that, however, when it is employed in time, it will obviate the affection of the larynx and the fatal termination. By an affection of the larynx, however, I do not mean mere

hoarseness and barking cough, or aphonia, all of which may last for days and still terminate favorably, but real stenosis.

"In place of the cyanide I sometimes give the bichloride: hydrarg. chlor. corros., 0.01-0.015; sodii chloridi, pepsin, āā 0.5; aq. destill. 60; tr. acon., 1-2—a drachm every hour, with the same result. The tincture of aconite was added for its effect on the temperature, the pulse, and the pharyngeal irritation."

With these quotations and reports the historical review of our subject is almost exhausted, if I mean to confine myself to the most important literary productions only. Still, a very few must still find places to prove the discrepancy of opinions. I copy the following from J. Forsyth Meigs and William Pepper ("A Practical Treatise on the Diseases of Children," 7th ed., 1882, p. 906):

"Recently Dr. G. A. Lynn ('Trans. Pennsylvania State Medical Society, p. 886, 1879) reported remarkable results from the use of large doses of bichloride of mercury in grave cases of diphtheria. He found that even so large a dose as gr. $\frac{1}{20}$ every three hours was well borne by children one year old, and asserts that from his experience it prevents the spread of the membrane or the development of blood-poisoning, and acts as much as a specific in diphtheria as quinia does in intermittent fever. These bold assertions have been corroborated by several good observers. We have not used this remedy sufficiently to authorize an expression of opinion, but a truly remarkable case, occurring in the practice of Dr. T. I. Yarrow, in Philadelphia, and seen by us in consultation ('Address on Medicine,' by William Pepper, M.D., 'Trans. Am. Med. Assoc.,' 1881), where this remedy was used in the above manner with excellent results, convinces us that further cautious trials should be made in this direction. The same may be said for the treatment by enormous doses of calomel, which has been advocated by some good observers as producing specific curative effects. It is difficult to define the cases in which it might be justifiable to try either of these modes of treatment, but it seems to us that it would chiefly be in cases where a

continued tendency to pseudo-membrane showed itself, while as yet no extreme degree of blood-poisoning had occurred."

In the latest French text-book, however (A. Deschroizilles, "Manuel de Path. et de Clinique Infantiles," 1884, p. 326) the following sentences are found:

"Mercurials have been eulogized in America, and are still fashionable in England. In France they are not believed in at all. Mercury has been used in the form of calomel in repeated doses, or the blue ointment has been employed round the neck. In spite of what has been said in England to the contrary, they debilitate, purge, and salivate, impoverish the blood, and facilitate hemorrhages. Therefore they have been almost given up."

Finally, in E. Bouchut's "Clinique de l'Hôpital des Enfants Malades" (1884) mercury is not mentioned at all amongst the remedies employed in Europe. Thus it is evident that the difference of opinions in regard to the availability of mercury, in croup, is very great indeed. But there is a peculiar feature in the controversy which cannot escape your attention. It is this, that those who speak of the subject in a text-book, and in brief text-book fashion, are apt to trifle with it because of their tendency to teach accepted facts only, while some of those who have personal observations to relate in full, appear as the friends of the mercurial treatment.

My own experience is not a very extensive one, but by what I have since seen my opinions of 1880 are somewhat modified in favor of accepting the beneficial results of mercury in croup. Particularly was I struck with, and encouraged by the force of the statements made by Pepper, cautious though they were, before the American Medical Association at Richmond, in 1881, and alluded to before. Since that time I have employed, or recommended, mercury in many cases, and I believe with fair result. I am not, however, of those who never lose a case. But what I have seen is at your service. Allow me, therefore, to detail a few cases as instances only, and finally to draw some conclusions.

Case of Dr. G. Mourraille.—F. M——, female, aged

three years and eight months. The doctor was called March 28th, 4 P. M. The little girl had slept well the previous night and took her breakfast as usual; complained of headache and refused to go out at 2 P. M. Took tinct. ferr. mur., gtt. iij. every hour, and was ordered for the evening a dose of pulv. dover. and hydrarg. c. cret., āā gr. j. At that time, temperature 101½°. gray extensive, but thin deposits on tonsils; no cough. Was called again at 8 P. M. Powder had been taken. Cough frequent and croupy, voice hoarse, great dyspnœa, face congested, but not cyanotic. 11 P. M.: Same condition; child has not slept. Another dose of pulv. dover. and hyd. c. cret., āā gr. j. Child falls asleep about midnight. Respiration less disturbed, cough less frequent, but of the same character; sleep restless. Consultation on the 29th, 9 A. M.: Temperature, 101°; voice feeble and hoarse; cough hoarse; pharyngeal membranes less extensive; respiration croupy; moderate præcordial and supraclavicular recession. Bichloride of mercury, gr. 1/24 every hour in water. Night restless; voice and cough not changed, but respiration rather easier.

March 30th.—No change in the general symptoms, but more diphtheritic deposits in the throat. Twenty-four doses of the bichloride of mercury had been taken by 3 P. M. It was ordered to be renewed. About 8 P. M. several loose passages, with griping pain. The remedy was discontinued and pulv. Dov. and hyd. c. cret., āā gr. j., given instead. Night fair; voice hoarse; cough rather looser; respiration rather easier.

March 31st.—The bichloride resumed in the morning, followed by loose passages. About noon one drop of the wine of opium was ordered with each hourly dose. In this way the remedy was well tolerated. The night was rather satisfactory; three doses only of the medicine were given.

April 1st.—Cough, loose; respiration, pretty easy; no membranes in the pharynx; the medicine is continued until 2 P. M. In the evening pulv. dov. and hyd. c. cret.

April 2d.—Voice hoarse, but cough more catarrhal. Treatment discontinued. Child very nervous. Pulse in-

termittent. Doses of bromide potass., gr. vj., in the evening. Night good. Temperature from March 28th to April 6th, 99° to 101° (rectum), the latter in the afternoon's mostly. Cough lasted until April 12th, hoarseness to April 16th. The total amount of bichlor. hydrarg. was grs. ij.

Case of Dr. T. N. Burchard.—Fibrinous bronchitis in a child five months old, treated with corrosive sublimate; recovery.—Called March 30th, 6 A. M., to see Lelia H——, aged five months. Found her suffering with dyspnœa, croupy respiration, and painful cough. The child had been perfectly well the day previous, and had been out for a ride. Two months before had had a severe capillary bronchitis which lasted eight days. Examination revealed hyperæmia of fauces, no swelling or membrane visible. Physical examination of lungs negative. Ordered mustard cloth to throat, to be followed with hot fomentations, two grains of quinine and a diaphoretic mixture of ipecac, nitre, and spirits of Mindererus. The room to be kept filled with steam. 9 A. M.: Had passed a comfortable day, and vomited considerable phlegm at 7 P M. Pulse, 120; temperature, 94⅘°; respiration, 38. Fauces red, no membrane; physical examination of lungs negative; respiration croupy; cough painful; voice absent. Ordered whiskey, gtt. viij. q. 2 h.; paregoric, gtt. iij. q. 2 h.; diaphoretic mixture to be continued. 12 P. M.: Child very weak. Pulse, 152; respiration, 34. Ordered carb. ammon., gr. ij., and tinct. digital., gtt. ij. Whiskey, gtt. xv., to be repeated at end of half an hour.

March 31st—3 A. M.: Child sleeping, breathing more easily. Pulse, 148; temperature, 103¼°; respiration, 32. 11 A. M.: Pulse, 132; temperature, 103°; respiration, 35. Respirations easier; cough not so painful; voice still absent. Diaphoretic mixture discontinued. Whiskey, gtt. x. q. 3 h.; quinine, gr. ij. 1 P. M.: Seen by Dr Jacobi in consultation. Pulse, 132; temperature, 101⅖°; respiration, 68. Physical examination of throat and lungs negative. Percussion over lungs posteriorly and apices anteriorly, extra-sonorous; a few faint sonorous râles heard posteriorly. Diagnosis of acute laryngitis confirmed. Since

last visit, however, respirations have doubled in frequency, with falling temperature. Dr. Jacobi suspects the exudative process is invading the bronchi. Pneumonia, pleurisy, and capillary bronchitis can be positively excluded. Ordered hydrarg. bichloridi, gr. $\frac{1}{50}$ q. 1 h.; stimulants, poultices, and steam to be continued as before. 6 P. M.: Pulse, 132; temperature, 101$\frac{5}{8}$°; respiration, 70. Condition about the same; voice absent. 7.50 P. M.: Vomited after taking corrosive sublimate. 12 P. M.: Again seen by Dr. Jacobi. Pulse, 132; temperature, 101$\frac{5}{8}$°; respiration, 62. Has taken $\frac{1}{50}$ gr. bichloride of mercury each hour since 2 P. M.

April 1st.—8 A. M.: Passed comfortable night; vomited corrosive sublimate at 4.45 A. M. Pulse, 128; temperature, 102°; respiration, 64. Ordered whiskey, gtt. xv. q. 2 h.; bichloride to be continued. 1 P. M.: Seen by Dr. Jacobi. Pulse, 132; temperature, 101$\frac{2}{5}$°; respiration, 66. Fauces slightly red; no swelling or membrane; examination of lungs negative, save few sonorous râles heard posteriorly. Has taken and retained twenty-two $\frac{1}{50}$ gr. doses of corrosive sublimate. Ordered treatment continued. 6 P. M.: Pulse, 132; temperature, 101$\frac{1}{5}$°; respiration, 64. Noticed slight puffiness on left side of neck; lymphatic glands not enlarged; no swelling of tonsils. 10 P. M.: Pulse, 120; temperature, 100$\frac{1}{2}$°; respiration, 48. Had natural movement at 8 o'clock, followed by a loose one at 8.45. Ordered paregoric, gtt. iij. and to omit one dose hydrarg. bichloridi. 11.30 P. M.: Seen by Dr. Jacobi. Pulse, 132; temperature, 100$\frac{1}{2}$°; respiration, 53. Mother's milk having failed, ordered barley-water and milk. Whiskey, gtt. xv. q. 2 h. The hydrarg. bichloride to be continued, unless diarrhœa or vomiting supervene. Physical examination of throat and lungs as before.

April 2d.—2.45 A. M.: Vomited considerable phlegm; swallows with difficulty; child's appearance worse. Ordered brandy to be substituted for whiskey, gtt. xv. q. 2 h.; tinct. digital., gtt. ij. q. 2 h. Poultices and steam to be kept up. 9 A. M.: Child supposed to be dying; marked dyspnœa with cyanosis. Pulse indistinguishable; respiration, 72. Found above conditions to be dependent upon

accumulation of mucus in the throat. Inverted the child, wiped out mucus from throat with finger; stimulated the child with friction, brandy, carb. ammon. and tinct. digital. 9.30 A. M.: Color and breathing greatly improved; considerable mucus in bronchi; caused vomiting by finger in throat. After vomiting, pulse about 160; respiration, 48; temperature 101°. Neck more swollen; hyperæmia of throat increased. 1 P. M.: Dr. Jacobi in consultation. Child has taken twenty-two doses of hydrarg. bichloride during past twenty-four hours, all except one dose having been retained. Dr. Jacobi detected a swelling on left side pharyngeal wall, low down, of phlegmonous character. Child's general appearance improved. Ordered brandy, gtt. xij. q. 2 h.; milk and barley-water to be continued; other treatment as before. 11 P. M.: Seen by Dr. Jacobi in consultation. Pulse, 144; temperature, 100⅕°; respiration, 60. Treatment continued.

April 3d.—9 A. M.: Child passed comfortable night, coughing less, and sleeping more. Two small, green movements during the night. Pulse, 140; temperature 101⅖°; respiration 66. Swallows better; cough less painful; hyperæmia of throat less; swelling about the same. Examination of the lungs gave numerous moist râles over both lungs, posteriorly. Percussion extra-resonant. Treatment continued. 1 P. M.: Seen by Dr. Jacobi in consultation. Has taken and retained twenty-one doses hydrarg. bichloride. Pulse 150; temperature, 100⅖°; respiration 60. Ordered brandy, gtt. xv. q. 2 h.; tinct. digital., gtt. ij. q. 4 h.; hydrarg. bichloridi, gr. 1/50 q. 1 h. 3.35 P. M.: Had large *constipated* movement. 4.35 P. M.: Vomited considerable phlegm. Pulse, 150; temperature, 101⅕°; respiration, 68. 11 P. M.: Breathing much better. Takes and retains nourishment and medicine. Nostrils considerably occluded with mucus. Pulse, 144; temperature, 100⅕°; respiration, 52 Has vomited some curdled milk during the evening. Swelling in throat about the same. Condition of lungs unchanged.

April 4th.—4 A. M.: Sleeping quietly. Respiration, 38; pulse, 132. Feet and legs very cold; hot-water bag applied to them. Brandy and carb. ammon. given freely. 5.30

A. M.: Small constipated movement followed by loose movement at seven o'clock. Vomited sour milk several times during the night. Child very restless, but general condition improved. 1 P. M.: Seen by Dr. Jacobi. Pulse, 160; temperature, 101⅛°; respiration, 54. Has taken nineteen 1/50 gr. doses of bichloride since yesterday. 6 P. M.: Nursed ten minutes freely this afternoon. Treatment continued.

April 5th—9 A. M.: Has passed a comfortable night. Has vomited phlegm a number of times. Stomach quite irritable; substituted inunctions of the oleate of mercury in place of the bichlorides. 1 P. M.: Seen by Dr. Jacobi in consultation. Pulse, 132; temperature, 100°; respiration, 28. Asleep. Has nursed twice during the morning; swelling in throat less; poultice discontinued. Ordered brandy, gtt. xv. q. 3 h.; tinct. digital., gtt. ij. q. 4 h.; hydrarg. bichloridi, gr. 1/50 q. 8 h. Steam to be continued as before.

April 6th.—9 A. M.: Passed comfortable night. Vomited phlegm twice or three times during night. Pulse, 128; temperature, 100°; respiration, 32 Voice returning; cough stronger and less frequent. Ordered whiskey, gtt. x. q. 4 h.; tr. digital., gtt. ij. q. 8 h. Child nursing.

April 10th.—Steam discontinued. Thoroughly convalescent.

April 15th.—Child was taken to Lakewood, N. J., today.

Case of Dr. E. J. Hogan. —Croup; tracheotomy; bronchial croup; recovery.—I was called to see Milton R——, aged two years, on March 9th. Two persons living in the house had suffered from pharyngeal diphtheria about a month previously. The child seemed to have a mild laryngeal catarrh with moderate dyspnœa. A careful examination failed to reveal more than congestion of the pharyngeal and tonsillar mucous membrane. His temperature was *normal.* General condition excellent.

On the evening of March 10th he was breathing easily, pulse good, temperature normal; so much better, indeed, that I did not think it would be necessary for me to call again.

An alarming dyspnœa developed at about 3 A. M., March 11th. A physician, called in the emergency, administered turpeth mineral, which was followed by emesis and partial relief of the dyspnœa. A profuse diarrhœa, lasting over twenty-four hours, also resulted from it.

During the morning of the 11th, the symptoms became steadily more threatening. (There were occasional remissions of short duration.) Pulse, 140 to 150; respiration, 50 to 60; cyanosis, at times very marked; semi-coma; considerable epigastric and suprasternal recession. On percussion, pulmonary resonance good. Auscultatory signs masked by the noisy laryngeal breathing. Neither Dr. McMahon (who had been called to see the case) nor myself could detect any membrane in the throat or nose. We both agreed as to the necessity of an early tracheotomy. Meanwhile the child was taking carbonate of ammonia internally and lime vapor inhalations.

Laryngo-tracheotomy was done by Dr. F. Lange at 2.30 P. M. No anæsthetic used, patient being insensible. Two bleeding veins were ligated. A portion of the first tracheal ring was removed after the windpipe had been opened. A thin, soft, easily detached membrane was removed from the trachea. A tube was inserted, covered with a sponge wrung out of hot water. The wound was treated with corrosive sublimate solution (1/2000) and iodoform; no spray used; no internal treatment except small doses of Dover's powder (p. r. n.) for cough.

On the evening after the operation the child was breathing easily through the tube and took nourishment (milk) freely. The pulse had fallen to 120. Temperature (rectal), 102.2°.

March 12th.—In the afternoon the patient began to suffer from increasing obstruction below the tracheal wound. Loud tracheal râles. Respirations very rapid. Both tubes removed in the evening by Dr. Lange, who, by the aid of a catheter and aspiration, freed some pieces of thick, very dense, adherent membrane. Later seen also by Dr. Jacobi (10 P. M.). Breathing still much obstructed. Examination of chest negative. On the suggestion of Dr. Jacobi the bichloride of mercury was administered in doses

of $\frac{1}{32}$ of a grain hourly, with the expectation of its favoring the disintegration and separation of the membranes.

From this time on it never became necessary to remove the outer tube for the sake of cleaning the trachea. The use of the feather with occasional instillations of a solution of common salt sufficed to remove any material causing obstruction. The bichloride was suspended on the third day, on account of intestinal irritation. The gums were not affected. On March 14th, the temperature reached 102.2°; on March 21st, 104.8°. On these two occasions, quinine was given, eight grains morning and evening in divided doses. On about the ninth day the patient was put on the elixir of gentian and iron (Wyeth's). The tube was removed on March 22d; after its removal the wound did nicely. During the course of the disease albumen in small amounts and some hyaline casts were found in the urine.

In connection with the report of his case, Dr. Hogan says: "My experience with the bichloride in this case, it is fair to state, has been such that I would feel it an injustice to withhold it from a patient in the future, under similar circumstances. Previous to its administration, as the history shows, there was a rapid formation of very dense, thick membrane, with every prospect of death from tracheal occlusion. Afterward, the case went on *steadily* to a favorable termination. Even granting the possibility of a coincidence, it would seem that a resort to this means is both rational and expedient."

These three cases are but specimens of what I have frequently seen in my own practice, and in that of colleagues, some of whom may be present. Not only have I seen a certain number of cases of pseudo-membranous croup, mostly complicated with pharyngeal diphtheria, getting well without tracheotomy with mercurial treatment, but the percentage of recoveries after tracheotomy in the last three years, in my experience, has been greater than through ten years previously when no mercury was employed.

Now, I am not so enthusiastic as to generalize on the strength of my cases—even dozens of cases count but little when we recall the fact that statistics without great

numbers are deceptive—but I know that for years past, with mercurial treatment, my established axiom, that in authenticated cases of membranous croup, not tracheotomized, the mortality amounted to ninety or ninety-five per cent., has been happily shaken in its foundations.

In regard to the preparations of mercury to be used I agree with Voit and Hartnack in this, that it is best to agree upon a very few of the preparations of mercury in medical practice. The bichloride may be given in a dilution of more or less than 1 to 15,000, that is, a grain in a quart, or Baerensprung's albuminate, or Bamberger's peptonate, may be employed. The latter's patients who used either, subcutaneously, were not salivated, though nothing was done to prevent salivation, and increased in weight during the treatment. Albuminate taken internally disturbed the stomach in no way; its favorable effect on the appetite has been observed occasionally. Soluble preparations in large dilutions are easily absorbed by the mucous membranes (or by ulcerated surfaces), thus they act in baths. In somewhat concentrated form it may give rise to inflammation, in stronger concentration to cauterization; gastric and intestinal disturbances may reach the degree obtained by arsenic or cholera, and prove fatal. Pills with larger doses of mercury lose their dangerousness by meeting with plenty of albumen to form albuminates, particularly when given after meals.

The corrosive sublimate is a strong antifermentative. Bacteria are killed by it in dilutions of one to twenty thousand (Buchholtz), or according to others, one to three hundred thousand. At all events it is ten times as powerful as thymol and benzoate of sodium; twenty times more than cresot or benzoic acid, or oil of thyme; thirty times than salicylic acid, or eucalyptol; one hundred times than carbolic acid, salicylic acid or quinia. The deductions of Dr. Wm. H. Thallon, of Brooklyn, as published in the *New York Medical Journal* of April 12th and 19th, prove not only that the bichloride of mercury is a proper antifermentative to be given, but also that the doses must be large when compared with those prescribed or permitted by the books.

Hydrargyrum bichloride combines in the stomach with chloride of sodium, is absorbed as such, and changes into an albuminate with the albumen of the blood. Dissolved albumen, it is true, is coagulated by hydrargyrum bichloride, and antagonized and rendered not absorbable; but both a surplus of albumen and the addition of chloride of sodium restore its solubility. These conditions are mostly found in the stomach, and always in the blood. In an alkaline solution of albumen, hydrargyrum bichloride produces no coagulation when sodium chloride was added. Thus, subcutaneous injections meeting with the alkaline tissue fluid are best tolerated when sodium chloride is added to the mercurial solution. The contents of the stomach and its fluids are mostly acid, however. Marle found that acid solutions of albumen are not coagulated at all by hydrargyrum bichloride; a slight obscurity of the solution is produced, however, by the addition of sodium chloride, so that the latter may better be dispensed with in internal medication, unless the dose of the hydrargyrum chloride be large. Marle expresses even the opinion that large quantities of the sodium chloride may disturb digestion by its shrinking influence upon the hydrargyrum albuminate. He found that in artificial digestive fluid hydrargyrum chloride does not coagulate peptone in a solution of one to three thousand, nor does it throw out the pepsine in a solution of one to one hundred, or less (*Arch. f. Exper. Pathol. u. Pharm.*, vol. iii.).

In regard to the treatment of croup after the performance of tracheotomy, I finally make the following fragmentary suggestions:

The temperature of the room must not be too high, not much over 70° F. The air must be kept moist. A kettle with boiling water on an open fireplace works quite well, provided the steam enters the room, and not the chimney. To obviate the latter, a tin cylinder, of the shape of a fish-horn, may be thrown over the spout of the kettle, which is generally too short. The old-fashioned cooking oven in the room, or a stove of former patterns will do as well. The self-acting stoves are bad; they give out a great deal of coal-gas, and have no place where to

put a kettle. Gas-stoves of any shape or pattern are injurious; gas consumes so much more oxygen than alcohol that a large alcohol lamp, to boil water on constantly, serves the purpose better. When the room is large, or cold, part of it may be easily changed into a closet by means of a few nails driven into opposite walls near the ceiling, ropes, and bed-sheets. Into such a closet, or tent, the steam may be introduced by a tin tube, the alcohol lamp remaining outside the sheets. A tablespoonful of spirits of turpentine may be poured on the boiling water every half hour, or hour. The steam or vapor, however, must not be too thick. Oxygen must not be excluded. Many years ago I demonstrated the necessity of allowing a full supply of oxygen by the case of a baby who suffered from descending croup, after tracheotomy was performed. He was in convulsions from carbolic acid gas poisoning. Whenever I introduced oxygen from a bystanding cylinder into the tube, the convulsions would cease, and the cyanosis decrease; when I stopped the supply, cyanosis and convulsions would return. Thus it may frequently be necessary to open a window, more or less. Here, as in everything else, the judgment of the physician will decide upon the indications of the individual case.

The nutrition of the patient has generally suffered much. Before the operation but little food was taken, still less was digested, and the operation itself and the anæsthetic have added to the previous weakness or exhaustion. Moderate feeding and stimulation are therefore to be commenced soon. Vomiting after chloroform I have seldom seen to last long or to be embarrassing under these circumstances. Feeding and stimulation is the more necessary the more the hungry lymph-vessels are liable to absorb injurious material when not supplied with healthy food.

Is internal treatment required? The general treatment must be continued. If it consisted in the administration of hydrargyrum, either internally or externally, it must be continued. If its effect was not sufficient to clear the larynx and to render the operation unnecessary, it will or may be sufficient to complete its effect in the

next day or two, to prevent the process from descending or the membranes becoming too many or too thick. No changes ought to be made in the treatment unless there be changes in the symptoms. Not infrequently the first symptoms of broncho-pneumonia come on within a few hours after the operation, recognizable by frequent pulse, respiration frequent beyond proportion, and physical symptoms. The stomach is not very reliable. Quinine answers best hypodermically. From six to ten grains may be injected at once. The preparation which has served me best in the last few years is a solution of the carbamid in five parts of water. If an additional remedy is required, from twenty to thirty grains of sodium salicylate may be given in the course of three or four hours, in hourly doses, to reduce the temperature. Tincture of digitalis will prove advisable at the same time when the heart appears to require it. Strychniæ sulphas will act as a powerful nervine; a twenty-fifth of a grain may be given to a child, two years of age, every two hours, until four doses, or five, will have been taken. The rest of the treatment of the complications depends on their nature and character. It is not the name of the disease which has to be treated, here as in every case, but the individual patient.

In regard to stimulants I have but little to say. I use alcohol in the most pleasant shape, preferring brandy or whiskey. I use a great deal of camphor, ten to forty grains daily, or in cases of urgency, Siberian musk, from two to five grains, every half hour or hour, until from fifteen to twenty grains have been taken, in cases of collapse or great prostration.

In this connection I have nothing to say about local applications to the trachea, or the handling or removal of the tube. My subject was a limited one. Besides, I meant to suggest rather than to teach. My object was to impress upon the minds of my colleagues, and particularly those younger than myself, the necessity of not despairing, even before one of the most serious problems of medical practice. This one fact I will urge upon you, trite though it may be, and ridiculous though its expression may appear, viz., that the name of a disease is not the ob-

ject of treatment, that the name of a drug is not the requirement in a morbid process, but its intelligent and appropriate use. Scores of times have I been told, for instance, that my method of treating diphtheria with tincture of iron was carried out in an individual case, when I found that three or four drops of tinct. ferr. mur. had been administered three or four times a day. This may serve as an instance, but also as a warning. It is not enough to administer hydrargyrum bichloride; to be effective, enough must be given, and quickly enough. The doses must be large, and largely diluted. Both local and constitutional effects must not be feared. They will seldom be met with. If they are they amount to little in comparison with the mortal enemy you are going to fight. Mercurial stomatitis in infants is very rare indeed, and will readily heal. In larger children, of from two to five years, it appears but late, if at all; as a rule, the administration of mercury is the less objectionable the younger the patient. My doses have varied from $\frac{1}{60}$ to $\frac{1}{24}$ of a grain (1 to $2\frac{1}{2}$ milligrammes) every hour, and the treatment has been continued from one to six days.

To conclude, however, I shall here suggest again, what has been the gist of the remarks of the evening, in brief words:

First.—The mercurial treatment of pseudo-membranous affections of the respiratory organs is promising of great results.

Second.—The corrosive sublimate is the preparation best adapted for internal medication.

Third.—The system must be brought under its influence speedily, by frequent doses.

Fourth.—It must be given in dilutions of 1 to at least 3000 to 5000.

Fifth.—Babies of tender age bear one-half grain and more a day, and many days in succession.

Sixth.—Salivation and stomatitis are rarely observed, and appear to heal kindly. Gastro-intestinal disturbances are not frequent; they are moderate, can be avoided by the administration of mucilaginous and farinaceous food, or of mild doses of opium.

Seventh.—If not well tolerated, the inunction of sufficient and frequent doses of hydrargyrum oleate takes the place of the corrosive chloride, either together or alternately with the internal administration.

Eighth.—The treatment of croup may be preventive to a great extent. Most of the cases are complicated with, or descend from, diphtheria of the fauces. Here the preventive treatment of croup must begin. Without desiring to encourage mere local treatment, which in unwilling patients has to resort to force or violence, and thereby does great harm, I point to the peculiar local effect of mercury on the pharynx, both in the healthy and sick, as a means to influence the threatened invasion of the larynx.

"SUMMARIES" ON DIPHTHERIA

The following are the summaries appended to the chapters of Dr. Jacobi's "A Treatise on Diphtheria," published in 1880 (William Wood & Co., New York):

SUMMARY OF HISTORY

Aretæus is the first whose description of diphtheria has reached us.

Asclepiades practised scarification of the tonsils and laryngotomy.

Cælius Aurelianus recognized diphtheria of the pharynx and larynx and the diphtheritic paralysis of the soft palate.

Frequent epidemics are known to have taken place in the second half of the sixteenth century over the larger part of Europe.

Diphtheria of the skin and of wounds was described by Herrera in 1515.

Communication of diphtheria through a wound in the finger is reported by Mercado in 1608.

An autopsy was made in 1642, and membrane found in the larynx.

The suffocative, asthenic, and paralytic forms of diphtheria were described by Heredia in 1690.

The first cases known in America occurred in Roxbury, Mass., in December, 1659. About that time, and mainly about 1671, the disease was very prevalent. It recurred, 1735, in New England, and never disappeared for any length of time until the beginning of this century. The main writers during this period are Douglas I. Dickinson, Calwalader Colden, Samuel Bard, Jacob Ogden, John Archer, Peter Middleton, Richard Bailey.

Samuel Bard proved the identity of all forms of diphtheria, cutaneous, pharyngeal, nasal, laryngeal, tracheal. So did Bretonneau fifty years later, and Trousseau, Louis, Rilliet and Barthez, and all the great clinicians.

Contagiousness was never doubted, but mainly sustained by Bourgeoise in 1823.

Virchow discriminates the catarrhal, croupous, and necrobiotic forms, 1847.

Graefe describes diphtheria on conjunctiva and cornea in 1854.

The main objects of the scientific literature of the subject in the last twenty years have been the microscopical histology and etiology, besides the reports of cases, epidemics, and therapeutics.

SUMMARY OF ETIOLOGY

Diphtheria is pre-eminently a disease of childhood. It is not frequent amongst adults, very rare in old age.

It is not frequent in the first year. Still there are, for physiological reasons, more cases before the third month than between the third and seventh or eighth.

The sexes are liable to be taken in about equal proportion. Laryngeal diphtheria is more frequent in boys. Recoveries from it in girls.

Diphtheria is apt to recur in those who once had it. Even membranous croup has been observed twice in the same patients.

Some individuals, and even families, have a certain degree either of immunity or predisposition.

Exposure and "colds" may act, but as proximate causes only. Most cases take place in the winter months in our climate, but there is no "invariable season law."

"Filth" contributes to the generation of diphtheria, as it does to dysentery and typhoid fever.

The question of a live origin of contagious disease in general was raised by Henle in 1840, also by Sir H. Holland, and Eisenmann.

Some pathologists find the morbific source of diphtheria in bacteria. "No bacteria, no diphtheria." This is not

truer than that fermentation or putrefaction depend on bacteria only.

The presence of bacteria in the diphtheritic blood has not been proven. There is no theoretical ground for assuming that preventing the bacteria of a diphtheritic patch from making their way through the underlying mucous membrane will, *per se*, prevent general diphtheritic infection of the system. On the contrary, the septic and putrid poison is claimed by A. Hiller as distinctly chemical. Of the same nature, viz., chemical, is very probably the poison of those of the infectious and contagious diseases in which the presence of a characteristic parasite is a recognized fact, as anthrax and relapsing fever.

SUMMARY OF MANNER OF INFECTION AND CONTAGION

The entrance of the diphtheritic poison into the system is not the same in all cases.

There are cases in which the origin of the disease is decidedly local.

There are others in which the poisoning of the blood through inhalation is the first step in the development of the disease.

In many cases, both a sore integument and the lungs are the inlets of the poison simultaneously.

It is probable that the configuration of the vestibules of the respiratory apparatus, and the amount of active poison, and the duration of the exposure to it, modify the intensity of the symptoms and the course of the disease.

Diphtheria is very contagious. Both the patient and his surroundings, dwelling, furniture, towels, etc., convey the disease. In dwellings it rises to the upper stories with the current of warm air. The poison clings mostly to mucous membranes. Mild cases may communicate serious ones and *vice versa*. The period of incubation lasts two days or more. It may last a fortnight. Fresh wounds do not require so long to be affected. In these cases the supposition is, that the patient was already influenced by the epidemic. Visible symptoms of diphtheria are often noticed after the constitutional ones.

SUMMARY OF SYMPTOMATOLOGY

The first invasion of pharyngeal diphtheria resembles sometimes very much that of a catarrhal pharyngitis. The latter is general. Local hyperæmia points to either trauma or diphtheria.

Three forms of diphtheria are found in the fauces: the "croupous," the "diphtheritic," and the "necrotic."

Glandular swelling about the neck is not always very marked. The above three species of diphtheria may each be found in mild or severe attacks. The last is apt to become septic and fatal. Nasal diphtheria is either the continuation of the process from the soft palate, or primary. It is complicated with and characterized by rapid swelling of the deep-seated facial glands in most cases.

A chronic catarrh of pharynx, nares, and larynx is sometimes observed after the acute attack.

Diphtheria of the conjunctiva terminates often in destruction of the sclerotic and prolapse of the iris. It is frequently the only symptom of diphtheria, and purely local.

The ear is affected either through the Eustachian tube, or in and from the external auditory canal.

Diphtheria of the epiglottis is rarely found extensively on the upper surface, more on the lower, and sometimes in more or less isolated spots on the free margin. When complicated with but slight laryngeal affection, the croupy symptoms are but mild. They are apt to be of long duration.

Local œdematous infiltration of the upper posterior portion of the larynx interferes with inspiration more than with expiration; membranous deposits in the larynx with both, and result in the worst forms of "membranous croup." Tracheal diphtheria is mostly the result of descending laryngeal membrane. But there are cases of primary tracheal diphtheria which, when ascending, result in speedy suffocation.

The lungs may be the seat of either broncho-pneumonia from several causes, or fibrinous pneumonia. The diag-

nosis is very difficult, both auscultation and percussion yielding but doubtful results, unless there is a sudden increase of fever and of respiratory movements. Blood entering the lungs during tracheotomy may result in broncho-pneumonia.

Diphtheria of the mouth is not frequently primary, mostly secondary, and the deposits are first seen on sore surfaces. The same is true in regard to the œsophagus. Its upper portion is often affected in cases of pharyngo-laryngeal diphtheria. Solid fibrinous deposits are met with in typhoid fever, variola, and other infectious diseases.

The intestine is affected with diphtheria (beside the dysenteric process) in its upper and lower portions. In animals very extensive intestinal diphtheria has been observed.

Recent wounds are liable to be affected with every one of the three forms of diphtheria within a day, or later, after an operation. Local or general cutaneous erythema is sometimes found. Complications of diphtheria with erysipelas are not uncommon, and dangerous. The bladder, in cystitis, or after operative procedures, vagina when eroded, prepuce when operated upon, and placenta are the seats of diphtheritic deposits.

Albuminuria is frequent, is mostly not dangerous, accompanies sometimes a rapid process of elimination of the poison, occurs often at an early period of the disease, does not depend on, nor does it increase, the fever, seldom lasts over a week, but is sometimes one of the symptoms of diffuse acute nephritis of a very grave character.

The heart may suffer from defective innervation, granular degeneration, thrombosis, or endocarditis. The blood may be of a dark color, but is not leukocythæmic. Pseudo-leukæmia, however, has been observed during diphtheria.

Thus the course of diphtheria is very various, prognosis doubtful, relapses are frequent, the temperature of the blood is not pathognomonic, the amount and rapidity of absorption and elimination changing.

The nervous system suffers often; sometimes in the very

beginning of the disease collapse is developing, and may lead speedily to a fatal termination.

Diphtheritic paralysis is considered peripheral by some, central by others. It does not always commence in the soft palate; the latter has been known not to participate in the paralysis at all. The muscles of accommodation are frequently affected, also the extremities, in some instances sensory nerves, sometimes the respiratory apparatus with dangerous results. Paralysis occurs mostly during convalescence from diphtheria, exhibits no regularity in the succession of the parts affected, does not injure the sphincters, and is in most cases amenable to treatment. While, in the majority of cases, the disease appears to strike the trophic fibres of the motory nerves, the action of the electric and galvanic currents is very variable. In but a few cases ataxy has been observed.

SUMMARY OF PATHOLOGY

The membrane, or the granular infiltration, are characteristic of diphtheria. Its contents are, more or less, fibrin, changed epithelium, blood, mucus, and pus. The main changes take place in the pavement epithelium, according to E. Wagner. The epithelium is as rapidly renewed as changed. The views of histologists do not, however, agree about the nature or the importance of the epithelial transformations. The doctrine that the diphtheritic process is caused, excited, or aided by bacteria is either sustained or denied by many. The membranes produced by artificial irritation are considered by some identical with, by others to differ from, the genuine diphtheritic product. The former view is held by the foremost clinicians.

Most organs are liable to participate in the diphtheritic process, the blood (thin, black), the heart (granular, fatty, hemorrhagic, thrombotic, endocarditic), the lungs (several forms of inflammation, infarctus, œdema, emphysema), the spleen and sometimes the liver (large, hyperæmic, soft), the kidneys (congested, nephritic), the muscles (ecchymotic, degenerated, atrophic), the glands

(swelled, ecchymotic, gangrenous, suppurating), the intestine and other viscera.

The several forms of diphtheria have a peculiar predilection for certain organs or part of organs. This predilection depends on the character of the surface and its epithelium. The greater or less amount of elastic tissue, the number or absence of muciparous glands and of lymph vessels, the nature of the epithelium (pavement, ciliated, or fimbriated), determine the character of the membrane in the different locations. Copious secretion of mucus induces early maceration.

The vocal cords are apt to serve as resting-places for the diphtheritic poison, but constitutional infection is prevented by the absence of lymphatics, and rapid maceration by that of muciparous glands.

Nasal diphtheria is apt to be very fatal by the immense net of lymphatics in the Schneiderian membrane, or by direct absorption into the superficial blood-vessels.

Lymphatic glands swell very considerably, but suppurate but rarely. They may serve as depots from which reabsorption and relapses may take place.

SUMMARY OF DIAGNOSIS

Diphtheria is characterized by its membrane. The diagnosis from muguet is easy. Complications with follicular stomatitis are of occasional occurrence. Follicular inflammation of the tonsils is recognized by its local character, by the ready removal of the deposits, and the easy introduction of a probe into the follicle. The congestion in the diphtheritic pharynx is sometimes less pronounced than in catarrhal pharyngitis. In the latter the hyperæmia is general, in the former it may be local.

Fever is not always high. Sometimes the temperature is even low in very bad septic cases. High temperatures in the beginning are less frequent than, for instance, in scarlatina. Glandular swelling may be absent for many reasons.

Nasal diphtheria has much glandular swelling; may, in some distinct cases, have none at all.

Diphtheritic laryngitis has less fever than catarrhal laryngitis, and when uncomplicated shows no glandular swelling. The character of the laryngeal membranes does not depend on the condition of the pharynx. Complete aphonia and uniform difficulty of inspiration and expiration indicates membranous obstruction; difficult inspiration with easier expiration and but partial hoarseness or almost clear voice indicates the presence of local œdema and consecutive paralysis of the vocal cords.

Primary diphtheria of the trachea is difficult to diagnosticate; it is likely to exist when after apparently catarrhal symptoms those of laryngeal stenosis occur very suddenly and fatally. The progress of the diphtheritic process downwards can be watched through the tracheotomy tube and estimated by the absence of irritability of the mucous membrane of the trachea.

The diagnosis of pneumonia accompanying laryngeal diphtheria is not impossible. In the other forms of diphtheria it is recognized by its usual symptoms.

The cutaneous eruption of diphtheria is usually distinct from scarlatinous eruptions, and the diagnosis easy in most cases. Albuminuria is mostly an early symptom, and disappears more readily than in scarlatina.

Diphtheritic paralysis is recognized by the previous history of the disease, by the frequency of its starting from the pharynx, its irregular course, its mostly peripheric character, and the absence of symptoms belonging to bladder or rectum. It is mostly motory, sometimes sensory or sensitive.

TREATMENT—GENERAL REMARKS

Every case should be treated on general principles; thus it is not possible to lay down a routine treatment for every individual case. High fever should be reduced by sponging and baths, quinine, and sodium salicylate; collapse speedily treated, and severe reflex symptoms, as vomiting, etc., checked at once. Whether to employ for this purpose ether, wine, cognac, champagne, or coffee, must be decided by the physician in individual cases. The ad-

ministration of the remedy, whether by mouth, by injection into the bowels, or subcutaneously, as I have employed cognac, ether, alcohol, and camphor dissolved in ether or alcohol, in some cases with decided and rapid success, must depend on the condition of the organs and on the urgency of the case. At all events, it may be stated that all the above remedies are frequently of no service because they have been administered too late, and in too small doses, and hence we may infer that to obtain the proper results both from external and internal treatment, the remedy must be employed early and often, and in sufficient quantity. If I have ever had cause to feel contented with the results of treatment in diphtheria, it is owing to the fact that I did not lose time. Moreover, the nourishment of the patient is a matter of very great importance, and should not be neglected, and no medicines resorted to which are apt to derange the digestion of the patient. It is true that caution must be exercised in the food administered to febrile patients, but we must bear in mind that, when the lymphatic vessels are kept empty, and no new and proper material is introduced into them, the absorption of locally existing poisonous substances is proportionately increased.

I dwell particularly on the foregoing remarks for the reason that, in diphtheria, unlike certain diseases having a typical course and those of a simple inflammatory character, expectant treatment should not be indulged in. Oertel's advice, that when neither high fever nor complications are present we should quietly wait, and "act only when new and most alarming symptoms present themselves," is decidedly perilous. A mild invasion does not assure a mild course. Never has a "perhaps superfluous" tonic or stimulant done harm in diphtheria, but many a case had a sad termination because of a sudden change in the character of the disease, putting the bright hopes of the physician to shame. Only the philosopher may be a passive spectator; the physician must be a guardian. When I again read, in the work of the same meritorious author, "that when in exceptional cases, in children and young people, death is imminent, not from

suffocative symptoms in the larynx and trachea, but from septic disease and blood-poisoning, it is necessary to resort to powerful stimulants," it strikes me that he is frequently too dilatory with his remedies, and furthermore, that his experience concerning the terrible septic form of diphtheria, which is so frequently met with in some epidemics, must have been very limited at that time. In New York, during the past twenty years, for every death from diphtheritic laryngeal stenosis, there have been three from diphtheritic sepsis or exhaustion. To generalize from a few cases or years would be unsatisfactory. But few authors have displayed the modesty of Krieger, who had repeated opportunity for observation ("Etiological Studies," Strassbourg, 1877), yet in his careful essay on the "Predisposition to Catarrh, Croup, and Diphtheritis," refers to the insufficiency of his own observations.

When a modern writer (Ripley, *Med. Rec.*, July 31st, 1880) teaches that "diphtheria is a self-limited disease," "which runs its course from a few hours to weeks," and may "end in recovery, according to the character of the epidemic and idiosyncrasy of the patient, even without medicine," he certainly stretches the definition of a self-limited disease to undue proportions, while in regard to spontaneous recovery he states what may be said of any and every disease. His teaching that the only rational plan of treatment of diphtheria is a symptomatic one, is dangerous, because it is apt to seduce into the neglect of preventives, and of the timely resort to medication, to say the least. It is true that the results of no treatment cannot be uniformly successful, but at all events the indications for causal treatment are commencing to be known at last. In that respect we have progressed somewhat beyond the most thoughtful therapeutics of the disease, as developed in the course of the last century, and so well illustrated by the "Tentamen medicum inaugurale de cynanche maligna," by Thomas Wilson, Edinb., 1790. He says, p. 24: "Cum hactenus nullum inventum est remedium quod contagionem in corpus receptam suffocare possit; cum medicamenta pleraque quæ putredinem corrigere dicuntur, corpus ejusque functiones manifesto roborant; et

denique, cum hunc morbum comitantur virium prostratio, et, etiam ab initio, summa functionum debilitas, qualis evacuantia omnigena prohibet, indicationem curandi unicam, scil. debilitatis effectibus obviam ire, proponam. Hinc corporis conditioni obviam itur præcipue tonica et stimulantia administrando." (As no remedy has yet been found which can extinguish the contagion after it has been received into the body, as most medicines which have the reputation of correcting putrefaction, are roborants for the body and its functions, and lastly, as this disease is attended with great prostration and such debility of functions as to preclude the use of all sorts of evacuants, I propose but this one indication for treatment, viz., to meet the effects of debility. This is fulfilled by the administration of mainly tonics and stimulants.)

While speaking of stimulants, I will say a few words in regard to the dose to be given. There is more danger in diphtheria from giving too little than too much. When the pulse begins to be small and frequent, they must be administered at once. A three-year-old child can comfortably take thirty to one hundred and fifty grammes of cognac, or one to five grammes of carbonate of ammonia, or a gramme of musk or camphor in twenty-four hours. In the septic form especially, the intoxicating action of alcohol is not observed, the pulse becomes stronger and slower, and the patient becomes restful. In those cases in which the pulse is slow, together with a weak heart's action, the dose can hardly be too large. The fear of a bold administration of stimulants will vanish, as does that of the use of large doses of opium in peritonitis, of quinine in pneumonia, or of iodide of potassium in meningitis or syphilis. I know that cases of young children with general sepsis commenced immediately to improve when their one hundred grammes of brandy was increased to four hundred in a day.

The remarks I have made in reference to the general treatment of diphtheria naturally render superfluous a discussion of the value of abstraction of blood. For nobody would dare to resort to jugular venesection, as our predecessors did in the last century. It may be safely

asserted of the latter that it has no influence on the process, but frequently increases the local swelling and makes the patient more anæmic. There is no case in which a resort to it would not be criminal. I can distinctly recall the time when bleeding and calomel formed the groundwork of the treatment. Until the year 1862, the death rate in Rupert, Vermont, from diphtheria was ninety per cent., according to the reports of the local physicians, and particularly of my pupil, Dr. Guild, who at that time finished his studies in New York and commenced practising. When, in the same epidemic, bleeding and calomel were replaced by stimulants and iron, with chlorate of potassium, ninety per cent. recovered.

That attention must be paid to the general condition, mainly during a retarded convalescence from previous sickness, is self-evident. Any complications, too, must be subjected to early treatment. Diarrhœa must be mentioned among these; it reduces the patient's strength very quickly; likewise, the early appearing nephritis which may suddenly end life.

One important axiom must be borne in mind, namely, that prevention is more easy than cure. I do not refer simply to the removal of the healthy members of the family beyond the danger of infection, or to the isolation of the patient. If the latter becomes necessary, the first indication is his removal to the top floor of the house. There are, in addition, however, certain prophylactic measures which will prove valuable in the hands of every good physician. It is necessary under all circumstances that the mouth and pharynx of every child be constantly kept in a healthy condition. Eruptions of the scalp must be treated at once, and glandular swellings of the neck caused to disappear. But lately some cases of laryngeal diphtheria have been traced directly to the presence of suppurating bronchial glands, with or without perforation (Weigert, in *Virch. Arch.*, Vol. 77, p. 294, 1879). The same rule applies to nasal and pharyngeal catarrhs, the treatment of which should be begun in warm seasons, when general or local remedies yield better results. Enlarged tonsils should be resected, or, where that cannot

be done, scraped out with Simon's spoon, at a time when no diphtheritic epidemic is raging. It is important that this take place at a time when, even though sporadic cases of diphtheria occur, the danger of infection is not great; for, during the height of an epidemic, every wound will give rise to general or local infection. This holds true for wounds of any part of the body, as well as of the mouth. I therefore avoid an operation at such a time, provided it can be postponed.

Prevention, after all, is but in part the business of the physician. It is mostly that of the individual, or the complex of individuals, viz., town, state, nation. Those sick with diphtheria must be isolated, though the case appear ever so mild, and if possible, the other children sent out of the house altogether. If that be impossible, let them remain outside the house, in open air, as long as feasible, with open bedroom windows during the night, in the most distant part of the house, and let their throats be examined every day. The watching eye of a father or mother will discover deviations from the norm, so that the physician can be notified. Let the temperatures of the well children be taken once a day, in the rectum. Ten minutes of a mother's time are well repaid by the discovery of a slight anomaly, which may require the presence of the physician. Happily, there are many mothers who keep and value a self-registering thermometer as an important addition to their household articles. The attendant upon a case of diphtheria must not get in contact with the rest of the family, particularly the children, for the poison may be carried, though the carrier remain well, or apparently well. Unnecessary petting of the patient on the part of the well ought to be avoided, kissing forbidden, the bed-clothing and linen to be changed often, and disinfected, the air cool and often changed.

The well, or apparently well, children of a family that has diphtheria at home, must not go to school nor to church. The former necessity is beginning to be recognized by the authorities and teachers, and also in consequence of partially enforced habit by parents, the latter will be resisted longer. Schools ought to be closed en-

tirely when a number of cases have occurred. Even when the school children have not been affected to a great extent, but a diphtheria epidemic has commenced in earnest, it will be better to close the schools for a time. If that be not advisable, the teacher ought to be taught to examine throats, and directed to examine every child's throat in the morning, and return home every one barely suspicious.

In times of an epidemic, every public place, theatre, ballroom, dining-hall, tavern, ought to be treated like a hospital. Where there is a large conflux of people, there are certainly many who carry the disease with them. Disinfection must be enforced by the authorities in regular intervals. Public vehicles must be treated in the same manner. That it should be so when a case of small-pox has happened to be carried in such, appears quite natural. Hardly a livery-stable keeper would be found who would not be anxious to destroy the possibility of infection in any of his coaches. He must learn that diphtheria is, or may be, as dangerous a passenger as variola. And what is valid in the case of a poor hack, is more so in that of railroad cars, whether emigrant or Pullman. They ought to be thoroughly disinfected in times of an epidemic, in regular intervals, for the high roads of travel have always been those of epidemic diseases, and railroad officers and their families have often been the first victims of the imported scourge. Can that be accomplished? Will not railroad companies resist a plan of regular disinfections because of its expensiveness? Will there not be an outcry against this despotic violation of the rights of the citizen, the independence of the money bag? Certainly there will be. But there was also, when municipal authorities commenced to compel parents to keep their children at home when they had contagious diseases in the family, and when a small-pox patient was arrested because of endangering the passengers in a public vehicle. In such cases, it is not society that tyrannizes the individual; it is the individual that endangers society. And society begins at last, even in America, to believe in the rights of the commonwealth, and not in the rights of the democratic person only. The establishment of State and Na-

tional Boards of Health proves that the narrow-hearted theories of the strict constructionists have not only disappeared from our politics, but also from the conscience and intellect of society.

The sick-room must be kept cool, the windows kept open—more or less—in the night, the floor frequently washed, the linen soaked at once, the excrements removed. Dead bodies ought to be kept moist, for infectious material, chemical or otherwise, will spread more easily when dry. Attendants must not talk unnecessarily over the mouth or diphtheritic wounds of the patient, and will do well to carry a little dry loose cotton—to be changed often—in each of the nostrils, for it prevents the transport of infection from septic material to such as would be considered exposed under ordinary circumstances (Wernich in F. Cohn's Beitr., III., 1859). A very urgent and important mode of prevention consists in disinfection.

THE TONSILS

In mild cases of diphtheria of the tonsils I at times endeavor to destroy the membrane, but only when it can be reached with ease. In my opinion, the indiscriminate use of mineral acids and lunar caustic has done more harm than good. Where I can easily reach the membranes, I usually apply concentrated carbolic acid; where the membranes are not entirely within reach, I desist from this procedure. A scratching of the mucous membrane and a wounding of the epithelium would assist in spreading the membranous process in a very short time to the surrounding parts. I have already discussed the tendency of the disease to extend rapidly, and the danger of creating fresh wounds. In most cases of simple tonsillar diphtheria, I administer small doses of chlorate of potassium or sodium in water, or the tincture of the chloride of iron, so that from two to eight grammes (ʒ ss.-ij.) are taken in a day. I add a little glycerine, partly for the sake of keeping the remedial agent longer in contact with the diseased surface, partly for its own antifermentative effects, and give it in short intervals. The accompanying fever is usually

not high, and the neighboring glands are as a rule but little swollen or not at all. When there is a slight swelling of the lymphatic glands, cold water or ice applications are usually all that is needed. The latter should be made according to general indications. The glandular (and peri-glandular) swellings are less the result of an actual filling-up with foreign matter than of secondary irritation. Ice has a happy effect in such cases, both on internal administration, in the form of frequent small quantities of ice-water, ice-pills, ice-cream, and iced medicaments, as also externally by ice-cold cloths, or india-rubber bags filled with ice.

In general, the treatment of the swelled glands must be both based on its causes, and adapted to the present condition. The adenitis and periadenitis is of secondary nature, the irritation being in the mouth, pharynx, and nares. In these localities it is where the main treatment is required. The sooner the primary affection is removed, or relieved, or rendered innocuous, the better it is for the secondary complaint. Frequent doses of chlorate of potassium, or sodium, or biborate of sodium (or benzoate?) in mild doses frequently repeated, according to the principles laid down in another part of my Treatise, mouth washes, gargles, nasal injections with water, salt water, or solutions of disinfecting substances are not only indicated, but highly successful. When the case is recent, cold applications are required, but no washes. When it is of older date, stimulant embrocations are in order. Iodine ointments are absorbed but slowly; mercurial plasters do good in some cases; iodide of potassium dissolved in glycerin (1: 3-4), frequently applied, iodine in oleic acid (1: 8-12), iodoform in collodion or flexible collodion (1: 12-15) applied twice daily, the latter frequently with very good result, are beneficial.

DIPHTHERIA OF THE NOSE

results either from an extension of the morbid process from the pharynx, or occurs primarily. It occasionally manifests itself by a peculiar, thin, flocculent discharge, not

necessarily copious, and at times even trifling, and very often by a very early swelling of the glands of the neck, especially those behind and beneath the angle of the jaw. Nasal diphtheria often occurs where the nasal mucous membrane has for a long time been the seat of catarrh. Especially during the prevalence of an epidemic of diphtheria must we be careful not to allow a nasal catarrh to have its own way; we must likewise guard against considering the thin and flocculent discharge in infected cases as a mucous secretion. Whatever be the origin of nasal diphtheria, whether primary or the result of a similar affection in the throat, local treatment should at once be instituted, and if this be done, the great majority of cases will terminate favorably. The danger in this form of disease consists in an excessive absorption of putrid substances, and in the breathing of contaminated air. The indications for treatment are clear and decisive. The interior of the nasal cavities must be thoroughly cleaned and disinfected. If this be commenced early, the original seat of the affection may be reached, and the disinfectant process will, as a rule, have good results. It is not necessary to select very energetic disinfectants; a solution of twelve to twenty-five centigrammes (two to four grains) of carbolic acid in thirty grammes (an ounce) of water is at once mild and effective, and hardly gives rise to more discomfort than luke-warm water. Nasal injections must be made very frequently, until each time the stream of fluid has a free exit through the other nostril or through the mouth. They must be made at least every hour, and even oftener if necessary; at the same time it is advisable to be careful that the fluid does not enter the Eustachian tube. This can be prevented, to a certain extent, by compelling the patient to keep the mouth open during the procedure. I have seldom seen evil, or only disagreeable results from the administration of nasal injections in diphtheria. Still, a medical friend assures me that he has seen convulsions to follow an injection, an occurrence I never met with. It is likely that the mucous membrane of the pharynx is swollen as far as the openings of the Eustachian tubes, to such a degree as to render

the entrance of fluids into the latter improbable. The hardness of hearing, which is of so frequent occurrence in the course of a severe catarrh or diphtheritic attack, seems to indicate that the mucous membrane of that part is in a state of swelling. An ordinary syringe will suffice. However, when administered by parents or nurses, the blunt nozzle of an ear syringe or nasal douche is preferable; furthermore, by using the latter, the distribution of fluid is more equal. Occasionally here, as in local applications to the mouth and pharynx, the atomizer may be used to advantage; but the tube must be properly introduced into the nostrils. There are cases of nasal diphtheria, however, which are far more troublesome to manage than the foregoing would seem to indicate. I have seen cases in which the nasal cavities, from the anterior to the posterior nares, were filled and completely occluded by a dense solid membranous mass. I was then compelled to bore a passage with a silver probe, to gradually introduce a larger-sized one, and then to apply the pure carbolic acid, in order to remove the densest and thickest masses, and finally was able to make injections; even in such cases I have often had the gratification of being able to give a favorable prognosis. The dangerous secondary swellings of the glands will often subside after a steady employment of disinfectant injections for from twelve to twenty-four hours, but it must not be forgotten that these injections require to be made very frequently, either every hour or half-hour. We must not be drawn from our line of duty by the patient's desire for rest and sleep, but must continue the treatment uninterruptedly. It will be found that the children frequently do not object to this method of treatment; I have even met with some who, after convincing themselves of the relief afforded thereby, asked for an injection. When we are about to bring each injection to a close, it is well to press together the nasal cavities for an instant with the fingers. By this procedure the fluid (unless doing so spontaneously) is forced backwards to the pharynx, and is swallowed or ejected through the mouth and thus washes the pharynx and mouth at the same time. Frequently, however, this latter object is

obtained with every injection; for, the palate being swelled, œdematous, and paretic, the fluid is not prevented from reaching the pharynx, even in the average case. In regard to the choice of a disinfecting agent, I have but a few words to say. I believe that no one of them has important qualifications above the others. I avoid those which stain, and produce firm coagula. For the latter reason I do not use the subsulphate and perchloride of iron; for the former, the permanganate of potassium. I employ, as a rule, carbolic acid in solution, of the strength above mentioned. Where there is but a slightly fetid odor, I have frequently employed lime-water, or water, with glycerin, or a solution (1:100, 1:50) of sodium chloride, or sod. bicarb., also sod. borate. Disinfecting agents and antiseptics, whether carbolic acid, salicylic acid, or iron, are of no service when administered internally only, unless the seat and cause of the septic infection be attended to previously. I refer to what I have said above in relation to iron and salicylic acid. Under the local employment of antiseptics, as described, or by simply washing out with water, or salt water, most cases recover; without them, death will result. This much my experience has assured me of, that there is a certain number of cases which terminate fatally; but it is likewise true that the mortality need not be excessively great. It is a great satisfaction to me to learn from a recent paper of R. J. Nunn (*The Indep. Pract.*, Sept., 1880) that my method is appreciated and valued to its full extent. The author speaks very highly of the local treatment with iodine and boric acid. I cannot grant that it is hard to carry out the exact and apparently barbarous treatment necessary for a favorable result, for it is certainly more barbarous to sacrifice than to save life.

It is a positive fact that when children suffering from nasal diphtheria, with its peculiarly septic character, are permitted to sleep much—and they are apt to be drowsy under the influence of the poison—they will certainly die. To allow them to sleep is to allow them to die.

The first symptom of improvement is often a rapid diminution of the glandular swelling. But not in all cases

of nasal diphtheria these glandular swellings will be so prominent; in fact, it would be expecting too much to suppose that all at once there should be a rule allowing of no exception. The exceptions are of twofold nature: 1st. There is very little absorption through the lymphatic ducts, and very little, if any, glandular swelling in such cases where the very beginning of the disease is marked by slight hemorrhages, or by a discharge of bloody serum from the nostrils. In these cases, the blood-vessels are so superficial that they rupture and aid in macerating and sweeping off the membrane before absorption into the lymph circulation can take place. These cases are not always, however, mild in character. Open blood-vessels do not only discharge, they are also apt to absorb; and thus it is that many of these cases, be the glandular swelling ever so slight, prove very serious, and thus also, that they can be saved by very frequent disinfection only. The second exception is formed by those cases in which nasal diphtheria, or any other, attacks a mucous membrane which has been the seat of chronic catarrh and intestinal cellulitis, with consecutive thickening, induration, and shrinking. In color, thickness, and consistency, a normal tonsil, pharynx, or Schneiderian membrane differs greatly from those which have undergone a hyperplastic tissue-change. In the latter condition, blood-vessels and lymph ducts are compressed and atrophied, and no longer a high road into the system. It is, therefore, rather hazardous on the part of as careful a practitioner as Dr. Ripley (*Med. Rec.*, July 24th, 1880) to declare it a folly to expect to cure the disease by any local application; or of trying to prevent auto-infection in a system already charged with the poison. For as there are cases in which its feverless character and the local changes clearly mark a case as probably of merely local origin, local treatment, if it could or can be applied, is indicated in just these cases; and secondly, the "system being charged with the poison" does not mean an unalterable condition; for while elimination is going on constantly, absorption of new poison is keeping pace with it more or less. Not even death is an unchangeable condition, much less a morbid process. Be-

sides, Dr. Ripley says: "Even on the theory that these children die of septicæmia, and that the poison is absorbed from the nasal cavities, is syringing out these cavities several times an hour indicated? Who thinks of washing out an infected uterus, or abscess of the pleural cavity, or other organ, with any such frequency?" Certainly nobody, but nobody ever thinks of an equality of condition in nasal diphtheria on one hand, and a puerperal uterus or an abscess on the other. Even in the impossible case that all the membranes were washed away by a nasal injection, it is nothing new that the membranes will form again and again, and thus there is always, in addition to the former infection, a new one, and a necessity to meet it. If the doctor says: "If carried out as recommended, it must prove a most exhausting plan of treatment," I refer him to what he relies on, viz., clinical observation, and very much desire he should try and be satisfied.

DIPHTHERITIC PARALYSES

The treatment of diphtheritic paralysis is simple enough in many cases; for sometimes nothing but patience and waiting are necessary. The limbs are usually restored to their normal condition, if the circumstances be in any way favorable. Anæmia and debility are invariable concomitants, and the diet and medical treatment must be regulated accordingly. We must not forget, however, that overfeeding and a sameness of diet are not permitted, for not rarely the muscular coat of the stomach suffers with the rest of the muscular tissue, and the secretion of gastric juice is very deficient in anæmic individuals. While therefore, from a therapeutic standpoint, iron is indicated, we must not neglect to pay particular attention to nutrition and digestion, and to aid the latter with pepsin and moderate amounts of muriatic acid, well diluted. Quinine and stimulants are appropriate wherever there is no contraindication to their employment. The treatment of paralysis itself, where it is not deemed judicious to wait, will naturally depend on the diagnosis of the condition in question. This alone can explain why various modes of

treatment, the electric current among others, after being recommended by some authors, are branded by others. Where we have to deal with those rare changes in the brain and spinal cord, with apoplexy, "the utmost care is necessary" in order "not to make the condition still worse," and in such cases there would be a contraindication to the use of the faradic current, but this would not hold true with regard to the use of the galvanic current in short sittings. Besides, central paralyses are by no means so frequent as peripherous ones. In most cases, there is not the slightest elevation of temperature during the course of the paralytic phenomena. I lay great stress upon this point, for I am aware that many cases of central congestions and inflammatory processes at times exhibit but very insignificant elevations of temperature. But as the diagnosis will depend on a positive knowledge of whether there have been changes of temperature, I rely on the rectal temperature only, for many a myelitis runs its course with no greater elevation above the normal than one-half or one degree. In all cases in which the temperature is normal or subnormal, I do not hesitate for a moment to employ the faradic or the galvanic current, according to circumstances. In addition to the internal administration of iron, I advise by all means the employment of nux vomica, in the form of strychnia. I cannot indorse Oertel's warning against the use of strychnia, on the ground that, as it acts centrally, it will positively give rise to an increased irritation of the morbid process in the spinal cord. The observations of a great many authoritise, and my own, which are rather extensive, cause me to look upon strychnia as the most reliable remedy in diphtheritic paralysis. Where there is no necessity for haste, we may give moderate doses, gradually increasing, in combination with iron; where there is danger in delay, it is more judicious to have recourse to subcutaneous injections, administered at regular intervals. Henoch has seen diphtheritic paralyses disappear in three weeks, under the use of hypodermic injections of strychnia. This, which has also been my experience on many occasions, corresponds with what Demme says (tenth report, 1873) in

connection with the treatment of infantile paralysis. His statements I have seen verified in the latter disease, in cerebral paralyses and in diphtheritic paralysis. It also agrees with the favorable results from subcutaneous injections of strychnia in the temples in amaurosis, which Nagel was the first to witness, and which since have been observed by others, and by myself in several cases. I especially advocate the use of injections where there are urgent and dangerous paralytic manifestations, as in case of danger depending on the paralysis of the muscles of deglutition and of respiration. Of course, where the former are affected, it is necessary to nourish the patient artificially, partly, perhaps, by nutrient enemata, but principally by means of the stomach-tube. In using the latter, it is unnecessary to introduce it into the stomach, as it only requires to be passed a few inches below the affected parts, when the œsophagus, far from manifesting the repugnance displayed by the pharynx, undertakes the further disposal of the food. In these cases, strychnia should be injected subcutaneously in the neck, once or twice daily. In a similar manner, it should be injected in the region of the chest, diaphragm, or neck, in paralysis of the respiratory muscles or of the glottis. In paralysis of the muscles of accommodation (in which Scheby-Buch claims to have seen the process cut short by the use of calabar bean, considered as inert by Hassner) they may be given in the forehead or temples.

Frictions dry and alcoholic, hot bathing, friction with hot water, kneading of the affected parts, will be found beneficial and pleasant.

SUMMARY

Every case should be treated on general principles, with symptomatics, tonics, stimulants, febrifuges, externally, internally, or hypodermically.

The uncertainty of the termination, and the frequency of collapse or sepsis, prohibit procrastination. Waiting long means often waiting too long.

Alcohol is a very important adjuvant and remedy. The dose must often be apparently large, from two to twelve

ounces daily, according to circumstances. Depletion is absolutely contraindicated. Debilitating complications, such as diarrhœa, must be stopped instantly.

Mouth and neck must be kept in a healthy condition. Stomatitis, chronic pharyngitis, hypertrophy of the tonsils, glandular enlargements must be relieved or removed preventively. Acute catarrh of mouth and pharynx requires the use of potassium or sodium chlorate in doses not exceeding a scruple daily for a child of a year, one and a half to two drachms for an adult, every hour, half, or quarter hour. Large doses are dangerous, result often in nephritis, and have proved fatal.

The main indication in local diphtheria is local disinfection. To disinfect the blood effectively we have no means. Salicylic acid changes into a salicylate which is no longer a disinfectant. The amount of disinfectants required to destroy bacteria is so great that the living body could not endure them; for instance, carbolic acid, quinine, and sulphur. But the discipline of the house, school, and social intercourse can be so modified as to prevent the spreading of an epidemic. The instructions for disinfectants published by the National Board of Health are as simple as they are effective.

The inhalation of steam is very useful in catarrh of the respiratory organs, and also in inflammatory and diphtheritic affections. In fibrinous tracheo-bronchitis it has proved quite successful. But it may prove dangerous by excluding oxygen and overheating the room or tent. Drinking of large quantities of water, with or without stimulants, also incites the action of the muciparous glands and aids in macerating membranes. The internal use of ice, and its local application to the affected parts, can be very useful. But the cases must be selected for each and any of the remedial agents and applications. The use of baths, and the cold or hot pack is controlled by general indications. The usefulness of lime-water and lactic acid has been greatly over-estimated. Glycerin is a valuable adjuvant both externally and internally, but not more. Turpentine inhalations are deserving of further trials, though naturally they are more effective in purely inflam-

matory than in diphtheritic processes. Inhalations of ammonium chloride act favorably in catarrhal and infammatory conditions and deserve a trial for the purpose of aiding maceration of membranes. Mercurials are contraindicated in the septic and gangrenous forms of diphtheria, but in those which assume more the purely inflammatory character with less constitutional debility and collapse, as in "sporadic croup," or in fibrinous tracheo-bronchitis, some reliable clinicians claim good results.

Astringents, such as tannin and alum, do not act favorably.

Chloride ferric is amongst the most reliable antiseptic and astringent agents. Small doses in long intervals are quite useless. Moderate doses frequently repeated have a satisfactory general and local effect. A child of a year must take at least four grammes (a drachm) of the tincture daily; a child of three or four years, from eight to fifteen grammes. The same or a larger dose for an adult. The chloride is to be mixed with water and glycerin in various proportions, so that a dose is taken every hour, every half-hour, every ten minutes. Thus the local applications to the throat become mostly superfluous. Potassium or sodium chlorate from two to four grammes (3 ss.-i.) daily may be added to advantage.

Carbolic acid is useful both in local and internal administration. According to the object to be reached, it may be used either in concentrated form, or in a one-per-cent. solution. Internally, in doses of a few grains to half a drachm daily.

Salicylic acid acts as a caustic when concentrated; in moderate solutions it destroys fetor; salicylates are antifebriles only. The antifebrile effects of quinine are not so favorable in infectious as in inflammatory fevers; its antiseptic action is not satisfactory in practice.

Deliquescent caustics are dangerous. Injury of the healthy mucous membrane must be avoided. Mineral acids, and carbolic acid, when their application can be limited to the desired locality, are preferable.

Bromine both internally and externally is warmly recommended by Wm. H. Thompson.

Boric acid, in concentrated and milder solutions, has been recommended as a local application to membranous deposits generally, and to the diphtheritic conjunctiva in particular.

Sodium benzoate does not deserve the eulogies bestowed on it from theoretical reasoning.

Eucalyptus, sulphur, copaiba, and cubeb cannot be recommended.

Membranes must not be torn off, and not removed unless they are nearly detached. Caustics are contraindicated except where their application can be limited to the diseased surface. No healthy part must be injured. Swelled lymph-glands require ice, iodine, iodoform, mercury, poultices, incision, carbolic acid, according to circumstances, and at all events frequent and careful disinfection of the mucous membrane from which their irritation originates. Diphtheria of the nose is apt to be fatal unless careful treatment is commenced at once. It consists of persistent disinfection of the nares and pharynx by means of injections. The tendency to sepsis forbids a long intermission of them. They must be continued day and night for one or several days, no matter whether the glandular swelling is considerable or not.

Laryngeal diphtheria proves fatal in almost every case. unless tracheotomy be performed. It is the less successful the more the epidemic or case bears a septic character. Emetics, such as zinc and copper sulphate or turpeth mineral, are useful for the removal of half detached membranes.

Diphtheritic paralysis requires good and careful feeding, iron, strychnine, the faradic or galvanic current, friction, hot bathing. Urgent cases indicate the hypodermic administration of strychnine.

Diphtheritic conjunctivitis is benefited by ice and boric acid; cutaneous diphtheria, by local cauterization and disinfection, besides general treatment.

LOCAL TREATMENT IN DIPHTHERIA

The bacilli and the toxine of diphtheria will invade the circulation by direct inhalation into the lungs in but very few instances. These are some of the cases in which the constitutional symptoms precede the local. Local deposits, however, are not always visible, as, for instance, in those cases in which the constitutional symptoms are connected with diphtheria of the nose, where but few deposits take place, and the virus—the nasal discharge being slightly bloody—is absorbed directly into the open blood-vessels. In the vast majority of cases, however, local deposits are easily found, and mostly on the mucous membranes, rarely on that of the intestines, very exceptionally the gastric, more frequently the genito-urinary, particularly the vagina, rarely the bladder, in most cases the pharyngeal or respiratory mucous membranes. Besides, diphtheritic pseudo-membranes are found on abrasions of the skin by scratching, eczema, erysipelas, vesicatories, and in surgical wounds, such as circumcision and amputation wounds, tracheal incisions, resection of tonsils or removals of adenoid growths. It is on the external wounds that the effect of local treatment can be best studied.

The local remedies employed have been used for the purpose of either directly destroying the pseudo-membrane, such as nitrate of silver, carbolic acid, the actual cautery; or to dissolve them, such as the alkaline carbonates, the chlorides, steam papayotin; or to act as astringents, such as lime-water and the chloride and subsulphate of iron; or to disinfect, such as the potassic chloride, chloral hydrate, turpentine, carbolic acid, mercury, sulphur, bromine, iodide, iodoform, chlorine-water and peroxide of hydrogen. The methods of application have been either direct local administration by the attendant, or washes and gargles, sprays, injections, inhalations.

The local treatment of the mouth and throat has two indications,—first, to keep the mucous membrane of the cavities in a healthy condition or restore them; second, to influence the diseased surface. Gargles in any shape will reach the oral cavity only. They never touch anything beyond the anterior pillars of the soft palate, and seldom more than a small part of the tonsil. The gargles with chlorate of potassium, the benzoate or biborate of sodium, have only a preventive, not a curative, effect; still, they ought not to be neglected when the children are old enough to use them. Mild solutions of the above salts may also be introduced into the mouth of babies from time to time by means of a brush or a pipette. Local applications to the throat, even where they are possible, ought not to be made with powders. They are apt to nauseate and produce vomiting by their mere contact. Even powders for internal administration require careful mixing with water, or they are liable to irritate the throat; thus, the direct application of calomel, the oxide of mercury, or sulphur ought to be avoided. Applications of substances with bad taste or those that give pain must be avoided, because the struggling and consecutive exhaustion of the patient will do more harm than the remedy will do good. That is so with a number of substances, particularly with the chloral hydrate and even with the chloride of sodium, which was recommended some years ago as a local application to the pseudo-membrane of the tonsil.

In diphtheria the danger arises, first, from suffocation. That can be easily recognized, and the indications for the treatment by mechanical means—that is, intubation or tracheotomy—are readily found. These are the cases in which repeated fumigations with 10 to 15 grains of calomel, under a tent or in a small room, are used to advantage. Steam will also answer well under the same circumstances. The second great danger is from exhaustion and heart-failure, which is not merely functional, but organic. It is always to be feared, for it is known that apparently mild cases may thus perish. The indication, then, is to save as much nerve strength as circumstances will

permit. The third great danger is sepsis, which is not to be feared to an equal degree in all cases, for those cases of diphtheria which are confined to the tonsils, with its large amount of elastic tissues surrounding it, and with their scanty communication with the lymph system, are not liable to produce sepsis, and thereby to terminate fatally. Both sepsis and fatal termination are the results rather of those cases which are confined to or implicate the nares and the naso-pharynx.

Where the diphtheritic pseudo-membrane is within reach, it ought to be either destroyed or disinfected. For that purpose a fifty-per-cent. solution of carbolic acid in glycerin may be applied several times a day, or the tincture of iodine, or solution of 1 part of the bichloride of mercury in 100 or 500 parts of water. It is in these cases that chlorine-water has been injected through the surface into the upper layers of the tonsils. But we must never forget, first, that only a small part of the pharynx is accessible to such treatment, and that it is only one class of patients who can be subjected to it. In order to be effective, the application must be thorough. None but adults or large children, and of them only a small number, will submit to opening their mouth and having the applications made. It is that very class of patients who can be induced to gargle with anything like success. Smaller children will object, will defend themselves, will struggle. It takes many a good minute to force open the mouth; meanwhile, the patient is in excitement, perspiring and screaming, exhausting its strength. You may succeed in forcing open the jaws; then there begins the practice of making applications, of swabbing, of scratching off the pseudo-membrane, of cauterizing, of burning. The struggling child will prevent you from limiting your application to the diseased surface. You cannot help injuring the neighboring epithelium; thus the process will spread. Instead of doing good, you have done harm; for indeed, no local application can do as much good as the struggling of the frightened child does harm. I have seen them die while defending themselves against the attempted violence, leaving doctor and nurse victorious on the battle-field. It is

incredible, but it is true, that more than one has recommended using the electro-cautery or the thermo-cautery on the throat of the baby, after forcing the mouth open. It is almost incredible, for you are aware that the offenders cannot have been ignorant of the fact that what they can reach with their instruments is but very little besides the tonsil, and they might have known that the tonsils are not apt to favor the inception of sepsis into the system.

There is an easy way of using disinfectants on the throat and mouth; give medicines which are, at the same time, disinfectants, digestible, and easy to take; give them in small doses; give them frequently; see that when they have been given, no water nor milk is taken immediately afterwards, so as not to wash them off from the mouth and throat. Such medicines are mild dilutions of the tincture of chloride of iron, or lime-water, or boric acid, or bichloride of mercury, most of which will act both by their constitutional and the local affect.

Diphtheria is most dangerous when located in the nose and naso-pharynx. The changes taking place in the nares may be an extensive catarrh, besides the diphtheritic deposits. The diphtheritic membranes are sometimes very thick, and contain a great deal of fibrin. Sometimes they are so thick as to clog the nares and prevent respiration. Underneath them copious absorption of toxines may take place. In most cases, though, the diphtheritic membranes are not so thick. Some of them macerate very readily, and the toxine is very speedily absorbed through the exceedingly copious lymph-ducts, and sepsis is the result. In some cases of diphtheria the membranes can hardly be seen. The discharge from the nose is liquid and acrid, contains small flakes and some blood. These are the cases in which the toxine is absorbed directly into the blood. All of these forms may lead to necrosis and gangrene of the tissue, and produce a very peculiar sweetish, nasty odor. Thus, the inhaled air is poisoned, and, being carried down into the lungs, acts as an additional danger. The most dangerous locality is the posterior nares, with their direct communication with the lymph-bodies below

the angle of the lower jaw. The pseudo-membranes, the lymph-ducts, lymph-bodies, swarm with bacilli and toxine, with streptococci, with staphylococci, and lead to immense tumefaction between the ears and clavicles, to the formation of multiple abscesses, to hemorrhages, to sepsis. All of these forms of nasal diphtheria require immediate, persistent, and efficient local treatment, for it is safe to say that every case of nasal diphtheria has a tendency to terminate fatally. The local treatment is to consist in cleansing and disinfecting. In most cases these two are identical, for if we simply succeed in washing out the macerating material, that would prove sufficient. In order, however, to have that effect, the washing and disinfecting must be done often,—every half-hour, every hour, every two hours. In the bad cases, in which the nares are clogged with pseudo-membrane, the cleansing and disinfecting is to be preceded by forcing a passage through the nares with a probe covered with wadding and dipped in carbolic acid. Particularly is this indication urgent when there is sopor, which owes its origin partly to the difficulty of respiration and partly to the septic condition. The methods of local treatment, besides the one just described, are the application of ointments into the nose by means of the brush or wadded probe, or the use of the spray or syringe or irrigator, or the use of a spoon or feeding-cup, through which liquids are poured into the nares.

In making local applications it is important that the whole surface should be touched; therefore ointments are not available in the average cases where the whole naso-pharynx is the seat of the affection. The atomizer will seldom convey a sufficient amount of liquid into the cavities to be of much use. A spoon or small feeding-cup, the nozzle of which is narrow enough to enter the nose, will do fairly well, and will allow the introduction of liquids into the nares in small or large amounts, all of which will enter the throat, be either swallowed or flow out. The irrigator is liable, by undue pressure, which cannot always be well measured, to injure the ear. It is true that this cannot take place very readily so long as the whole naso-pharynx is covered with pseudo-membrane, but this will

not always remain, and then there is a possibility of the injection entering the middle ear. This will take place the more readily the younger the infant, because the pharyngeal orifice of the Eustachian tube is relatively larger and more funnel-like in the very young than in advanced age. I prefer a small glass syringe with a conical nozzle of soft rubber. It will close up the nostril, the pressure can always be well measured and modified, and it is effective. The injections must be made in the recumbent or semi-recumbent position. On no condition must a child be taken out of bed for the purpose of having the nares washed and disinfected. I know of many cases in which the patient has died simply from being taken up repeatedly.

The applications to be made may be quite simple. In many cases a solution of table salt in water (7 to 1,000), or boracic acid (3 or 4 to 500), or lime-water will answer all purposes. The latter is particularly indicated when there is a thin, acrid, slightly fetid discharge. A more efficacious disinfectant than all of those mentioned is the bichloride of mercury, 1 part mixed with 100 parts of chloride of sodium in from 2,000 to 10,000 parts of water. It can be used freely.

If moderate quantities of a mild solution of bichloride of mercury be swallowed while being injected, no harm is done. Where there is a fetid odor, the nares ought to be deodorized by carbolic acid or creolin.

Carbolic acid may be used in solutions of from 1 to 10 in 1,000 parts of water, but it must not be forgotten that there is some danger in swallowing the carbolic acid, because of the nephritis which it may give rise to. For the same purpose of deodorizing, creolin may be used in one-per-cent. solutions.

For the purpose of dissolving membranes, papayotin (not the proprietary medicine sold under a similar name) has been used in five-per-cent. solutions, either as a spray or injection, or direct applications by means of a sponge or brush. I have used it to dissolve the diphtheritic membranes of the trachea below the tracheotomy tube in greater concentration. Its application in powder does not answer

well. For the same purpose trypsin in five-per-cent. solutions has been employed, mixed with bicarbonate of sodium.

The cervical lymphadenitis, of which I have spoken as the result of nasal diphtheria, must be treated persistently and effectively. This treatment may be preventive and curative. The preventive treatment consists in the nasal injections described. When large tumefaction has taken place, tincture of iodine has been applied externally; it is useless. Mercurial ointments have been applied; they are useless, both as a remedy and as a means of massage. Ice externally is rational, but it is useless as long as the infection is not stopped. I have in a number of instances injected iodoform, in ether, into the swelled mass. It is too painful and too inefficacious, and does not pay for the agitation, anguish, and exhaustion of the unhappy baby. So, indeed, there is no remedy, besides the preventive measures, except in long and deep incisions into the immense mass. Do not wait for fluctuations or even semi-fluctuations to become apparent. A great deal of the swelling is inside the fascia. Abscesses, when they form, are seldom large. The contents consist more of necrotic tissue, which ought to be laid open as soon as possible and disinfected. The incision must be a long one; in most cases from ear to clavicle. The disinfection of the wound may be obtained by subnitrate of bismuth, by tincture of iodine and iodoform, or other antiseptic gauze. No carbolic acid can be used for disinfection, because of its tendency to give rise to hemorrhages. When hemorrhage takes place, it is apt to stop, under pressure with antiseptic gauze; but sometimes, large blood-vessels having been eroded, the hemorrhages are very copious. In such cases the actual cautery, acupressure, sometimes the ligature of blood-vessels, have to be resorted to. Chloride of iron and subsulphate of iron must never be used on such necrotic surfaces. They give rise to a thick coagulated scab, under which septic absorption is apt to take place.

The treatment of diphtheritic paralysis is in part local. Friction and massage of the paralyzed limbs, either dry or with oiled hands, or with alcohol and water, will restore circulation and nutrition to the muscles. The prin-

cipal indications for local treatment, however, are found in those cases in which the respiratory muscles are paralyzed and life is in imminent peril. Fortunately, these cases are rare, but they require immediate treatment. In the neighborhood of the paralyzed muscles strychnine injections can be made at brief intervals, and the electrical current must be passed so as to stimulate the paralyzed muscles. Care must always be taken, however, not to overstimulate, thereby paralyzing the muscles, which is the invariable result if the current is allowed to pass through the tissues uninterruptedly.

LARYNGISMUS STRIDULUS

Scarcely in any chapter of infantile pathology do we meet with more confusion than in the expositions on laryngismus stridulus. The very large number of names that has been applied to the very same symptoms, shows that authors agree neither as to the nature of the affection, nor its cause, nor even always as to its symptoms, or its seat. Thus only is it possible, that the names of laryngismus stridulus, apnœa of infants, thymic asthma, crop-like inspiration of infants, crowing inspiration, spasm of the glottis, paralysis of the glottis, suffocative asthma, stridulous angina, internal convulsion, and many others, could be applied to the same affection. Thus only was it possible to mistake laryngismus stridulus (asthma Koppii) for spasmodic laryngeal catarrh (asthma Millari), and, as several modern writers have done, to separate spasm from paralysis of the glottis; although it ought to be acknowledged, at last, that the symptoms of glottic spasm and glottic paralysis are not only the results of the same irritations, but also identical. It is, in my opinion, a fact which I am sorry to state, that with a single exception the authors on infantile pathology have been mistaken, at least in the physiological explanation of the symptoms of laryngismus. The exception is formed by Dr. Friedleben, of Frankfort, a German, whose name I have had the honor of bringing repeatedly before the profession of our country, and whose eminent work, on the physiology of the thymus gland in health and disease, I again recommend to your attention. His expositions on our subject are, in my opinion, so satisfactory and convincing, that I willingly follow him, as far as I dare, in discussing one of the most puzzling subjects of infantile pathology.

Laryngismus stridulus is emphatically a disease of infantile age. It is observed in children, both healthy and sick,

in their sleep or while they are awake, playing, eating, singing. The first stage of an attack of laryngismus is a sudden and entire apnœa. Respiration is stopped suddenly, entirely, for a few seconds, even for a minute, the face is pale and bloodless, in attacks of long duration cyanotic, the skin cool, the heart scarcely perceptible, the entire muscular system in a state of paralysis. The second stage is that of a beginning reaction to this thorough inactivity, viz., the first action of the recurrent nerve stimulating again the function of the muscles of the glottis, after which the spinal nerves commence again to enliven the other respiratory muscles to such an extent as to produce a violent, deep, "crowing" inspiration. In the third stage, finally, the reaction is complete. Short convulsive expirations restore the functions of the respiratory organs to their former condition. Attacks of great intensity and long duration are usually attended with contractions of the hands, and even general tonic convulsions of the trunk (opisthotonus) and lower extremities. Sometimes general eclampsia has been observed to accompany the attack of laryngismus, but also to return without another attack, or an attack to return without eclampsia. Involuntary evacuations of the bowels have been observed to occur during the attack. It is seldom fatal, a large number of attacks have been observed in a single day, and the disease is apt to last for months. Whenever death ensues in the attack, it will be in the first stage; but it may be caused also by exhaustion of the nervous faculties, or by tuberculosis, or other local diseases being the last cause of the attacks.

The symptoms of the first stage of laryngismus cannot be explained except by a functional trouble, by paralysis, perhaps of the oblongated spine alone, perhaps of the nervous centers together. We are unable to state what are the alterations going on in the nervous system, but there is no doubt that the influence of the period of life in which laryngismus is observed, of insufficient or unappropriate nutrition, of foul air and morbid taints are strong enough to change or interrupt its functions, especially in such cases where, as will be shown later, peripheric influences will bring new irritations to bear on the suffering nervous

centers. Paralysis of the muscles of the glottis alone is unable to produce all the symptoms of the first stage of laryngismus; for by cutting a recurrent nerve such general symptoms could never be produced. And the dissection of both the recurrent nerves gives rise to real suffocation, pretty rapidly, but not at all suddenly; lungs and brain are hyperæmic, the cutaneous veins and heart full of blood; whereas post-mortem examinations in laryngismus show a positive absence of hyperæmia in the brain, and anæmia of the cutaneous veins and the heart. Death in laryngismus ensues in the same manner as in animals whose oblongated spine has been cut. They die either instantaneously, both respiration and circulation ceasing at once, or some few contractions of the extensors of the trunk and lower extremities are early observed; repulsion or retention of venous blood is nowhere found, neither in the brain, nor lungs, nor heart.

The crowing inspiration, and the convulsive expirations are symptoms of returning reaction, of the recommencement of nervous functions. Thus the attack is at an end, but not the disease. Crowing inspiration, after what I have said about it, is therefore not at all pathognomonic to our subject, nor is it right to mistake one for the other, but it is certainly a very valuable symptom. A very similar process is going on in asphyctic newborn infants, in which the first muscular exertions of the glottis, hitherto unsupported by other respiratory muscles, give notice of beginning life.

Uncomplicated laryngismus is never accompanied with fever. Its duration is very various, some children being affected but once in all their life, and recovering, some dying in the first attack, and some suffering for months, even years, from a series of mild or severe attacks, until they will either finally recover, or perish in the last attack. The disease is most frequent about the commencement of the first dentition; that is to say, from the seventh to the twelfth month of life. About this period the general growth of the body is very remarkable; especially the osseous system in all its parts undergoes a rapid development. The tubular bones grow longer, the medullary cavity wider, the

epiphyses thicker; the vertebral column, and the cranium increase in substance and size, the circumference of the thorax and abdomen becomes larger; and at the same time the contents of the large osseous cavities, as brain, spine, lungs, heart, thymus, and the abdominal viscera gain in size and weight. This period is somewhat similar to that of puberty, not only in its physical, but also in its psychical relations. Neuroses are very common in either of these periods of life, where with the rapid changes in the substance and volumes of the organs unexpected changes in their functions may be observed to take place. It is no wonder, then, that the slightest causes may prove sufficient to greatly influence the nervous centers, exposed as they are to any irritations from any organ; a slight indigestion, fright, refrigeration of the skin, morbid dispositions of any kind will sometimes suffice to bring on an attack of laryngismus, with its paralytic influence on the whole number of respiratory muscles. No less astonishing, however, is the fact that laryngismus is not very seldom observed at a somewhat later age. Such children as are suffering from a morbid taint, or rhachitis, or have been retarded in their general development by severe diseases, or injured in their health by either bad or superabundant food, will reach dentition and the general rapid development of the osseous system, at an unusually late time. Thus the attacks of laryngismus will appear later, and become the severer the more the nervous system has been affected before. In both very early and very advanced age cases of laryngismus have not often come under observation; but there are some related of newborn infants, and up to the age of six or seven years.

The mildness or severity of the attacks of laryngismus will depend on the constitution of the patients and occasional causes; if such was not the case every one would resemble the other. The milder form will be particularly recognized by a milder appearance of the first stage of the attack, viz., the sudden paralysis of all the respiratory muscles, and the unimportance of the accompanying carpopedal or other spasmodic symptoms. Of this kind are those mild attacks which are described by Rilliet and Bar-

thez, Hérard, and Ranking, and called "holding-breath spells" by J. Forsyth Meigs. The first stage of the attack is not very violent, and crowing inspiration is not always perceived, but in the cases witnessed myself, I have never missed the convulsive expirations forming the third and last stage. "The most frequent cause of the paroxysms is contradiction. They are determined also by fright, pain, and crying," but I feel sure, after what I have observed myself, that the first causes will be such as have been named above. Further, in Dr. Meigs' opinion, "they never occur spontaneously, and never during sleep," but I am sure that in the case of a tuberculous little girl of five months the patient was very often, sometimes several times during a day, awakened with a slight attack of laryngismus, or "holding-breath spell." I have been unable to comprehend any other difference between an attack of laryngismus and of holding-breath spell but that of a different severity of symptoms of the same affection. There are cases, however, without any paralysis of the respiratory muscles, but with crowing inspiration, which are to be distinguished from laryngismus stridulus. They are not the consequence of some trouble of the nervous centers, neither original nor produced by peripheric influences, but are those affections comprehended under the name of spasmodic laryngitis, or asthma Millari, which is not a general neurosis, but a local affection, viz., catarrh of the larynx complicated with spasm of the muscles of the vocal chords.

Amongst the peripheric influences which we have been hitherto taught to consider of foremost importance in producing laryngismus, is hypertrophy of the thymus gland. Hypertrophy of the thymus was considered not only to be a frequent occurrence, but of particular tendency to exercise pressure on the recurrent nerve and thereby give rise to attacks of laryngismus stridulus. Even some of the latest medical journals report some cases of laryngismus in which this anomaly is said to have been found out as the cause of death. But Dr. Friedleben has satisfactorily proved that the number of hypertrophied thymus glands that have ever been observed is very limited indeed, and

that of all the cases in which the thymus was really hypertrophied, only seven-twelfths died of laryngismus. The majority of thymus glands believed to be and described as hypertrophied had not at all exceeded, nor even reached, a normal development, and from careful observations and measurements, the author arrives at the conclusion that the thymus gland is not able, neither in its normal state nor in its hypertrophied condition, to prevent respiration, to disturb circulation, to cause a pressure on respiratory nerves, to injure cerebral circulation nor the innervation of the muscles of the glottis, nor to exhibit in its own substance a periodical turgescence, produced by retention or repulsion of blood. The only periodical turgescence that really takes place in the thymus, is produced, physiologically, during the assimilation of food, but it has no influence in bringing on attacks of laryngismus, as such attacks will appear at any time and hour, before and after meals, and with any kind of food.

The whole number of cases ever observed of really hypertrophied thymus glands is about eleven or twelve. All of them are congenital, and not at all pathological; only one single case of inflammatory exudation into the tissue of the thymus and its neighborhood, is known in the whole range of literature, and even this case did not occur in infantile age. In all of them, as far as it is stated in the reports, the thorax was developed in accordance with this anomaly, and in none of them, consequently, was there any reason to try the effect of therapeutical influences upon this congenital, as it were physiological, anomaly.

The only nerve, by which spasm or paralysis of the muscles of the glottis could be affected, is the recurrent. The only nerves that could be reached and influenced by the thymus gland, could be either the phrenicus, or the vagus *below the origin* of the recurrent. The latter is situated immediately on the trachea and protected on both sides in such a manner as not to be troubled by either enlarged bronchial glands or swelled thymus. The only pressure possible may be produced by the enlarged thyroid and the lymphatic glands into which it is naturally imbedded. They will sometimes swell, undergo tubercular degeneration, and

give rise even to pathological alterations in the neurilema and primitive fibres of the nerves.

Thus it appears that the name of thymic asthma is wholly unscientific, as likewise the name of "asthma Koppii" is not justified by the facts. For Kopp, who wrote in 1830, has neither been the first to exactly describe this disease, being preceded by Hamilton in 1818, John Clarke in 1815, and Alexander Hood in 1827, nor the first to attribute its symptoms to a presumed hypertrophy of the thymus gland. This has been considered as the cause of laryngismus as early as in the seventeenth century by Felix Plater, 1712 by Budaeus, 1723 by Richa, 1725 by Scheuchzer, 1726 by Verdries, about the end of the eighteenth century by Peter Frank, 1826 by Velsen, and 1827 by Alexander Hood.

It is not my opinion, however, that affections of the nervous centers will always be the only causes of laryngismus; it must be considered as an undoubted fact that disturbances of the functions of the vagus and sympathetic nerves give rise to the very same symptoms. Thus any troubles of the alimentary canal, superabundance of food although it may be of good quality, presence of a large number of ascarides in the intestines, and obstinate constipation produced by vicious nutrition and consecutive torpor of the muscular layer of the intestinal canal will be reflected on the nervous centers, and thereby produce the symptoms of laryngismus. In such cases the results of post-mortem examinations, and the symptoms during life are exactly like those following genuine affections of the cerebrum; thus, at all events, the nervous center is foremost, if not alone, active in giving rise to the dangerous symptoms during life, not to speak of those cases of laryngismus which directly depend on craniotabes or hydrocephalus.

Dentition, too, is often reported to have been the cause of laryngismus; the symptoms being taken as reflex actions produced by the peripheric irritation of the n. trigeminus. If the degree of this irritation was such as it is generally supposed to be, its importance and danger would certainly not be overrated. But I am not of the opinion of many, particularly English writers, as Marshall

Hall, etc., and of the public at large, that dentition itself is accompanied with the large number of dangers said to be brought on by it. In our own country, even in our large cities, we are used to see, almost every week, dentition enumerated amongst the direct causes of death, and the prejudice of both public and physicians lays too much stress on the supposition that a physiological process will by itself produce death. Therefore I feel justified in reminding you of the fact that dentition is almost the only visible sign of the general alteration which takes place about this period of infantile age, especially in the osseous system, and certainly it is feared by the public for no other reason but because it lies open to the eyes of everybody. There may be, in some rare cases, an abnormal development of the maxillæ and their alveoli, or abnormal osseous deposits or infiltrations in the osseous tissue and its canals, and some unusual irritation of the last ramifications of the n. trigeminus, but the influence of normal dentition in producing diseases, and causing death, is certainly not such as is often supposed even by well-educated medical men.

In some cases, described by Dr. Friedleben, a congenital hypertrophy of the thyroid gland has probably been the cause of laryngismus. The patients were newborn infants, of normal development and born by normal labors. There were no constitutional causes of the disease, but a remarkable vascular swelling of the thyroid gland. Whenever the swelling increased, the veins of the face and head increased in size also, the face grew livid and the extremities and spinal column exhibited slight tonic convulsions. The recurrent nerves were entirely surrounded by the glandular tissue, their neurilema looked unusually red, and their function was probably injured during the occasional swellings taking place during life-time. Moreover, the anatomical position of the thyroid gland gives a great deal of probability to the supposition, that whenever its volume is unusually large it is able to exercise a pressure on the trachea, and to give rise to retention of blood in the cerebral veins, to dyspnœa, to atelectasis, and to a slow carbonization of the blood. In such cases we are certainly

justified in supposing the swelling of the thyroid gland to be the cause that the nervous centers are not able to act in a normal way, especially as the children were not in the period of life when laryngismus is a more common occurrence, and when bad food, superabundance of food, and eccentricities in the normal development may give rise to paralytic symptoms in the respiratory functions. There is certainly no less reason to believe in the abnormal function of the recurrent nerve in such cases, where it is evidently subject to some pressure from either the swelled thyroid, or, in a later period of life, of the hypertrophied tracheal glands.

The latest attempt to discover a general and uniform cause of laryngismus in some local affection, has been made by an English surgeon, Mr. Hood. He seems convinced that the cause of laryngismus, which he considers as identical with crowing inspiration, is always found in enlargement of the liver. His pathology is as vicious as his etiology erroneous, therefore I omit criticizing the opinion of a single writer, as I consider it my duty to state scientific facts only, with their logical consequences.

The difference of opinions on the treatment of laryngismus stridulus is as great as on its nature and causes. The majority of modern writers, considering the disease to be spasm of the glottis, resort, in the attack, to derivants and antispasmodics. Applications of spir. sinap., and ol. hyosc., have been made, hand and foot-baths given, even the inhalation of chloroform has been recommended. From the remarks I have made on the nature of the disease, the conclusion must be drawn that no result at all can be expected from the action of those agents. The performance of tracheotomy, as recommended by some, is of no use, for the same reason; no artificial entrance for the air is needed, where the inactivity of the respiratory muscles is the only cause of the dreadful attack. Antispasmodics, as cherry-laurel water, valerian, musk, asafœtida (given internally and administered in injections) will also fail to answer the indications. Bloodletting will certainly prove useless, except in some cases complicated with severe eclampsia. I feel almost sure that the first case of what is described

as laryngismus, in the excellent manual of Prof. Meigs, of Philadelphia, in the words of Dr. Pepper, who observed it in a child of four months, has been somewhat endangered by the application of sixteen leeches; to say nothing of its really having been a case of spasmodic laryngeal catarrh, or asthma Millari, instead of laryngismus stridulus, or asthma Koppii. The only indication, in an attack of laryngismus, is the thorough irritation of the respiratory muscles. If electricity could be applied at the right moment, it would be of great value. At all events the patient ought to be kept in a sitting posture, and the access of air to be made as easy as possible. Sprinkling of the face with cold water, and application of ice or cold water to the sternum, will act as powerful stimulants. If the respiratory muscles could not be stimulated enough to recover their physiological power, artificial respiration must be resorted to. There are some undoubted cases in literature, of children who had become asphyctic from an attack of laryngismus, but were saved by artificial respiration being kept up until the temporary paralysis of the central organs was removed.

Of much more importance than the treatment of a single attack of laryngismus, is that of the general disposition and of the cause of the affection. Such authors, as take it to be a spasmodic affection, propose a protracted administration of antispasmodics, like those mentioned above; Bouchut recommends the endermic use of morphia. Others, attributing it to indigestion, or constipation, or diarrhœa, or worms, prefer either carminatives, or aperients, or astringents, or anthelminthics. Those who, like Mr. Hood, consider hypertrophy of the liver to be the only cause of laryngismus, do not know of anything more specific than calomel, and naturally, those who take the hypertrophy of the thymus as the cause of laryngismus, believe in iodine, and iodide of potassium as their panacea. This appears to be less indicated, for to what I have stated before I have to add, that, with one single exception, all the cases of hypertrophy acknowledged in literature are congenital, and not the results of inflammation or exudation. Thus, iodine, in such cases, is undoubtedly deprived of any effect, and I have no doubt that wherever iodine has proved to be

of any benefit in laryngismus, it has done so by its effect on the small tracheal glands which are able, sometimes, when hypertrophied, to exercise pressure on the recurrent nerve. And, certainly, we cannot expect to have any influence in reducing the size of vascular swellings of the thyroid gland, which is also a congenital anomaly.

Dentition, finally, is the nightmare of medical men writing on laryngismus, as on almost every other infantile disease, particularly in England. Marshall Hall directs, in laryngismus, the gums to be incised, in different places and directions, once, two, and even three times a day, and expects a cure from this kind of scientific butchery. I warn you most emphatically against following his advice to the extent in which it is given. In some cases cutting the gums may be indicated, and I practise it myself, but this readiness to operate on helpless infants, who are so unfortunate as to "teethe," that is to say, to be from five to thirty months old, is a mistake that cannot be too much reprimanded. I shall avail myself of some other occasion to explain my views on this custom of "lancing the gums" in a more explicit manner.

From the remarks I have made on the causes of laryngismus, the therapeutical and dietetical treatment is distinctly indicated. Any cerebral disease that may be discovered must be attended to; laryngismus consequent on hydrocephalic condition of the brain will not be cured unless the other symptoms of hydrocephalus are removed. Such is the case also with craniotabes, which will require a continued treatment with phosphate of lime, and iron, and tonics in general, before the symptoms of laryngismus will be extinguished. Every anomaly, both material and functional, that may have the effect of weakening the organism in general, and the nervous system in particular, must be removed, and the general health taken care of. Nutritious and digestible diet, antiscrofulous treatment, cod liver oil, iron, and iodide of iron will prove powerful means of restoring health in the hands of a scrutinizing practitioner. Supposed or diagnosticated swellings of the tracheal glands, pressing on the recurrent nerve, require the constant use, for a long period, of iodide of potassium, or

iodide of iron, and I need scarcely add, that all other influences of greater or less importance, as of fright, cold, indigestion, worms, must not be entirely overlooked, and are deserving of particular attention, although they have so often been greatly overrated. Thus it appears that much circumspection is needed in selecting the means of removing a disease which may have originated in consequence of many coördinate influences affecting the nervous centers. One case, as it occurred but recently in my practice, shows that even mental education may be necessary, and sufficient, to act beneficially on the cerebral functions. A little girl of about eleven months was affected with "holding-breath spells" for a long time, and to such an extent as to become asphyctic. I found out that the attacks always occurred whenever the child was contradicted, or refused anything she wanted to lay hands on. I then ordered a pailful of cold water to be kept always in readiness and poured over the fretful patient, as soon as any mental irritation would show itself in occasions like those that had always been sufficient to bring on the attacks. I may be allowed to add that three or four administrations of the same dose, in the course of a week, proved sufficient to soothe the temperament of the patient, and to entirely remove her attacks of laryngismus stridulus.

CATARRH OF THE INFANTILE LARYNX

The causes of laryngeal catarrh are very various. Inhalation of cold air, of dust, over-exertion of the voice, entrance of a hot liquid into the larynx; cold of the external surface of the body, and particularly of the feet and neck; progress of the catarrhal process of the nose or bronchi, and sometimes even of the pharynx, on the laryngeal mucous membrane; and finally, certain diseases attended with decomposition of the blood, as measles, and sometimes scarlatina, are amongst the causes of laryngeal catarrh in children.

The anatomical lesions found in individuals who have died while affected with catarrh of the larynx, do not always correspond with the symptoms during life. The mucous membrane of the larynx is so full of elastic fibres, that after death the blood is squeezed out of the capillaries. In very severe catarrhs, small apoplexies, or sugillations, occur occasionally, and are visible even after death. On the mucous membrane there is none of the normal vibratile cylinder epithelium which forms the upper layer of the epithelium in the larynx. The mucous membrane is moist, succulent, loose; the sub-mucous tissue is seldom œdematous, but sometimes, even in quite an acute laryngeal catarrh, small catarrhal ulcerations have been found. Thus the anatomical lesions left in the mucous membrane of the larynx after death fully correspond with those found in the mucous membranes of other organs. Sometimes the vestiges of catarrh are clear and distinct, sometimes nothing is found in post-mortem examinations. An example of this fact is the occasional absence of any post-mortem results in children who have died in a severe attack of cholera infantum. While in some all the signs of catarrh, from simple hyperæmia to ulcerations of the follicles, are discovered, in other cases no alteration at all is found.

In chronic catarrh the mucous membrane appears darker, livid, or brownish. The blood-vessels are varicose and full of blood, and numerous enlarged follicular glands have been found in the mucous membrane, which is covered with a yellowish purulent secretion. As consecutive stages of the catarrhal process we may mention chronic catarrhal ulcers, polypous granulations, and thickening and induration of the submucous tissue.

The acute catarrh of the larynx is seldom, from the beginning, a feverish disease. The patients feel comfortable, and the functions of the diseased organ are alone abnormal. There is a certain degree of sensibility in the region of the larynx, a burning or itching sensation. The voice is altered, becoming indistinct and hoarse, in consequence of the thickening of the margins of the vocal chords, which the muscles are no longer able to force into as many vibrations as before. Besides the itching and burning sensation, and hoarseness, there is another symptom present—viz., severe cough, occurring in paroxysms, as if produced by some foreign body touching the mucous membrane of the larynx. Expectoration is not copious; in the commencement of the disease there is none, or it is clear and serous, containing some few cylindrical epithelia, and a few from the lower layers. In the other stages of the disease, particularly in the course of recovery, the expectoration becomes more consistent, more purulent, and yellowish. Older children only will remove at all the expectorated masses; children generally swallow whatever touches their fauces, and it is sometimes very difficult indeed to obtain any information as to the nature of their expectorations. Physical exploration of the larynx gives no result, or very little indeed. Sight alone is of some use, as a few remarks will illustrate:

Some five years ago (in 1854), after having attended a young man suffering from secondary syphilitic symptoms, I was much troubled by my patient's continual complaint of his larynx. In order to examine his larynx by sight, I had this instrument made. It is, as you see, a small oval mirror, in a wooden frame, and with a flexible handle, which, when applied to the soft palate and uvula, renders,

after some exercise, the insight into the larynx possible. The laryngeal mucous membrane was healthy, and has proved to be so for five years. As I seldom afterward used my instrument, and as I, indeed, never thought of rendering it profitable in other cases, and to the profession generally, I certainly do not pretend to have any priority regarding this invention. Dr. Manuel Garcia has published a series of observations and experiments on the examination of the larynx by sight, in the "Philosophical Magazine and Journal of Science," vol. x. July to December, 1855. London: "The method which he has adopted consists in placing a little mirror, fixed on a long handle suitably bent, in the throat of the person experimented on, against the soft palate and uvula. The party ought to turn himself toward the sun, so that the luminous rays falling on the little mirror may be reflected on the larynx. If the observer experiments on himself, he ought, by means of a second mirror, to receive the rays of the sun, and direct them on the mirror which is placed against the uvula." Dr. Garcia was followed by Professor Brücke, in 1856, Dr. Türck, in 1857, and Professor Czermak, in 1858,[1] by whose experiments a great number of questions regarding the physiology of the larynx have been answered. For it is not only possible to see clearly the basis of the tongue, the margin of the epiglottis, the arytenoid cartilages, the posterior two-thirds of the vocal chords, Morgagni's fossæ, and a portion of the mucous membrane of the trachea, but a large part of the posterior (or inferior) surface of the epiglottis, and sometimes even the bifurcation of the trachea. As to the best method of examining the larynx by means of the mirror (or *laryngoscope*), it is more profitable to use reflected light, which can always be brought to a single point you are about to examine. The reflector before you is nearly plain, has a radius of about 1½ inches, and is fixed to the forehead by means of a turning nut-joint,

[1] "Wien. Med. Wochenschr." 1858. Nos. 13-16. "Sitzungsberichte der Mathem. Naturw. Classe der Kais. Akad. d. Wissensch. zu Wien." 1858. Vol. xxix., No. 12, page 557. "Physiologische Untersuchungen mit Garcia's Kehlkopfspiegel." Wien, 1858. Pp. 30, and 3 plates.

and an elastic strap encircling the head. This apparatus, as modified by Dr. E. Krackowizer, of this city, is preferable to the one used by the savans of Vienna, which is perforated in its center, and applied directly to the eye.

There is no doubt that the diagnosis of severe laryngeal affections is greatly facilitated by the apparatus now before you, no matter whether the laryngoscope is made of glass, like my old one, and Dr. Garcia's, or of German silver, as those now generally used in Vienna, and by me also.

The sub-mucous tissue is much swollen in some exceptional cases only, as far as adult persons are concerned. For the glottis, and particularly its posterior third, forms a pretty large opening in adults, and the entrance of air into the respiratory organs is not prevented by the tumefaction of the mucous membrane. Even children do not suffer very often from dyspnœa, in consequence of simple laryngeal catarrh. Although in them the glottis is short and narrow, the swollen chordæ vocales, by means of the constant and uninterrupted action of the posterior crico-arytenoid muscles, are sufficiently distant from each other not to prevent the entrance of air. But sometimes children, who have been coughing and hoarse during the day, without feeling sick, will be observed to awake suddenly in the night, with an attack of suffocation. Inspiration is extremely difficult and exhausting; in the utmost height of their anxiety and trouble, the children will roll about, jump upon their knees and feet, and grasp their throat; their cough is hoarse, rough, and, as it were, barking. These attacks have been and are very often mistaken for croup, have been and are described as pseudocroup, false croup, and usually disappear without leaving a trace, after a duration of one or a few hours. These are the attacks which readily disappear after the administration of hot milk, by putting hot sponges over neck and throat, and by emetics, and which have won for these remedies the reputation of being infallible in croup, when given in time. Physicians who are better business men than diagnosticians, and more shrewd than honest, will readily support, by the weight of their words, the opinion of the parents that the child has been suffering from croup, and was saved from

a speedy death. You may be certain that all the children who are reported to have suffered from croup four, six, and twelve times, and have always been saved, were simply suffering from attacks similar to those of which I have just been speaking. Perhaps the sudden attacks of suffocation are produced by a momentary swelling of the mucous membrane and narrowing of the glottis, which the muscular action could not counteract, as sometimes a nostril is thoroughly impermeable in consequence of a severe cold. Perhaps even a reflected action is produced by the irritation of the mucous membrane and spasm of the glottis affected. But it is better explained in the following manner: The suffocative attacks almost always occur in the course of the night; they diminish and disappear, after the child has been awake for a time, with screaming, coughing, and vomiting; and will appear anew after the patient has again fallen asleep. From this fact it is probable that the cause of the sudden suffocative attacks is due to the exsiccation of a collection of tough secretion in the larynx and glottis. At all events, the quick operation of the above-mentioned remedies is best explained in this manner. Such attacks will not unfrequently return, the children playing around all day, and appearing to be perfectly healthy, except a slight hoarseness.

As to the course, duration, and termination of the disease, it may be added that usually after a few days the larynx ceases to be as sensitive, the cough subsides, the hoarseness vanishes, and the disease terminates in recovery, after a week or two. But a duration of several weeks is not uncommon, and do not forget that the infantile organism has a great tendency to inflammatory affections, and to the exudative processes, and that the infantile vocal chords will not bear so well, as those of adults, a thickening of their substance and a considerable narrowing of the rima glottidis. The patient may be apparently well during the day but troubled by attacks of coughing every morning and night, and this state of things may last for a long time, until the catarrh and its consequences have become chronic, and removable only with difficulty. But more serious consequences may follow the slightest dysp-

nœa continuing for a long time, a smaller amount of oxygen enters the blood than is necessary for the combustion of matter, and for a complete and regular physiological metamorphosis of the organism. This is undoubtedly proved by the assertions even of adult patients suffering from slight laryngeal catarrh, who will also experience suffocative attacks, and surprise you by showing a mass of mucus brought up after long coughing, dry, hard, sometimes slightly tinged with blood, and exactly bearing the outlines of Morgagni's fossæ between the superior and inferior vocal chords, or some other part of the larynx.

In chronic laryngeal catarrh, the larynx is seldom sensitive; there is no longer any burning, itching, or sore feeling. But in consequence of the hypertrophy of the mucous membrane and the thickening of the vocal chords, there is constant alteration of the voice, which is rough, and hoarse. This chronic hoarseness is sometimes the only sign of chronic laryngeal catarrh, and wherever it is the only complaint, or symptom, it is pathognomonic and renders the diagnosis easy. Every intercurrent, acute irritation of the laryngeal mucous membrane will thicken the vocal chords to such a degree as to render vibrations totally or nearly impossible, and deprive the patients, temporarily, but entirely, of the voice. At the same time, also, a spasmodic cough is observed, as in acute catarrh. But whenever, in cases of laryngeal catarrh, you meet with a sibilant sound in inspiration or expiration, you may be sure that you will have to deal with a complication of a serious nature. It may be that there are exudations of the submucous tissue of such an amount as to render the glottis exceedingly narrow, and to produce the sibilation in inspiration and expiration, and the vocal chords becoming stiff and immovable in consequence of this degeneration, even perpetual extinction of the voice. But generally this symptom of sibilant inspiration and expiration, together with some others, as night-sweats, general decline, will necessarily direct your attention to some not suspected pulmonary affection, and very generally tuberculosis. I may be allowed to lay this stress on a fact not strictly belonging to our subject, but you will meet with physicians of this

and neighboring cities who, either wholly, or for the most part, deny the occurrence of pulmonary tuberculosis in infants and children. But I can assure you, who enter upon a large practice in our climate, that you will have frequent occasions to see cases of tubercles in the lungs of children, perhaps every week.

Catarrhal ulceration, produced by catarrh of the larynx, is not very often found in children; but it may be present where it cannot be detected, because children are very unwilling to have the throat closely examined. In an intelligent little girl I could readily detect it by means of the laryngoscope, which I have exhibited to you. Follicular ulcers may be supposed to exist in the larynx, when there are a large number of them in the pharynx, and when difficulty of deglutition begins to accompany the chronic catarrh of the larynx. The therapeutical results obtained by our countryman, Dr. Horace Green, in this very disease, as far as it occurs in adults, are well known to you, as they have given this physician a well-deserved reputation, as well in Europe as in our own country. The diagnosis of both acute and chronic catarrh is not at all difficult in the majority of cases; the laryngeal affection alters the voice itself in such a manner as to render it indistinct and hoarse, while in nasal and pharyngeal catarrh the resonance of the voice only is affected. Frequently, however, acute catarrh of the larynx is mistaken for croupous inflammation. Whenever a child is hoarse and has a barking cough, mothers are always afraid of the presence of croup, although there be no other symptom of this much-dreaded disease; and particularly in cases where the above-mentioned nightly attacks of suffocation make their appearance. On this point I feel satisfied with merely adding a single remark, with reference to symptoms: whenever there is difficulty in diagnosticating between acute catarrh of the larynx and croup, you may be almost sure of the catarrhal nature of the case when but a slight trace of nasal catarrh is observed at the same time, provided that a diphtheritic discharge from the nostrils is not mistaken for the catarrhal secretion of the mucous membrane.

After all, laryngeal catarrh is seldom a dangerous disease,

and fatal cases will always be rare occurrences; but consecutive troubles, as thickening of the mucous membrane, and of the vocal chords, and narrowness of the rima glottidis, may lead to serious trouble. Polypi, and papillary tumors may even destroy patients, instantaneously, by suddenly occluding the rima glottidis. It is important, therefore, to attend to prophylactic and therapeutic measures.

In general, it is better to accustom healthy children to the causes of laryngeal catarrh than to guard them too cautiously. If they have been affected before, they must be dressed according to the temperature of the atmosphere, be exposed to fresh air, and accustomed to cold washing, to river or sea baths. Such will be the most efficient preventives. Common cases of acute laryngeal catarrh, produced by atmospheric influences, require warm foot-baths and slight diaphoretics, such as tea of elder or lime-tree flowers, or tartar emetic in small doses, or the hydropathic application of a cold, wet cloth, covered with flannel, round the neck. Wherever a complication is found of pharyngeal with laryngeal catarrh, astringent gargles with, or applications of, tannic acid, or alum, or even nitrate of silver, will prove useful. No blood-letting, however, either local or general, will be of any use. Fatty food is injurious, while sour or acid liquids are useful. The temperature of the sick-room is to be mild and equal and every exertion of the larynx, speaking, crying, coughing, must be avoided as much as possible. For the purpose of suppressing the irritation of the laryngeal mucous membrane, the best remedy will be found in the internal administration of narcotics. It is true, that narcotics, like opium, are generally said not to be well tolerated by the infantile organism, and there are a sufficient number of cases reported in the journals to show that even a slight dose of narcotic may be an overdose to an infant. But you will always find a slight dose of Dover's powder, repeated several times a day, to exhibit a favorable effect in soothing the irritability of the catarrhal mucous membrane of the larynx, and in suppressing or at least diminishing the trouble of, and the danger from, continued coughing.

And now, gentlemen, allow me to avail myself of this

occasion for adding some remarks on the doses of narcotics that may be administered to patients of infantile age. The skepticism of our time has a great tendency to do away with our therapeutical agents, even with the materia medica. You will often be told that there is no relying on medicines, that for the most part it will matter little what you do, that the longer you practise the more indifferent you will become to the materia medica; in a word, that the effects of medicines are uncertain. This incredulity in regard to our therapeutics is wide-spread in our time, and must be considered as one of the causes of the reign of nostrums and quackeries of every kind. I dare not take your time to explain this fact, but shall only express my firm conviction, that the older and more experienced we become, the more confidence we shall have in the unvarying effects of medicines, in spite of what has been said to the contrary.

The cause of all this skepticism is found in the absence of both an exact and a distinct diagnosis, and of strict indications in the use of medicines. We shall always learn, that wherever a medicine is really indicated, a good effect will always follow a good dose, in such a manner that this one principle, *Few medicines, simple prescriptions, and large doses,* will find its full justification. The following case proves this assertion; a boy, two years and two months of age, whom I have been attending for extensive ulceration of the colon, has taken for three weeks, and digested, and assimilated, nine grains of opium, in liquid form, every day. Thus it appears, that, with the exception of individual idiosyncrasies, no medicament, especially no narcotic, is to be feared when a real indication is fulfilled by its administration; the much dreaded opium will lose all of its supposed danger, and a dose of Dover's powder, as recommended above, in acute laryngeal catarrh, may be given with perfect safety.

In chronic laryngeal catarrh, Plummer's composition of calomel and the oxysulphuret of antimony, joined to a dose of extr. hyosc., extr. bellad., etc., has been in use for a long time. The dose of the oxysulphuret of antimony being very small, and calomel being not at all indicated in catarrhal affections of the mucous membrane of the respiratory

organs, the good effect, if any there was, has undoubtedly been due to the narcotic. Powerful derivatives, as application of croton oil, or croton oil mixed with turpentine, rubbed into the skin over the diseased part, will answer in a large number of cases. So will, in very severe cases, direct local applications to the diseased parts, either of solutions of nitrate of silver, alum, etc., by means of a sponge, or of the same remedies in solid form, or of the powdered drug, if any intelligent little patient can be found to inhale it through a quill. Blood-letting is unnecessary, even in the frightful attacks of suffocation. A sudden irritation of the skin by means of hot water, or mustard, and more than anything else, the administration of an emetic consisting of tartar emetic and ipecac., will remove the attack. After a suffocative attack, do not allow the child to sleep for a long time, nor soundly; better arouse it from time to time and offer some water in order to prevent the mucus from drying up in the pharynx and remaining too long in the larynx. Even such children as are subject to periodical attacks, ought to be aroused from time to time every night, to remove, or at least liquefy the mucus of the pharyngeal membrane.

There are two other remedies on which I wish to make some special remarks, because they have been unaccountably overlooked except in a small portion of Europe; I mean the hydrochlorate of ammonia, or better, chloride of ammonium, and of the oxysulphuret of antimony. The Dispensatory of the United States (Eleventh ed. p. 91) mentions the resolvent, anti-neuralgic, anti-rheumatic effects of the hydrochlorate of ammonia, and scarcely touches the results obtained by a French savan in chronic bronchitis. I have no high opinion of other effects of this medicine but those referable to the mucous membrane, particularly those of the respiratory organs. Its effects on the mucous membrane of the stomach and intestines are far inferior to those which may be obtained by a judicious use of emetics, alkalies, and acids (especially the bicarbonate of soda, and the diluted muriatic and the nitro-muriatic acid). But its effects on the mucous membrane of the larynx, trachea, and bronchia are inferior to none. They are wanted not only

in simple catarrhal affections of the respiratory organs, but wherever there are accidental troubles of the bronchial or pulmonary functions in typhus, acute exanthems, and intermittent fever, in short, wherever it is necessary to facilitate and finally to lessen the mucous secretion and expectoration. Therefore it is indicated in bronchitis, pneumonia, pulmonary tuberculosis, etc.

Similar indications have been set forth by me at a former occasion, for the use of the oxysulphuret of antimony. But is cannot be urged too strenuously that certain distinct indications will always limit the use of the two expectorants. Whoever would contend against the fever of the first onset of pneumonia, or acute bronchitis, with one of the two, would soon become aware of his mistake. Their operation is only to liquefy and facilitate the secretions of the respiratory organs. For this very reason their adaptedness in catarrhal affections of the larynx is readily understood and justified.

The dose of the hydrochlorate of ammonia, in infantile age, is from ℈j-℥j a day. The simplest manner of prescribing it is to dissolve equal parts of the medicament and extr. glycyrrh. in water. Narcotic extracts, or whatever appears to be indicated, may be added to the mixture, or the medicament may be heated over a slow fire and, evaporating, inhaled by the patient, either directly or by filling the room with the vapors of the salt. The oxysulphuret of antimony is given daily, according to the age, in from 4 to 8 doses of gr. ss-j-ij-iij, each, in powder or mixture. Diarrhœa, wherever it is present, contraindicates its administration, as in this case there is a great tendency to increase the intestinal catarrh.

Now, gentlemen, as I have given like indications for the use of both the hydrochlorate of ammonia and the oxysulphuret of antimony, you will naturally ask whether there is no difference at all in their effects, and whether those remedies may be prescribed at random. First, the oxysulphuret is an antimonial preparation, and, like the others, sedative and depressing; the hydrochlorate of ammonia is a stimulant. To a feeble child suffering from pneumonia, or bronchitis, whom you expect very soon will require strong

stimulants to keep him alive, you would give no antimonials; and in case of a robust, strong boy, whom it will do rather good than harm to be lowered for a while in order to avoid a new attack of the inflammatory fever, you will prefer an antimonial to a stimulant. Again, by the decomposition of blood accompanying the majority of epidemic diseases, the constitution of almost every individual is shaken, and the depressing and enfeebling influence of antimonials is to be feared; then an expectorant ought to be a stimulant from the first. During this last epidemic of diphtheria, there were but very few cases in which the expectorant effects of the oxysulphuret of antimony could be put to trial.

ACUTE CATARRHAL LARYNGITIS (FALSE OR SPASMODIC CROUP)

Pathology.—Catarrhal inflammations of the mucous membrane and the submucous tissue of the larynx are of frequent occurrence. They are either general or local; that is, confined to the epiglottis or the vocal cords, etc. The affected parts are red (only less so where the elastic fibres are developed to an unusual degree and capable of compressing the dilating capillaries) and more or less tumefied. Sometimes small hemorrhages occur. The secretion is either changed in character or in quantity. It is either mucous or purulent, or (mainly in passive congestions produced by interrupted venous circulation) serous. The epithelium is either thrown off or accumulated in some spots, particularly on the vocal cords, so as to form whitish conglomerates which may become the abode of schizomycetæ. The muciparous follicles are enlarged and dilated; to this condition is due the granular form of laryngitis, with the nodulated condition of the epiglottis or the fossæ Morgagni or the inferior vocal cords.[1]

When the catarrhal process is of longer duration, the capillaries and small veins become permanently enlarged; round cells are deposited between the epithelium and cellular tissue; the cellular tissue becomes hypertrophied; papillary elevations are formed on the vocal cords. The disintegration of the epithelium and the bursting of the tumefied muciparous glands lead to the formation of erosions and ulcerations; the chronic swelling and hypernutrition of the muciparous follicles to their destruction by cicatrization or simple induration; and to atrophy of the mucous membrane.

Many of the specific causes of inflammation of the larynx exhibit no peculiar alterations of their own. Scar-

[1] Ziegler, *Pathol. Anat.*

latina, measles, and exanthematic typhus are complicated with either a catarrhal (in most cases) or a diphtheritic laryngitis. Variola, however, has a peculiar form of its own, with red, pointed, whitish stains or nodules, consisting of a cellular infiltration or of a deposit upon or into the upper layers of the mucous membrane, composed of necrotic epithelia and pus-corpuscles or of coherent membrane. Hemorrhages or abscesses are but rare, and chondritis seldom results from it. Even syphilis has not always changes which are characteristic. The laryngitis accompanying it is often but catarrhal, without anything pathognomonic about it. But whitish papules consisting of granulation-tissue (plaques muqueuses), gummata often changing into sinuous ulcerations, particularly on the epiglottis and posterior wall of the larynx, also perichondritis with loss of cartilage and deep cicatrization, such as are not found in either carcinosis or tuberculosis of the larynx, are frequently met with. Typhoid fever shows different forms of laryngitis, from the catarrhal to the ulcerous. Epithelium is thrown off at an early period of the disease; erosions and ecchymoses follow; rhagades on the margins of the epiglottis, and a deposit on the anterior wall of the larynx and the vocal cords, consisting of epithelium and round cells, are frequent. That they should be mixed with micrococci and bacteria is self-understood. Not so that these bacteria are to be considered as the cause of the disintegration which is taking place, the less so as no specific typhoid bacterium has been demonstrated, and several varieties of them are found both in the mouth and in these ulcerations. These changes are apt to terminate in ulceration of the epiglottis and false vocal chords; these will extend in different directions, and to the deeper tissue down to the cartilage.

In tuberculosis, laryngitis is a frequent occurrence. In most cases it is secondary to the pulmonary affection, and due to the direct influence of the contagious sputum—according to Heinze, however, not to contagion, but to the influence of the infected blood. In other cases it appears to develop spontaneously, before any pulmonary affection is diagnosticated, and may then be due to some

poison circulating in either blood or lymph. Tubercular laryngitis, according to Rindfleisch, commences in the excretory ducts of the muciparous glands. That this is so in a great many cases is undoubted. The first changes visible are small cellular subepithelial infiltrations or real subepithelial tubercles, which, while growing undergo gaseous degenerations and ulcerate. These ulcerations are either flat and small or deeper with an infiltrated edge, and are apt to terminate in secondary nodulated infiltrations and abscesses. Large tumors are not met with, but œdema and phlegmonous inflammations are by no means rare.

Etiology.—The predisposition varies according to individuals, ages, and seasons. Some mucous membranes appear to be more sensitive than others. The hereditary transmission of peculiarities of structure of all or some tissues or organs is apparent, in the case of laryngitis, in the fact that many children in the same family or the children of parents who were sufferers themselves are affected. Children are more liable than adults, infants more than children: 20 per cent. of all the cases are met with under a year, 25 from the first to the second, 15 from the second to the third. Not many occur after the twelfth year. The narrowness of the infant larynx and the looseness of its mucous membrane afford full play to injurious influences, such as dust, cold and moist air, changing temperatures, hot vapors and beverages. Colds, though their nature and effects can hardly be said to be understood, are certainly amongst the main causes. Perspiring surfaces afford frequent opportunities. One of the principal causes is insufficient clothing—more amongst the well-to-do than amongst the poor. The latter have this blessing in their misfortune, that they are protected uniformly if at all, and have their skins hardened by exposure. The bare necks and chests, the exposed knees, the low stockings and thin shoes of the children of the rich, old and young, are just as many inlets of laryngeal catarrh, inflammatory disease, and phthisis. Persons suffering from nasal catarrh or pharyngeal catarrh are liable to have laryngitis. Thus, not only rhachitis, with its in-

fluence on lymphatic glands and the neighboring mucous membranes, but also acute infectious diseases, such as whooping-cough, measles, influenza, erysipelas, hay fever, tuberculosis, syphilis, typhoid fever, and variola, are as many causes of laryngitis. That over-exertion of the voice should produce laryngitis seems probable, but experience does not teach that those babies who cry most are most subject to laryngeal catarrh.

Symptoms.—Acute laryngitis is a frequent disease, and has always been. Still, in 1769, Millar mistook it for a sensitive neurosis, considering it as identical with spasm of the glottis, and recommended antispasmodic treatment. Guersant understood its nature better. He first (1829) used the names false croup and stridulous laryngitis. Acute laryngitis is attended with but little fever in the adult, but with a high elevation of temperature in the young. In all, it yields a number of symptoms, part of which are uncomfortable only; others are liable to become dangerous.

Seldom without any catarrhal premonitory symptoms of other parts of the respiratory tract, sometimes, however, without any, there is a burning, tickling, irritating sensation in the larynx—a sense of soreness in it and the lower portion of the pharynx. Sometimes these sensations amount to actual pain, to difficulty of deglutition, and to the sensation of the presence of a foreign body. Speaking, coughing, cold air, increase the discomfort and pain. Hoarseness, sometimes increasing into aphonia, follows soon after, is seldom simultaneous with the first appearance of cough, but lasts longer than the latter, which is, according to the severity of the case or the stage of the disease, changing between loose and dry, hoarse and barking. Inspiration is apt to become impeded, mainly in infants and children. In these it is often sibilant. It is followed by a reflex paroxysm of cough, with interrupted and brief expirations, during which the forcible compression of the thorax may result in cyanosis. The principal attacks are met with at night amongst children. Quite suddenly they wake up with a dry, barking cough, interrupted by considerable dyspnœa, which is great enough

sometimes to give rise to much anxiety. They toss about or cling to a solid body, raise themselves on their knees, breathe with great difficulty, exhibit cyanosis in its different hues, perspire very freely, and yield all the symptoms of the strangulating attacks of membranous croup, its over-exertion of the sterno-cleido-mastoid muscles and supraclavicular and diaphragmatic recessions not excepted. These attacks occur but rarely during the day; on the contrary, well-marked remissions are quite common in the morning. Their occurrence during the night is best explained by the facility with which mucus will enter the larynx from above during the reclining posture, the increasing dryness of the pharynx during sleep, perhaps also the nervous influence depending upon the relative diminution of oxygen and increase of carbonic acid in the respiratory centre, leading to spasmodic contractions.

Some of these grave attacks of sudden dyspnœa are explained by the participation of the submucous tissue in the morbid process. When that occurs, adults also, who as a rule do not suffer from dyspnœa in laryngeal catarrh, are badly affected. The symptoms are rigor, high temperature, pain, hoarseness or aphonia, a barking cough, labored expectoration—which is sometimes bloody—dyspnœa, orthopnœa, cyanosis. In some cases, to which the name of laryngitis gravis or acutissima has been given, the symptoms grow urgent to such a degree that tracheotomy alone is capable of saving life.

Otherwise, the severity of the symptoms does not go parallel with the local lesions. Particularly in children, hoarseness, cough, and dyspnœa are liable to be grave, while the local hyperæmia is not intense at all. A pharyngeal catarrh is very apt to increase the suffering. Complications with tracheitis or bronchitis are liable to prolong the course of the disease and to render respiration—which is not accelerated in laryngeal catarrh—more frequent. Otherwise, the disease runs a favorable course. Remissions of the severe attacks which may occur in several successive nights take place in the morning. Expectoration, which in the beginning was either absent or scanty, becomes soon more copious and mucous; the hard,

barking, loud cough grows looser with increasing secretion. In most cases the violence of the affection is broken in from three to five days, and the disease runs its full course in a week or two. But hoarseness may remain behind for some time; in rare cases aphonia has become permanent and relapses are frequent. Not infrequently children are presented who are reported to have had croup five or ten or more times. In some families all the children are subject to laryngeal catarrh, and hereditary influence cannot be doubted.

The very worst complication of laryngitis is œdema of the glottis. It affects both the mucous membrane and the submucous tissue of the larynx. It is met with on the inferior (posterior) surface of the epiglottis, in the ary-epiglottic folds, and on the false (inferior) vocal cords, the submucous tissue of which is of a very loose structure normally. Amongst its causes—which may be various (foreign bodies in the larynx, injuries, mechanical and chemical irritants of any kinds; typhoid, tubercular, variolous, syphilitic ulcerations; erysipelas of the neighborhood, inflammations of the parotids or tonsils, suppuration in the pharynx, thyroid body, and cellular tissue of the neck)—both catarrhal and croupous laryngitis are not at all uncommon. This is particularly so when they are complicated with cardiac and renal anomalies, pulmonary emphysema, and compression of the veins of the neck by glandular swellings; also with changes in the structure of the walls of the blood-vessels. The last-named pathological conditions are alone capable of giving rise to chronic œdema of the larynx, which is by no means so fatal, but still dangerous.

In glottic œdema the dyspnœa is both very great and very sudden. First, it is inspiratory only, but soon becomes both inspiratory and expiratory. The swelling is felt distinctly by the examining finger; the laryngoscope is neither required nor advisable.

Diagnosis.—It is by no means easy in all cases. When laryngeal diphtheria (membranous croup) happens to be frequent, the most experienced diagnostician will meet with occasional difficulties. The sound of the barking, explo-

sive, tickling cough locates its origin in the larynx, but the affection may be very mild or very severe. Expectoration in small children is not pathognomonic; even when it is copious it is not brought up, but swallowed. Fibrinous expectoration would settle the diagnosis of a croupous process. Depressing the tongue with a spoon or spatula and producing the movements of vomiturition often reveals the presence of a tough, viscid mucus rising from the larynx. It renders the catarrhal nature of the laryngitis positively clear. The frequency or volume of the pulse is of no account in diagnosis; it is too variable. Of more importance is the temperature, at least in children. Uncomplicated sporadic croup has no increase, or very little; catarrhal laryngitis is mostly attended with high fever. In very many cases this symptom has guided me safely, in spite of the statements of the books. The stenosis of catarrhal laryngitis comes on very suddenly, in diphtheritic laryngitis mostly slowly. In the former it is not of long duration; remission sets in soon, and is more complete than in membranous croup. An attack of stenosis occurs mostly in the night, and is apt to return with the same vehemence after a fair remission after twenty-four hours. The frequency of relapses in catarrhal laryngitis in children who have been affected before must, however, not prejudice in favor of the catarrhal nature of an individual case, for not infrequently will those who have had many attacks be taken with membranous croup some other time. In the latter the main symptoms—viz., stenosis, hoarseness (or aphonia), and cough—will mostly develop simultaneously and in equal proportion; the unproportionality of these symptoms—for instance, much stenosis and cough, but little hoarseness, or barking cough and hoarseness with little stenosis—would speak for catarrh. The laryngoscope, when it can be used—viz., in the adult and very docile children—reveals redness of the mucous membrane of the pharynx and all or part of the larynx; also tumefaction of the epiglottis or fossæ Morgagni or aryepiglottic folds. Sometimes the inferior part of the larynx only is affected; Ziemssen has described a severe form under the name of hypoglottic laryngitis. The vocal

cords can be watched easily. Their proportionate and parallel contraction is often interfered with.

Tubercular laryngitis, particularly when there is no pulmonary tuberculosis, is not easily diagnosticated by the local changes only. The long duration of hoarseness and fever, increasing emaciation, and the knowledge of the presence of tuberculosis in the family are more conclusive than local examinations can be.

Prognosis.—The termination of catarrhal laryngitis in the adult is almost always favorable. Still, relapses are frequent, and it may become chronic, with permanent tickling of the mucous membrane and submucous tissue. In children it is mostly favorable; still, it is doubtful, because of the frequency of complication with, or transmutation into, bronchitis, pneumonia, or glottic œdema, and because of the facility with which in a prevailing epidemic the catarrhal laryngitis becomes diphtheritic. The elevation of temperature is not a very significant symptom in regard to prognosis. The danger does not increase with the temperature at all. On the contrary, those cases which set in with a high temperature will, as a rule, terminate soon and favorably. When, however, the temperature rises again after having gone down to the normal or nearly normal standard, complications or extension of the catarrhal or inflammatory process must be expected. Catarrhal secretion from the nasal mucous membrane, which was dry in the beginning, is a favorable symptom; so is the looser and moister character of the cough.

Treatment.—Whatever plays an important part in the etiology of the disease ought to be carefully avoided. The feet must be kept warm under all circumstances, nothing being more injurious to health in general, and to that of the respiratory organs in particular, than cold and moist feet. Shoes and stockings must be kept dry, the latter changed when wet, and of slowly-conducting material. No part of the body must be kept uncovered, and the dresses of children made the particular object of care on the part of the family physician. Linen must not be in immediate contact with the skin, cotton—or, still better in all seasons, wool—being required for the

undergarment. At the same time, the hygiene of the skin requires attention. Regular washing or bathing need not be mentioned as a requisite, as it is self-understood. What, however, cannot be insisted upon too much is this, that the skin must get accustomed to cold water. The whole body must be exposed once a day to cold water—washing or bathing—and well rubbed off afterward with a thick towel. Young infants and those who are very susceptible to colds begin with tepid water, the temperature being lower from day to day. Even children of three or four years enjoy, finally, a morning bath at sixty or sixty-five degrees F. in winter. Such as do not get easily warmed up under the succeeding friction may mix alcohol with the water they use for washing and sponging purposes, in the proportion of 1 : 5-8. Sea-bathing also makes the skin more enduring, to such an extent that exposure to cold air has no longer any damaging influence. In fact, cold air without wind is easily tolerated even by those who have a tendency to respiratory disorders, while wind and draught must be avoided. From this point of view the change of climate sometimes required for such as suffer from catarrhal laryngitis must be instituted. It is not always necessary to select a very warm climate; undoubtedly, many of the winter resorts are badly selected, for the very reason that they are too warm. On the other hand, great elevations are not advisable. The sudden atmospheric changes and fogs of high mountains are injurious.

Patients suffering from catarrhal laryngitis or a tendency in that direction must avoid all irritation of the pharynx and larynx. They must not smoke, or talk too much or too loud. Those few clergymen who suffer from clergymen's sore throat in consequence of speaking only will remember that they can speak just as forcibly when speaking less vehemently. The use of alcoholic beverages, unless greatly diluted, is prohibited. Catarrh of the nares and pharynx must get cured. The former will get well in most cases under the use of salt water. A tepid solution of one or one-half per cent. of table-salt in water, snuffed up copiously (a tumblerful) from the hand of an adult patient, or a similar solution in a small quantity injected

through each nostril of a child, twice or three times a day for weeks and months in succession, will often remove a laryngeal as well as a pharyngeal catarrh. Care must be taken that the fluid passes the whole length of the nasal canal. It must be applied in the fauces, and will then be ejected through the mouth, or a small portion of it swallowed. Many a severe nasal catarrh requires no other treatment. Some chronic ones require the use of a spray of nitrate of silver in a solution of one-half to one per cent. every other day, or of a two per cent. solution of alum daily. Where both the pharyngeal and nasal catarrh are complicated with, or kept up by, enlarged or ulcerated tonsils, these organs must be resected. The combination of these two measures, exsection of the tonsils and nasal injections, has proved very beneficial in a great many cases.

The treatment of an acute case requires great care. Avoid injurious influences. The patient must be kept silent and quiet in bed. The temperature of the room is to be about 70° F., the air moistened by vapor, which must not be allowed to get cold before it reaches the patient.

When swelling and dyspnœa are considerable, particularly in those grave cases attended with swelling of the submucous tissue, the application of an ice-bladder or ice-cloths will be found beneficial and agreeable. But the cases in which these applications are indispensable are but few. In most of them the necessity of subduing intense inflammation is less urgent than the advisability of increasing the secretion of the congested larynx. For that purpose warm poultices, but of light weight, act very favorably. Inhalation of warm vapors either constantly or at short intervals, or of muriate of ammonium or spirits of turpentine, will prove beneficial. The latter is evaporated from the surface of boiling water, on which a small quantity, from a teaspoonful to a tablespoonful, may be poured every one or two hours. The hydrochlorate of ammonium is evaporated, 10 or 20 grains (1.0 gramme), every one or two hours by heating it on a hot stove or otherwise. The white cloud penetrates the air of the whole room, and, while not uncomfortable to the well, serves a good purpose in liquefying the viscid and tough

secretion of the mucous membrane. The internal administration of liquefying and resolvent remedies may properly accompany the external applications and inhalations. Amongst them I count the alkalies, mainly bicarbonate and chlorate of potassium or sodium and the hydrochlorate of ammonium. A child of two years will take daily a scruple (gramme 1.0-1.5). The iodide of potassium will also have a good effect and counteract many a predisposition to chronicity. A child may take from 8 to 15 grains a day (gramme 0.5-1.0). Hydrochlorate of apomorphine, grain $\frac{1}{50}$-$\frac{1}{30}$ (0.001-0.002), dissolved in water, a dose to be given every two hours or every hour, is quite sufficient to act as a fair expectorant without being enough to produce emesis. Antimonii et potassii tartras has been used more extensively in former times than at present. An adult would take gr. $\frac{1}{20}$-$\frac{1}{15}$ every two hours. Children ought to be spared the drug, as it is depressing, produces unnecessary vomiting now and then, even in small doses, and, what is still worse, diarrhœa. The other antimonial preparations, such as kermes mineral and the oxysulphuret of antimony, are less depressing and less purging, but also less effective; and there are but few cases where a good substitute could not be found. For the purpose of increasing secretion the hydrochlorate of pilocarpine has been recommended. It certainly has that effect, but its indications become doubtful in many cases where the saving of strength is of paramount importance. I shall return to this subject in my remarks on the therapeutics of membranous laryngitis.

Derivation is of great service when well directed. Local depletion must be avoided. A purgative in the beginning is beneficial—a dose of calomel is as good as, or mostly better than, anything else. Diaphoretics and diuretics act quite well; the best of them all are warm beverages of any kind. They need not come from the apothecary's nor be very unpleasant to take—water not too cold, Apollinaris, Selters, or Vichy, hot milk, tepid lemonade in large quantities and very often. Sinapisms have a good effect. When not kept on longer than a few minutes —long enough to give the surface a pink hue—they may be applied every hour or two.

Some urgent symptoms may require symptomatic treat-

ment. When secretion is copious, but too tough, and expectoration insufficient because of both the character of the mucus and the incompetency of the respiratory muscles, ipecac in small doses or camphor is indicated. A child's dose of the latter would be gr. $\frac{1}{4}$-$\frac{1}{2}$ (gramme 0.015-0.03) every one or two hours. In these cases the hydrochlorate of ammonium may be combined with the carbonate (ammon. chlorid. ℥ss. (2.0); ammon. carbonat. ℈j (1.25); extr. glycyrrh. pur ℈ij (2.5); aq. pur. f℥iij (grammes 100.0)—teaspoonful every hour. When the difficulty of expectoration is excessive an emetic may be resorted to. It is true that infants and children vomit with less straining and difficulty than adults, but, still, the practice of flinging emetics around is too common. The unpleasantness of getting up in the night because of a pseudo-croup in a distant patient's baby is not a correct indication for encouraging the indiscriminate use of emetics. When they are required, antimonials ought to be excluded from the list. Ipecac, sulphate of zinc, sulphate of copper, turpeth mineral are preferable.

In urgent cases the hydrochlorate of apomorphia may be used hypodermically (six or ten drops of a 1 per cent. solution in water). Cases of such urgency, and so excessive dyspnœa coupled with cyanosis, as to necessitate tracheotomy are but very rare. But once in thirty years and in many more than four hundred tracheotomies have I been compelled to operate for a case of catarrhal laryngitis. Still, a few such cases are on record. The best-known amongst them is that of Scoutetten, who operated successfully on his own daughter six weeks old.

Narcotics prove quite beneficial, particularly in complications with pharyngeal catarrh. A dose of gr. j-jss. of Dover's powder (gramme 0.05-0.1) at night will secure rest for several or many hours to a child of two or three years; an adult is welcome to a dose of 10 or 12 grains (0.6-0.75). When the irritation is great during the day, it is advisable to add a narcotic (acid. hydrocyan. dil., min. j; vin opii, min. viij-xij; codeine gr. $\frac{1}{3}$-$\frac{1}{2}$, or extr. hyoscyam. gr. ij-iij—daily) to whatever medicine was given. I am partial to the latter, giving it up to gr. viij-x

(0.5-0.6) to adults daily in their mixture, retaining the single dose of opium or morphine to be taken for the night. At that time a single larger dose is rather better than several small ones. Narcotics cannot be dispensed with in all those cases in which—as, for instance, in tubercular laryngitis—deglutition is very painful, because of the catarrhal and ulcerous pharyngitis. Bromide of potassium has a fair effect, but frequently fails, and the administration of morphia before each meal is sometimes an absolute necessity.

That complications, such as bronchitis, have their own indications is self-understood. The general rules controlling the treatment of laryngitis are not interfered with by them. Œdema of the glottis, however, when occurring during an attack of laryngitis, has its own indications, and very urgent ones indeed in all acute cases. In chronic cases a causal treatment is required according to the etiology of the affection as specified above. In acute cases it is not permitted because of want of time. The danger of immediate strangulation is often averted only by a deep scarification or the performance of tracheotomy.

Chronic cases require all the preventive measures enumerated above and the internal use of iodide of potassium or sodium (℈ j-℈ iiss = gramme 1.25-3.0 daily, for adults), and tincture of pimpinella saxifraga three or four teaspoonfuls daily. When it is given it ought to have an opportunity to develop its local effect on the pharynx also by giving it but little diluted, and not washing it down afterward (tinct. pimpinella saxif., glycerin, *āā*, teaspoonful every two hours). In these cases, while the local salt-water treatment recommended above is indispensable, the nitrate of silver spray mentioned in that connection is here again referred to as very beneficial indeed. But the solution of 1 per cent. is the highest degree of concentration allowable. Conducted through the nose, it will reach the larynx better than through the mouth. When both accesses are rather difficult the application must be made directly to the larynx.

PSEUDO-MEMBRANOUS LARYNGITIS

Pathology.—Pseudo-membranous laryngitis is characterized by the presence, on and in the mucous membrane, of a pseudo-membrane of a whitish-gray color, various consistency, and different degrees of attachment. It has been called croupous when it was lying on the mucous membrane without changing much or at all the subjacent epithelium and could be removed without any difficulty. It has been called diphtheritic when it was imbedded into the mucous membrane and was difficult to remove. This difference exists, but it does not justify a difference of names except for the purpose of clinical discrimination; for the histological elements of the two varieties are the same, and the difference in their removability is explained by the anatomical conditions of the territory in which they make their appearance. The membrane consists of a net of fibrin studded with and covering conglomerates of round cells, mixed with mucus-corpuscles, epithelial cells more or less changed, and a few blood-cells. The fibrinous deposit is either quite superficial or lies just over the basal membrane or on layers of round cells originating from the basal membrane. It is continued into the open ducts of the muciparous follicles, filling them entirely in the worst cases, or meeting the normal secretion of mucus in the interior of the duct. The principal seat of the pseudo-membrane is that mucous membrane which is covered with pavement epithelium; thus it is that the tonsils are the first, usually, to exhibit symptoms of diphtheria. But cylindrical epithelium is by no means excluded. However, while pavement epithelium is generally destroyed by the diphtheritic process, the cylindrical epithelium is frequently found unchanged, or but little changed, on top of the mucous membrane under the pseudo-membrane.

The nature and consistency of the pseudo-membrane in

the larynx is best studied by the light of the study of its anatomy. There is a great deal of elastic tissue in both epiglottis and larynx; the mucous membrane of the latter is thin, and sometimes folded on the vocal cords. The epithelium of the epiglottis is pavement; only at its insertion it is cylindrical. In the larynx it is also pavement on the true vocal cords and in the ary-epiglottic folds, and fimbriated toward the fossæ Morgagni and trachea. Lymph-vessels are but scanty on the epiglottis, still more so in the larynx. Of acinous muciparous glands there are none on the epiglottis, none on the true vocal cords; they are more frequent in and round the fossæ Morgagni, with cylindrical epithelium in the glandular ducts. The trachea and bronchi contain a good many elastic fibres, less connective tissue, fimbriated epithelium, some lymph-vessels, but no lymph-glands, and acinous muciparous glands in large numbers. Wherever the pavement epithelium membrane is abundant the membrane is firmly adherent and imbedded into the mucous membrane. Where it is cylindrical and plenty of acinous glands secrete their mucus, they are loosely spread over the mucous membrane, from which they can be easily removed; while the histological condition of both the imbedded and the loose membrane is exactly the same.

Before the membranous deposit takes place the surface is in a condition of catarrh. Round the membrane the mucous membrane is red and slightly swollen. Not always, however, is that so. Particularly, the epiglottis may be covered on its inferior surface with a solid membrane or be studded with tufts of membrane, without much or any hyperæmia. The same can be said of the larynx, which is supplied with but a scanty distribution of blood-vessels and a sufficient network of elastic fibres to counteract the dilatation of blood-vessels peculiar to the catarrhal and inflammatory processes.

In uncomplicated cases of membranous laryngitis the membrane is confined to the larynx. Dozens of years ago —viz., before 1858, when diphtheria began to settle among us, never, it appears, to give up its conquest again—that took place in most cases. But since that period we meet

with few such simple cases. As a rule, the membrane makes its appearance in the pharynx first, from there to descend into the larynx, and not infrequently into the trachea and bronchi. In other—fortunately, but few—cases the membrane is formed in the bronchi and trachea first, and invades the larynx from below.

Other organs suffer but consecutively and from the results of impeded circulation only. Thus, in post-mortem examination hyperæmia of the brain, liver, and kidneys, and bronchitis, broncho-pneumonia, or pulmonary œdema, are met with. Only those cases of membranous laryngitis which are complicated with general diphtheria yield the additional changes of the latter.

Etiology.—Intense irritants will produce an irritation on mucous membranes. In the larynx the product is according to the severity of the irritation, either a catarrhal or a phlegmonous or a croupous laryngitis. The irritating substances may be mechanical, chemical, or thermical. Heubner produced diphtheria of the bladder by cutting off, temporarily, the supply of circulation. Traumatic injury of the throat and larynx will soon show a croupous deposit. Caustic potassia, sulphuric acid, caustic ammonia, corrosive sublimate, arsenic, chlorine, or oxygen, applied to the trachea or larynx produce croupous deposits.[1] Inhalations of heat, smoke, and chlorine have the same effect. These, however, are not the usual causes of croup. Cold and moist air is a more common cause, mainly during a prevailing epidemic of diphtheria. In former times, which are unknown to the younger generation of physicians, when no such epidemics existed, the only form of diphtheria occurring now and then was local laryngeal diphtheria called pseudo-membranous croup. It was then a rare disease, while at the present time it is of but too frequent occurrence. In my *Treatise* I have explained at some length the relations of the two.

Age has some influence in its development. The disease is not frequent in the first year of life; between the second and seventh years almost all the cases are met with.

[1] A. Jacobi, *Treatise on Diphtheria*, p. 111.

There are families with what appears to be a general tendency to croupous laryngitis. It may return. Even tracheotomy has been performed twice on the same individual.[2] It is contagious. In the same family, from a case of croup, either another case of laryngeal croup may originate or another form of diphtheria will develop in other members of the household. It is not so contagious, it is true, as generalized diphtheria must be, for the infecting surface is but small in uncomplicated membranous croup, and the membrane not so apt to macerate and be communicated. Boys appear to be affected more frequently than girls. But the previous constitution makes no difference.

Symptoms.—Membranous laryngitis begins sometimes with but slight symptoms of catarrh, sometimes without them. Nasal, pharyngeal, and laryngeal catarrh may precede it a few hours or a week, with or without fever and with a certain sensation of pain or uneasiness in the throat and a moderate amount of cough and hoarseness. This condition has been called the prodromal stage of membranous laryngitis, though it is just as natural to presume that the changes in the mucous membrane merely facilitated the deposit of false membrane. The latter is more apt to develop on a morbid than on a healthy mucous membrane. The membranous laryngitis proper dates from the time at which, with or without an elevation of temperature, a paroxysmal cough makes its appearance—first in long, afterward in shorter intervals—which is increased by a reclining posture, mental emotions, or deglutition. At an early period this cough, which is very labored, and gives rise to dilatation of the veins about the neck and head, is complicated with hoarseness, which gradually increases into more or less complete aphonia. Respiration becomes audible, sibilant, with the character of increasing stenosis. Inspiration becomes long and drawn; expiration is loud; head thrown back; the scaleni, sterno-cleido-mastoid, and serrati muscles are over-exerted; above and below the clavicles and about the ensiform process deep recessions take

[2] *Treatise*, p. 27.

place in the direction of the lungs, which are expanded with air, but incompletely; dyspnœa becomes the prominent symptom, and occasional attacks of suffocation render the situation very dangerous and exciting indeed. These sudden attacks of suffocation are due—besides the permanent narrowing of the larynx by the membranes, which gradually increase in thickness—to occasional deposits of mucus upon the abnormal surface of the larynx and vocal cords, by partly-loosened false membranes, which now and then become audible, yielding a flapping sound, by œdema in the neighborhood, and by secondary spasmodic contractions. They are mostly met with in the evening and night; there is often a slight remission in the morning, which rouses new hopes, which soon, however, prove unfounded. Meanwhile, the pulse becomes more frequent in proportion with the increase of dyspnœa, and finally irregular; the temperature rises but little, and usually only when the throat or other organs, which are in more intimate connection with the lymph circulation than the larynx, are participating in the exudative process; and the laryngeal sounds become so loud as to render the auscultation of the lungs impossible. The glands of the neck are not swollen when the process is confined to the larynx. Now and then small or larger, rarely cylindrical, pieces of false membranes are expectorated, with or without any amelioration of the condition. In this condition the patient may remain a few hours or a few days.

Then the dyspnœa will rise into orthopnœa; the anxious expression and bearing of the little patient—for the vast majority of the sufferers are children—becomes appalling to behold; cyanosis increases; the head is thrown back; the larynx makes violent excursions upward and downward; the abdominal muscles work in rivalry with those of the thorax and neck; the surface is bathed in perspiration; still, consciousness is retained by the unhappy little creature tossing about and fighting for breath, and in complete consciousness he is strangled to death. Now and then the carbonic-acid poisoning renders the pitiful sight a little less appalling to the powerless looker-on by giving rise to convulsions or anæsthesia and sopor, which finally ter-

minate the most fearful sight, the like of which the most hardened man, the most experienced medical attendant, prays never to behold again.

Besides the brain symptoms just mentioned, but few other organs give rise to abnormal function. In the kidneys the stagnant circulation results in albuminuria—in the bronchi and lungs, in hyperæmia, inflammation, and œdema.

The symptoms described above are the same both in those cases which are strictly localized and those which descend from the pharynx. In the latter there is fever only when the pharyngeal diphtheria was attended with it. The process descending into the trachea and bronchi changes the symptoms but little, as far as the laryngeal stenosis is concerned, for it is the latter which destroys by suffocation. Only when tracheotomy has been performed, and the immediate danger of suffocation has been removed, the further progress in a downward direction gives rise to a new series of symptoms. After the temporary relief procured by the operation dyspnœa will set in anew, not always, however, of that intense degree of the laryngeal stenosis; respiration will become dry and loud again, and a little more frequent than in the uncomplicated laryngeal cases. Death will finally also result, either from suffocation or from the symptoms I enumerated above.

Lastly, when membranous laryngitis is but the terminating development of extensive membranous bronchitis, the symptoms differ from those described above in this, that the laryngeal symptoms last but a short time. For days or weeks no symptoms but those of an ordinary bronchial and tracheal catarrh were observed: all at once the process reaches the larynx; in a few hours the very last stage of croupous stenosis is reached; even tracheotomy does not relieve the symptoms. Or the fibrinous bronchitis was extensive enough to give rise to a sufficient number of symptoms before the larynx was reached. Amongst them is, foremost, frequency of respiration, because of its insufficiency; diminution of respiratory murmur over the area supplied with the affected bronchi; sometimes localized absence of respiratory murmur, while the percussion sound

is sonorous. Another complication is emphysema, either subpleural or pulmonary. It is not frequent, except in combination with fibrinous bronchitis. The increase of respiratory movements is quite sudden, percussion sound tympanitic, and auscultation negative. Pulmonary œdema is quite frequent; it is the result of the rarefaction of air in the bronchi, the consecutive dilatation of the blood-vessels, and the effusion of serum by intravascular pressure. Every severe case is accompanied with it; in every tracheotomy it is met with coming up into the incision. Œdema of the glottis is less common, but it is met with in the same manner and with the same symptoms which characterize the glottic œdema of catarrhal laryngitis.

Prognosis.—It is not favorable even in the simple and uncomplicated cases. Infants and children under two years almost invariably die. The percentage of average mortality rates very high—from 80 to 90 and more. It is probable that some recent therapeutical advances have reduced it, will reduce it, considerably. Tracheotomy is known to do so certainly, as from 20 to 45 out of 100 operations prove successful. The previous condition of the patient is of very little account in regard to the course and termination of the disease; no constitution protects or saves. The more the disease is local the better the prognosis. When fever makes its appearance, it means a complication, such as extending diphtheria or bronchitis or broncho-pneumonia, and impairs the chances of recovery. The expectoration of membranous shreds or whole membranes does not improve the prognosis much, as the new formation of membranes may be very rapid indeed. I have seen new membranes rising to a formidable extent in from two to seven hours. The prognosis is improved when the cough becomes looser, expectoration more purulent, pulmonary respiration become audible again after having been covered by the laryngeal noises, rhonchi become moist, and portions of lungs which before were inaccessible to air by clogging membranes are reopened. Increasing debility, frequent and irregular pulse, are ominous symptoms. Even more so is the failure on the part of emetics to take effect.

Diagnosis.—It may be quite difficult to diagnosticate croupous from catarrhal laryngitis, particularly in those cases where the former is not complicated with any visible exudative process in the fauces. In membranous laryngitis stenosis begins gently (except in those cases which ascend from the bronchi) and increases gradually; there are, it is true, remissions in the morning (mostly), but they are but slight, and the subsequent evenings are worse than the previous ones. It increases from day to day until a slight cyanotic hue of the lips is followed with more general cyanosis. There is no fever or very little, except in the cases of generalized diphtheria. The character of the cough does not change; perhaps it becomes more dry and suppressed after a while. Hoarseness does not improve, but increases steadily into aphonia. Expectoration is but scanty; now and then a small portion of mucus from the lower portion of the respiratory tract, now and then shreds of membrane, are expelled.

In catarrhal laryngitis stenosis begins abruptly and suddenly, and is often at its height a few minutes after the commencement of the attack. Remission sets in soon, is more marked, sometimes complete, and a new attack, just as sudden as the first, may occur in the next night. Real cyanosis is but rarely developed; when it is, it changes soon into a more normal condition. Catarrhal laryngitis in the child is a febrile disease. In it the cough changes after a little time, some moisture mixes with the expectoration and changes both cough and articulation; also, the voice is not equally husky; now and then a clear note comes in. Close inspection of the throat exhibits sometimes a thick, viscid mucus floating up and down with the excursions of the larynx in catarrh. It never has any membranous expectoration.

Local œdematous swelling of the ary-epiglottic folds, with or without membranous deposits in some other parts of the larynx, yield all the symptoms of membranous croup with its dangers and death-rate. The effect of this œdema is partial paralysis of the vocal cords. Thus, inspiration is impeded, as in membranous obstruction; expiration, however, is free and the voice intact to a cer-

tain extent. This local œdema may be detected by palpation.

General œdema of the larynx (glottis) is fortunately rare. The attack is very sudden; there is no cold, no hoarseness, no choking cough, no membrane; there is only dyspnœa, gasping, asphyxia, sopor, and death, unless relief is given almost instantaneously.

The presence of a foreign body has been mistaken sometimes for membranous laryngitis. The history is a different one; there was no prodromal catarrh; the children were taken suddenly while playing or eating.

The laryngoscope would be a great aid in diagnosis if it could be used during the distress of a membranous laryngitis. Still, it has been employed by Ziemssen, Rauchfuss, and others. But the opportunities are rare.

Treatment.—The objects of treatment differ with the various stages of the disease. The inflammatory symptoms of the commencement, the completed exudation, the maceration and disintegration, and also the expectoration of the pseudo-membranes, and, finally, the asphyctic stage, have each their own indications. If there is anything which must not be recommended, it is depletion. Fortunately, there are but few practitioners left who still apply leeches or employ more general depletion, but these few are still doing too much harm by their practice and teaching. The application of ice, however, in bags over and near the larynx, and of iced cloths frequently changed, combined with the swallowing of small pieces of ice from time to time, is apt to be beneficial in well-nourished, hearty children. Such as have been anæmic, with thin muscles and pale mucous membranes, do not bear it so well.

The most powerful and reliable preventive and solvent, thus far, is hydrargyrum. It is true that many voices have been raised against it, but from Bard, Bretonneau, and Billard to Rauchfuss, Ch. West, Lynn, Pepper, and others, the remedy has had its admirers. Large single doses of calomel have been given by some amounting to 15-30 grains (gramme 1.0-2.0), but that treatment has not found many friends. In small and frequent doses it

has been of good service to me both in fibrinous laryngitis and bronchitis, particularly in the latter; gr. $\frac{1}{4}$-$\frac{1}{2}$ may be given every half hour or every hour. Tartar emetic is liable to develop so many unfavorable effects that even doses—in combination with calomel—of $\frac{1}{100}$ of a grain require great caution. The most reliable mercurial preparation, in my experience, and the least hurtful, is the corrosive chloride. In the stomach it combines with the chloride of sodium, is absorbed without being changed, and transmuted into an albuminate, during its circulation in the blood. Babies of tender age bear one-half of a grain and more, daily, many days in succession. Salivation and stomatitis are exceedingly rare after its use. Gastro-intestinal disturbances are not at all frequent; diarrhœa, if observed at all, is very moderate, and can be avoided or removed, by the administration of mucilaginous and farinaceous food or a mild dose of an opiate. But the administration of the bichloride requires care in regard to its solution. A fiftieth of a grain may be safely given to a baby a year old every hour, but it must be dissolved in one-half of a tablespoonful or a whole tablespoonful of water. The solution of a grain in a pint of water is about correct. In those very rare cases in which no preparation of mercury is borne internally the inunction of sufficient and frequent doses of the oleate of mercury may take the place of the internal administration or alternate or be combined with it. The blue ointment is not so effective as the oleate. The subcutaneous injection of the corrosive chloride may be added to the modes of administration if no time must be lost in introducing as much as possible of the drug into the system. Now and then, however, the subcutaneous tissue of the child does not tolerate it well in that form, though the solution may be not larger than 2 per cent.[3] The cyanide of mercury, in doses of a hundredth of a grain every hour, has been warmly praised by A. Erichsen and C. G. Rothe.

The large mortality in croup and the inefficiency of remedial treatment have been the reasons why the recom-

[3] *The Medical Record,* May 24, 1884.

mendations of remedies have been very numerous. Alkalies were held in great favor during different periods of our literature, mainly the carbonate and bicarbonate of potassium (and sodium), in daily doses, to a child, of ½ drachm or 1 drachm or more; also the chlorate of potassium or sodium. As an adjuvant it may be useful; as an antidiphtheritic or antimembranous remedy it must not be regarded. What it can do is to heal or prevent a catarrhal stomatitis and pharyngitis. The best and most reliable is probably the iodide, in larger doses than are usually given. One or two drachms daily (grammes 4.0-8.0) are well tolerated when sufficiently diluted. Benzoate of sodium was recently recommended for its supposed antifermentative and antibacteric effect; its practical utility is but very limited; not even its antifebrile effect is anything but reliable. Lime-water has not fulfilled in my hands the promises made by others—neither its internal use nor spray nor inhalation. The most certain mode of introducing lime particles into the larynx is, after all, the inhalation of slaked lime, which allows a quantity sufficient to be somewhat effective to enter the respiratory organs. Its comparative inefficiency has been acknowledged by those who add 1 per cent. of the liquor of caustic potassium or sodium to the lime-water.

Quinia, in doses of 15 to 30 grains (grammes 1.0-2.0) daily, has been recommended by Monti for the same indications, mainly in the commencement of febrile cases. It has been claimed that cold applications, to be changed every hour or two according to the Priessnitz or hydropathic plan, had a great power in macerating and disintegrating mucous membrane. Many of the successful cases of these, as of all other specialists, are undoubtedly the result of the convenient substitution of a grave diagnosis for a milder one. The effect of such applications in laryngeal catarrh, like that of warm applications, is undoubted. Vesicatories applied to the neck over the larynx are never useful—frequently injurious by the sore surface becoming the seat of a pseudo-membrane.

Inhalations of warm vapor are decidedly beneficial, but atomized water is not of equal value. Thus, Richardson's

atomizer is not so useful as Siegle's inhaler or other apparatuses working on the same plan.

Lactic acid, in solutions of 1:10 or 25 (Monti's solution of 1:200 is certainly too weak), has been applied by means of a sponge, inhaled, or thrown in from an atomizer for the same purpose. Good results have been reported, failures also; and still, recoveries are rushed into print much more readily than failures. The same may be said of the local applications of glycerin, boric acid, carbolic acid in solutions of 1 or 2 per cent., salicylic acid, iodoform, and hypermanganate of potassium; also of bromine (bromine and potas. bromid. *āā*) 1: water 500, or a stronger solution.

Tannin, dry or with glycerin, is rather more injurious than it can be useful. It is apt to coagulate the mucus contained in the pharynx and the upper part of the larynx, and to render the dyspnœa graver than before. Such an aggravation of symptoms must be carefully avoided, though it be but temporary. The same must be said of alum, which has been used solid, in finely-powdered condition, down to a 3 per cent. solution in water.

Spirits of turpentine are inhaled either from an inhaling apparatus or by saturating the air of the room. Water is kept boiling constantly on a stove, oven, or alcohol lamp (not on gas, which consumes a larger quantity of oxygen), and a tablespoonful of the spirits of turpentine is poured hourly or in shorter intervals upon the boiling surface.

Hydrochlorate of ammonia can be used in the same manner as described in the article on Catarrhal Laryngitis.

Hydrochlorate of pilocarpine was introduced into the treatment of diphtheria and pseudo-membranous croup some years ago, and recommended as no less than a specific. It increases, physiologically, the secretion of the skin, the mucous membranes, the lachrymal and muciparous glands, the kidneys. It also depresses the heart's action. In all cases in which the latter effect is to be feared the drug is contraindicated; thus in septic diphtheria, in pseudo-membranous croup with great asthenia, in general debility and anæmia. By increasing the secre-

tion of the mucous membranes it is expected to macerate the pseudo-membrane and raise it from its bed. This can be accomplished wherever the membrane is deposited upon the mucous membrane—that is, whenever the number of muciparous follicles is large and the epithelium is cylindrical. This is not so on the vocal cords, and thus the floating effect of pilocarpine cannot be obtained exactly where it is most needed—that is, on the vocal cords, where the pseudo-membrane is more intimately imbedded into the tissue than, for instance, on the posterior wall of the fauces or the trachea and bronchi. Still, pilocarpine may be tried, in combination with other modes of treatment, as long as the heart's action is competent and the general condition satisfactory. It is dissolved in water; its dose, for a child a year old, $\frac{1}{30}$ grain (2 milligrammes = 0.002) every hour. A subcutaneous injection every four or six hours of $\frac{1}{60}$ grain (three drops of a 2 per cent. solution) will prove very effective for good and evil. I believe it has rendered me good service in some well-marked but mild cases of pseudo-membranous laryngitis, which it either aided in healing or prevented from getting worse.

Emetics have their distinct indication. It is irrational to expect any relief from them when the larynx is narrowed by firmly-adhering pseudo-membranes. Their indication depends on the possibility of removing something which acts as a foreign body. This something can be either mucus or loose or partially loose membrane. The peculiar flapping sound produced by the latter admits of or requires the administration of an emetic. Above I have stated which of them ought to be selected. Turpeth mineral in a dose of from 3 to 5 grains, repeated in six or eight minutes, acts quite well. Hypodermic injections of apomorphine may be required in urgent cases.

The introduction of catheters into the larynx, according to the methods of Horace Green, is a dangerous proceeding and ought not to be indulged in. It gave the idea to Loiseau and Bouchut to force a tube into and through the larynx, full of pseudo-membrane, for permanent use until the pseudo-membrane would have disappeared. This tubage was rendered ridiculous at once by the assertion of

Bouchut (1858) that children suffering from croup who were supplied with this laryngeal tube were not only relieved at once, but expressed their gratitude in audible oratory. Still, there are some cases on record of more recent date in which tubage is reported to have been attended with success. It is not very probable, however, that a larynx which admits of no air, because of its being clogged with firm pseudo-membrane, should be willing to admit and endure the presence of a tube.

Massage of the larynx has been recommended by Bela Weiss. It consists in systematical gentle pressing and kneading of the larynx by the physician while sitting behind the patient. He asserts its satisfactory influence not only in catarrhal but also in diphtheritic (croupous) laryngitis.

The inhalation of oxygen has proved rather advantageous in my hands in a few instances. The most memorable case of the kind I have mentioned elsewhere. It was that of a child on whom tracheotomy had been performed. The pseudo-membranous process, however, invaded the bronchi, with the result of producing dyspnœa, cyanosis, and convulsions. Whenever a current of oxygen was introduced into the lungs through the canula both cyanosis and convulsions would cease, and returned when its supply was stopped.

But if no medication will have proved successful, the symptoms of stenosis, dyspnœa, cyanosis, and the supra- and intraclavicular and epigastric recension increase steadily to an alarming extent. When the pulse becomes frequent and intermitting, even without the presence of asphyxia and anæsthesia, air ought to be introduced into the lungs by tracheotomy. No positive rules can be laid down as to the length of time one ought to wait before performing it. No subdivision of the disease into several stages is of any benefit in selecting the exact period in which the trachea must or may be opened. No alleged contraindication to the performance of tracheotomy, whether the tender age of the patient or a complication with either an inflammatory or an infectious disease, must be considered valid. The one strict indication for the perform-

ance of tracheotomy is when the diagnosis of pseudo-membranous laryngitis is undoubted, the increasing dyspnœa, cyanosis, and approaching asphyxia, with the certainty that a well-directed and sufficient medicinal treatment has been, and in all probability will be, useless. Even under these circumstances there is no mathematical certainty. The matured experience of a well-informed and thoughtful physician will commit but few errors. If there be the slightest doubt, the operation ought to be preferred to suffocation.

The nutrition of the patient has generally suffered much. Before the operation but little food was taken, still less was digested, and the operation itself and the anæsthetic have added to the previous weakness or exhaustion. Moderate feeding and stimulation are therefore to be commenced soon. Vomiting after chloroform I have seldom seen to last long or to be embarrassing under these circumstances. Feeding and stimulation are the more necessary the more the hungry lymph-vessels are liable to absorb injurious material when not supplied with healthy food.

Is internal treatment required? The general treatment must be continued. If it consisted in the administration of hydrargyrum, either internally or externally, it must be continued. If its effect was not sufficient to clear the larynx and to render the operation unnecessary, it will or may be sufficient to complete its effect in the next day or two, to prevent the process from descending or the membranes becoming too many or too thick. No changes ought to be made in the treatment unless there be changes in the symptoms. Not infrequently the first symptoms of bronchopneumonia come on within a few hours after the operation, recognizable by frequent pulse, respiration frequent beyond proportion, and physical symptoms. The stomach is not very reliable. Quinine answers best hypodermically. From 6 to 10 grains may be injected at once. The preparation which has served me best in the last few years is a solution of the carbamid in five parts of water. If an additional remedy is required, from 20 to 30 grains of sodium salicylate may be given in the course of three or

four hours, in hourly doses, to reduce the temperature. Tincture of digitalis will prove advisable at the same time when the heart appears to require it. Strychniæ sulphas will act as a powerful nervine; $\frac{1}{25}$ grain may be given to a child two years of age every two hours, until four or five doses shall have been taken. The rest of the treatment of the complications depends on their nature and character. It is not the name of the disease which has to be treated, here as in every case, but the individual patient.

In regard to stimulants I have but little to say. I use alcohol in the most pleasant shape, preferring brandy or whiskey. I use a great deal of camphor, 10 to 40 grains daily, or in cases of urgency Siberian musk, from 2 to 5 grains, every half hour or hour, until from 15 to 20 grains have been taken in cases of collapse or great prostration.

CHANGES OF BREAST-MILK

In many of the digestive disorders of the infant the best preventive, and often curative aid, is the breast-milk of mother or wet-nurse. That is an axiom, an indisputable law of nature, as long as the circumstances of the case are favorable. In view of the great mortality in the first few months, breast-milk is the one and indispensable food for those of that age. It is true that a baby may be taken sick with intestinal disease in spite of being nursed at the breast, for there are *many* causes of disease; it may, indeed, occur that babies are taken sick *because* of being at the breast. And it is those cases that both mothers and physicians ought to be well acquainted with. Sometimes it is not the breast-milk which is at fault, in the beginning, but the faulty use it is put to. Many babies suffer intensely because they are not limited to intervals of from 2 to 4 or 5 hours, as required by either age or constitution. In their cases, by too frequent feeding, both the milk of the mother and the digestion of the infant, are impaired. Here regularity is the sole indication. Sometimes, though fortunately in few cases only, there appears to exist an idiosyncrasy not explained, on the part of the baby who cannot thrive on the milk of the mother, but may do so after a change of food. In many cases, however, there are demonstrable dangers in the very breast-milk of either mother or nurse; there may be an undue percentage of fat, or of cheese, or of salts, or of sugar, or even accidental admixtures. These may occur in the secreting organ (thus blood may be found in the milk) or be traceable to the circulating blood of the whole system; of the latter they may be the very constituents, or foreign bodies floating in it. They can be classed as either morbid dispositions or as actual admixtures. Women suffering from constitutional syphilis, chronic consumption,

or anæmia, extensive rhachitis, severe nervous derangement, hysterical or other, those suffering from care and hard work, and those who are compelled to take a great deal of medicine, will serve their babies best by not nursing them at all.

In regard to the influence of medicine, the opinions have been divided. It was claimed that milk, being a secretion of the gland, and not a transudation from the blood, could not contain foreign material to any great extent. That is true as far as an absolutely healthy woman and normal milk are concerned. But the first period of lactation yields colostrum, not normal milk, and very often the latter is changed into a colostral condition, such as it was soon after birth, containing different-shaped fat globules, more sugar, soluble albumin, in fact, real blood serum. This may take place in every case of impaired health. And the more serum of blood is contained in any milk, the easier is the admixture of soluble substances circulating in the blood. As I formulated the subject some years ago, milk secreted from an insufficient mamma, by a woman not in full health and vigor, by an old woman, by a very young woman, by an anæmic woman, by a convalescent woman, who has consumed a large portion of her albumin, be it circulating or tissue albumin, by a neurotic woman with frequent disturbances of the circulation—milk, in fact, which is not the normal transformation of the elements of the mammary glands, but consists of more or less transuded serum, is apt to be impregnated with elements circulating in the blood. The indications on the one hand, for the permission to nurse, on the other, for the administration of medicines to a nursing woman, require, therefore, a greater strictness than is usually conceded. At all events, the good results obtained in many cases of ailment on the part of infants, by artificial feeding, in preference to nursing, are often better than merely accidental.[1]

Changes in animal and woman's milk in consequence of nursing, diseases, organic and inorganic substances are

[1] Inaugural address *Trans. Med. So.*, State of N. Y., 1882.

very frequent, and their occurrence was considered to take place at a time when exact analyses were out of the question.

One of the many pretty stories of the younger Pliny (xxv. 47) is as follows: Lysippe, Iphinœ and Iphianassa were the three daughters of Proteus, King of Argos. They were poisoned by the milk of goats fed on hellebore. They became insane, roamed about the country, and seduced and abducted the other young girls of the community. The two surviving princesses were cured by Melampus and his brother Bias, who married them, and the rest by the most vigorous young men who hunted them up.

In Gerhardt's Handb. d. Kinderk. Vol. II, I have collected a large amount of material, partly from reliable veterinary literature, showing the influence of different kinds of food, sickness, and drugs upon the milk of animals. Here I shall refer only to a number of facts belonging to our own race.

Zukowski observed that tired and hungry wet-nurses gave milk that was not nourishing. Among the wet-nurses at the foundling-hospital in Moscow, the percentage of fat in the milk when they were first admitted was from 1.8 to 3.0 per cent.; among those who had been in the institution a short time, it was 3.2 to 4.0 per cent. Seasons of fasting exerted a great influence upon the milk, especially upon its fatty element, and many nursing children were wont to become sick at such times. Upon the first day of the fast, the fat usually decreased to 0.88 per cent., but rose again to 3.4 per cent. by gradual habituation to the retrenchment in diet, and probably by the appropriation of an extra quantity of albumin from the general system, which satisfied the demand of the milk glands. The instrumentalities most rapid in their action upon the milk, are those which take effect through the nervous system, and their action is upon an organ in which, when functionally active, rapid changes occur.

Firmin (Bull. Thérap., 1886; Schmidt's Jahrbücher, 1875, No. 8) reports the case of a child six months of age, who was attacked with urticaria, fainting, vomiting, and offensive diarrhœa; all of these phenomena were pro-

duced by the mother's milk, after she had partaken of oysters, crabs, cod-fish, and shad. It may be proper to mention here an observation which was made by R. Monti (Schmidt's Jahrb. 173 p. 160). The right arm of a nursing woman, whose right breast was functionally incapacitated by mastitis, was treated locally with ammoniacum and camphor; the result was a marked decrease in the secretion of milk by the breast upon the healthy side. The passage of coloring matter into the tissues within a short space of time is a well-known possibility. According to Mosler, milk will become yellow through the influence of marsh turnips, caltha palustris, saffron, and rhubarb. According to Schauenstein and Späth, it becomes red after the ingestion of rhubarb, garlic, opuntia, rubia tinctorum; it becomes blue from the ingestion of myosotis palustris, polyganum, mercurialis, anchusa, and equisetum. This blue discoloration which pervades the entire volume of the milk so affected must not be confounded with the superficial blue layer which occasionally appears upon milk which has stood for some time. It gradually permeates the entire volume when added to milk which is otherwise pure. The milk thus treated will not lose its color by triple filtration. This color is dependent upon the growth of a fungus, which must not be confounded with Hessling's sour-milk fungus, and is identical with penicillium glaucum, and aniline blue, giving rise to severe attacks of catarrh of the stomach and intestine, and severe prostration.

Next to the coloring matters, the ethereal oils combine most readily with milk before it leaves the gland. The ethereal oil from rape seed, impregnated with sulphur is quickly passed into the gland. In the same way we get the peculiar odor from thyme, wormwood and garlic, when these substances have formed a part of the diet. The foregoing facts being established, the important question, theoretically as well as practically, arises: How far can disease be propagated through the medium of milk? Not all the chemical and microscopical analyses which have been made for the purpose of solving this question, can lay claim to absolute reliability. Percy ("What effect

has the meat or milk from diseased animals upon the public health."—*N. Y. Med. Jour.*, viii., 1866), has contributed reports of forty analyses of milk, which go to show that there is a chemical difference between the milk of well and sick cows, and that important ingredients are entirely wanting in the latter. He admits, however, that he has not been able to detect the presence of an active poison in it. During the same decade were published Hexamer's overdrawn pictures in reference to the swill-milk scandal in New York, which created a great impression in Europe and quickly passed out of notice in New York. Dewees has observed yellow fever among nursing women and has been unable to see positive harm to their infants from the use of their milk. D'Outrepont observed the same thing in patients with petechial typhus. In typhoid fever I have often made a similar observation. If the disease be diphtheria, I am chiefly concerned that the infants should not be exposed to direct contagion and that they should approach the mothers only for the purpose of nursing. On the other hand well-authenticated reports are published (Twelfth report of the medical officer of the privy council 1870 p. 294.—J. C. Gooding in *Med. Times and Gaz.* 1126, 1872) to the effect that unboiled cows' milk, from animals which were affected with mouth and hoof disease, produced derangements of digestion, fever, vesicles and swelling upon the lips and tongue, and marked weakness upon attempting to walk. There is likewise a published report of a case in which a number of officers and men belonging to an English ship, suffered severely after drinking some milk which had been obtained from goats which had fed upon euphorbiaceæ. This occurred Nov. 27, 1861. In regard to the infectiousness of animal flesh when taken into the stomach, authentic reports abound. Gamgee and D. Livingstone report the flesh of animals which had suffered from epidemic pleuro-pneumonia, to cause carbuncles and furuncles. D. Livingstone emphasizes the fact that boiling and roasting did not nullify this poisonous influence. From this it is sufficiently evident that goats, sheep, cattle, birds, and fishes may consume many poisonous substances

which are harmless enough to them, but are dangerous to those who afterward eat their flesh. The milk of a syphilitic mother was seen to be directly injurious in a case reported by Cerasi (*Gaz. di Roma Jul.* 1878).

Gallois, Appay, de Amicis, were unwilling to believe that this last statement was founded upon fact. The same is true of Banzon, whose opinion is remarkable, for he is even willing that tuberculous mothers should suckle their young. Fr. Unterberger (Rig. Zeitung, 1877, No. 69; Zeitsch f. Thiermed, 1878, p. 466) gives no absolute opinion upon this subject. He thinks, however, that the milk from tuberculous cows should be boiled, under all circumstances. Bollinger (52nd Vers. d. Naturf. u. Aerzte) believes, like many others since, that the infection of human beings is possible by means of the milk of tuberculous cows. We should, therefore, avoid using the milk of old cows, which are frequently found to be tuberculous. In all cases the milk ought to undergo proper treatment before being used. Virchow (Berl. Klin. Woch. 1879, 17, 18) does not deny the possibility of infection through a tuberculous cow, and calls to mind the observations of Kolessnikow (V. Arch. X p. 531) in regard to the pathological changes which take place upon the udder of tuberculous cows, and have a possible influence upon their milk. Uffelmann relates the case of a child who died from tuberculosis, where it was impossible to trace the origin of the disease to anything but the milk of a tuberculous cow. (Arch. f. Kinderh. II.) Stang had a similar case in a child five years of age. It is difficult to point to positive proof in these cases. Many more histories must be collected before we can be justified in prohibiting the customary supply of milk in every case of constitutional or severe local disease. But the interdiction will be warrantable in individual cases, upon the ground of probability.

Of importance in connection with the foregoing is the question of transmission of inorganic materials into the milk. While organic chemistry has not yet made sufficient progress to give a decision as to whether the gramme of quinine which gives a bitter taste to the milk, exists

in the milk as quinine or as something else (Chevallier and Henry), or whether alcohol, opium, or morphine are again recoverable from the milk, inorganic chemistry, on the other hand, is capable of better results, although here, too, there are differences of opinion in abundance. The direct experiments which were made upon human beings were only of a clinical character. Experiments upon goats and cows in this direction have also been made. Harnier and Simon found no iron (yet the ash residue of human milk always contains much pheno-phosphoric acid, 0.21 less than that of cow's or swine's milk, according to Wildenstein), they readily found salts, however, in loose combination, which quickly disappeared. According to Bistrow's observation anæmic children improved rapidly, when those who nursed them took iron. According to Wildenstein's experiments upon a goat, the quantity of milk, under the use of iron, was less, but its specific gravity was greater, and the quantity of iron in the ash increased two-fold, but not until the iron had been in use for twenty-four hours. A small quantity of bismuth was found by Lewald; a large quantity by Chevallier and Henry, and a trace by Marchand. Fifteen grammes of iodide of potassium were found by Lewald in the accumulations of four days. In the following three days twenty-one grammes more were recovered and then all traces disappeared. This was in accordance with a previous calculation. In a further use of iodide of potassium, the milk gave an iodine reaction at the end of four hours, and continued to do so for eleven days.

Lazanski made observations upon a syphilitic mother and her infant five months of age. The mother had been infected two years previously, had no indications of the disease upon the genital organs, but had syphilides in the groins, and swollen glands. The child was affected upon the skin and the mucous membranes. The mother received half a gramme of iodide of potassium twice a day, the result being that the urine gave an iodine reaction upon the same day that the treatment was begun. In the child the iodine reaction appeared upon the following day. Gemmel also relates that a cow which received ten

grammes of iodide of potassium daily, began to dispose of it through the milk glands, upon the tenth day. In a case where the nurse was treated with iodide of potassium, a desired effect was soon produced upon the child which she was suckling. Upon the basis of such facts, Leviseur recommends in the secondary syphilis of infants, the use of iodide of potassium through the medium of the breast-milk, likewise the sulphate of quinine in neuroses of an intermittent character, and arsenic for the moist eruptions upon the skin. Arsenic was found seventeen hours after it had been given, and it continued to be traceable for sixty hours thereafter. (Hertwig states that medicinal doses for a cow are sufficient to poison the meat.) Lead may be separated from the milk, likewise oxide of zinc, and probably all other preparations of zinc. They were found in from four to eight hours after they had been given, and disappeared after fifty or sixty hours. Antimony passes into the milk, therefore special care should be exercised in prescribing it. Mercury has not been found by Peligot, Chevallier and Henry, and Harnier, but it has been found by Lewald and Personne.

O. Kahler has made the cases of three women who were receiving mercury by inunction, the occasion of accurate investigations. The milk was examined for mercury by the chemico-electrolytic method of Schneider, but none was found. He considers the affirmations of Lewald and Personne, under this head, as questionable. In my personal experience, the results of mercurial treatment of the mothers and nurses of syphilitic infants, where the disease was hereditary, have not been satisfactory; but in cases where the symptoms of the disease first appeared after the child was some months old, the customary internal treatment has yielded very beautiful results. Tudakowski was able to detect traces of mercury in three hundred and sixty-six grammes of milk tested according to Schneider's method. Likewise, Klink treated a syphilitic mother with twenty-five inunctions of ung. hydrarg., giving twenty grammes at each treatment. The infant had large condylomata and adenitis, and quickly improved under the treatment (during the same period the infant had

three baths, each containing 0.3 gramme of corrosive sublimate). Carbolic acid, bicarbonate of potassium, chloride of sodium, Glauber's salts and sulphate of magnesium are all transmitted to the milk. The vegetable acid salts loose carbonic acid to the milk, but the alkaline compounds of sulphur, according to Marchand, do not. Stumpf found iodine speedily in the milk of woman, but slowly in herbivorous animals. It is found in combination with casein, but in uncertain quantities. Alcohol he did not find in the milk of herbivores, lead in traces, and salicylic acid in small quantities. A large number of similar observations and experiments have since been made, too many to be here recorded. One of the most interesting is that of Dr. Koplik, who observed iodine eruptions in a baby, whose mother took iodide of potassium in but small doses. (*Med. Record,* Sept. 24th, 1887.)

THE SALIVA

The function of the saliva is two-fold. First, to lubricate, and second, to transform starch into grape sugar. The latter change is also observed in plants. There is a large quantity of starch in the potato, with a very small proportion of the ferment that changes the starch slowly between spring and winter.

The ferment contained in saliva, which contains 99 per cent. of water, acts in the same way.

The three pairs of glands which secrete it, begin to be developed in the second fœtal month, are quite noticeable in the third, and then develop rapidly. The parotids, for example, weigh two grammes, (half a drachm) at the age of one month; that is, $\frac{1}{1500}$ part of the weight of the whole body, that is more in proportion than in the adult.

At the age of fifteen months they weigh five grammes, and eight grammes at the age of two years.

Since the time of Bidder and Schmidt, Ritter von Rittershain, and Joerg, during the past twenty-five years, a great many experiments have been made with reference to the formation of sugar by the action of saliva.

Schiffer experimented upon babies at the age of two hours, sixteen days, and two months, and in every instance he found, as the result of the action of saliva on starch, sugar by Trommer's method.

Korowin made infusions of pancreas and of parotids, added starch, and the result was that the pancreatic infusion changed starch at a later period than did the infusion of the parotids. In his experiments the pancreas did not change starch in the first month, only slightly in the second month, but noticeably in the third month.

The infusion of the parotids, however, was efficient in

in the first few days of life, particularly in infants of large size and well developed. The effect increased visibly towards the end of the first month, and the quantity of secretion increased to such an extent that he could collect a cubic centimeter (fifteen minims), within five or seven minutes in the fourth month of life.

The saliva of seventeen babies, at the age of from one to ten days, exhibited the same diastatic power. A number of these babies remained under observation a long time, so that no mistake could be made. The number of his quantitative analyses amounted to one hundred and twenty. When he compared the diastatic effect of the saliva of a baby eleven months old with that produced by his own, he found that it was the same from the same quantity.

Since his first observations Korowin has gone over the same subject, and has given the results in the Jahrbuch f. Kinderh., 1875, p. 381; they are as follows: It is possible to collect the secretion of the oral cavity in babies a few days old. Still there is some difficulty in gathering saliva before the age of six weeks. The quantity of this secretion increases towards the end of the second month, and this augments with every month. The secretion is almost always acid, unless the oral cavity is carefully cleansed. After it has been washed out, it is slightly acid, or slightly alkaline, or simply neutral.

From the very first month of life a distinct diastatic effect is produced by the oral secretion, and this increases with every month.

Infusions of the parotids, prepared at different times after death, produce the same effect. Infusions of the pancreas within the first three weeks of life have not produced any change; its diastatic effect begins with the fourth week, and remains feeble up to the end of the first year.

Zweifel has made a number of observations, and given the following conclusions: The infusion of the submaxillary glands of the infant do not transform starch into sugar even when it has been exposed to the influence of the infusion for one hour. The effect of the infusion

of the parotid of a baby seven days old was distinct after four minutes exposure; that of the parotid of a baby that died of gastro-enteritis at the age of eighteen days, did not show itself until after the lapse of three-quarters of an hour.

There was no effect produced by a similar infusion made from the parotids of a child prematurely born, from one that died of diarrhœa and debility, from a fœtus in the third month, from a fœtus in the fourth month.

An infusion of the submaxillary glands of a fœtus in the ninth month of the utero-gestation produced no effect upon starch. The parotids of the same fœtus produced a change after three-fourths of an hour.

It is a remarkable fact that different varieties of starch are not changed into grape-sugar in the same length of time. Solera found that the transformation of the starch of the potato was the most rapid; next was the starch of Indian corn, then that of wheat, and the change of the starch of rice was the slowest. The same results were obtained by Malay.

Raw starch changes slowly; boiled starch quickly. According to him the starch of potato required from two to four hours; that of peas from one and three-fourths to two hours; that of wheat one-half to one hour; of barley, ten to fifteen minutes; of oats, five to seven minutes; of rye, three to six minutes; of potato paste, five minutes.

It is important to know that *the effect produced by the saliva persists in the stomach,* although this effect ceases within two hours.

It ceases altogether, and the starch will not be changed in the stomach as soon as the secretion of hydrochloric acid has begun in the digestive process. This is a very important fact, because it shows that the *infant food, although it is not masticated and passes the mouth very rapidly, is still under the influence of the saliva in the stomach.*

Hydrochloric acid is not secreted at once. The first acids in the stomach while digestion is going on, are of an organic nature, the lactic (and sometimes the butyric). Thus it is that when gastric juice is removed from the

normal stomach, it contains organic acids only. So also, there is no free hydrochloric acid during digestion, for instance, in fever, a considerable amount of catarrh, or in dilatation of the stomach when the pylorus is constricted. In that condition amylacea are taken to advantage, principally because the diastatic effect of the saliva is not disturbed.

In a gastrostomized boy, Uffelmann found that while there was no fever, there was lactic acid only in the stomach and no hydrochloric acid during the first half hour of digestion; afterwards, hydrochloric acid was found.

Some starch is digested at the very earliest age. If there be a moderate surplus, it is expelled like the surplus fat in normal woman's milk, without annoyance or injury. Besides being nutritious, to a certain degree, and in its peculiar way, it serves to dilute cow's milk, to reduce its percentage in casein, to prevent the latter from coagulating in large masses, and thus to render it digestible. To accomplish all this, no large quantity is required. Thus those cereals and farinacea are to be preferred which contain a small proportion of starch, and a large one of protein, or those substances (gum arabic, gelatine) which, while serving the above indications, are also nutritious. Of cereals belonging to the former class, I prefer barley, and oatmeal. Thus the number of available articles is by no means small. They all come up to the requirements we look for in such substances. They must be, to be of *universal* usefulness to the rich *and poor,* perfectly simple and recognizable. *They must be accessible, and for sale everywhere. The mode of their preparation must be perfectly simple and easy. They must be cheap.*

These requirements are not always fulfilled by the artificial foods offered for sale. I cannot help referring to them again, though my doing so before has not increased the number of my friends, and one of these at least, who felt offended and injured because he did not think I included him with the honest gentlemen amongst the advertising manufacturers, threatened me with a lawsuit.

The community insists, with the utmost pertinacity, upon

giving their babies, as soon as weaning time arrives, or before, such articles of food as they know nothing about. When an adult sits down to a meal and finds placed before him articles of food with which he is not familiar, he makes inquiries in regard to such articles before eating them. The baby, however, is credulously fed upon things with which the child, father, mother, or doctor has not the least familiarity; many of which have a composition unknown to the public, although sold in large quantities. When some manufacturers deign to say anything about their merchandise, it is to the effect that the food offered is the best in the market, that it is the proper thing and the only thing for children and invalids of all ages, that the relation of the albuminous substances to carbo-hydrates is exactly correct, and that a package costs a certain amount of money. In regard to this subject the public appear to be smitten with absolute blindness. They insist upon forgetting that the man who offers for sale, and advertises at a very heavy expense, does so, as society is constituted, for his pecuniary advantage. To say that if the article offered is not good, it will find no market, is deceiving ourselves, experimenting on our babies, relying on the character of a single man or corporation, on the honesty or intelligence of the manufacturer's chemist, or his superintendent, or his workmen, on the nature and condition of the elements used in the composition of the article, and on ever so many influences, which can work before the manufactured article gets into the hands of the consumer. Why the sellers and advertisers of unknown compounds should be more trusted than those who sell a simple article of food, such as milk, which is constantly adulterated, can hardly be perceived. Is it necessary to say that the factory furnace is lighted more in the interest of the proprietor than for the benefit of the public?

Still, in regard to the growing evil, which has assumed vast proportions, the profession is at fault, to a certain extent. There are few but are aware of the inexpediency and sometimes danger attending the exclusive feeding of cow's milk, and look for substitutes. Examples of infants thriving on almost any food are numerous; the

public taste runs in the direction of the unknown; thus the responsibility of advice or assent is but a slight one; many of the foods in the market come in a pleasant form and convenient for use; thus the food business firm thrives. Professional men have come to look upon the use of patented foods as something quite unobjectionable. Those imbued with the strictest sense of ethics, who would not patent an invention, nor tolerate the fellowship of a professional man who does so, who frown upon patented medicines, because they are unknown and unknowable compounds, or though their components be printed on the labels, these very men forget their habits and principles when the question of patent-right and secrecy comes up in regard to foods. If I add, that many of the scientific journals of Europe, particularly those of Germany, dedicated to the study of children's diseases, are frequently used for the purpose of discussing the merits and effects of some new infants' foods, it is only to show to what extent the evil has grown.

No profound thinking is required to appreciate the fact that of a great many of the articles offered for sale a few only are available compositions. But the very fact that they are compositions, that everything organic may spoil, that every compound depends on too many circumstances which are apt to interfere with its uniform condition, and that when we rely on a compound, we rely at the same time on a proprietor, his foreman, his workman, his chemist, and the wholesale or retail dealer, we feel that we are easily deceived or disappointed. Besides, for an article, the constituents of which we can purchase at a low price, we are taxed to an inordinate extent. I repeat what I often said before: artificial foods must be simple, recognizable, accessible, cheap, and easy to prepare. Thus only will they become universally useful to the rich and poor, to city, country, prairie and backwoods.

DENTITION

The formation of the teeth begins in the first third of embryonic life. According to Goodsir, narrow grooves are formed, in the sixth week of utero-gestation, between what is afterwards to be the lips and the rudimentary maxillary processes, at a time when the former are hardly visible. The first change consists in the formation of wart-like excrescences upon the bases of the grooves, the grooves, as it were, forming receptacles for these excrescences. This is the first indication of the dental sac with a dental papilla in its cavity. In this cavity the dental substance is gradually deposited.

This is the way in which dental sacs of the twenty milk teeth are formed. They undergo ossification in the fifth month of utero-gestation. Behind them are the sacs for the permanent teeth, but whether or not there is a communication between those of the former and the latter, is not yet known. After they have been separated from each other, however, there is still some connection between them and the "gubernaculum dentis." The separation is complete when the fœtus is finally born. About that time the margin of the dental cavity is cartilaginous, and the root of the tooth begins to grow, and by its formation and growth the tooth is pressed forward. During this process the cartilage of the wall and the gums is made to disappear. The lateral wall of the dental sac becomes the periosteum of the dental root. Sometimes the cartilage disappears before the tooth has reached it. In those cases the tooth can be felt before it can be seen. The two lower incisors will appear, as a rule, between the seventh and ninth month. Then there is an intermission of from three to nine weeks, and the upper incisors will appear between the eighth and tenth month, with an intermission following of from six to twelve weeks. Six more teeth make their appearance between the twelfth and fifteenth

month; that is two upper molars, two lateral lower incisors, and two lower molars. This growth is followed by an intermission of from three to six weeks or more. Four bicuspids protrude between the eighteenth and twenty-fourth month, and the four second molars between the twentieth and thirtieth month.

These twenty teeth are all the infant has before the second dentition begins.

The second dentition begins with the protrusion of the third molars, and this takes place in the fifth or sixth year. About that time the arteries of the temporary teeth are obliterated and the nerves disappear. The alveolus becomes large and the teeth fall out without any caries taking place. At that time the temporary canine lies in front of the external incisors and the first molar. Thus it is that very often in later life the teeth have an oblique position. The wall between the alveoli of the temporary and the permanent teeth becomes slowly absorbed and the milk teeth fall out painlessly, unless the roots of the teeth have not been absorbed in the order of their first appearance.

In the twelfth year there protrude four more molars. Between the sixteenth and the twenty-fourth year four more molars (or the wisdom teeth) appear, the crowns of which ossify as late as the tenth year of life.

There may be great anomalies with regard to the appearance of the teeth. Now and then teeth have been found at birth. They are generally the incisors. Some of them hang loose in the gums; some, however, are solidly imbedded in the gums. Such an occurrence is rare. Thus it is that in some parts of Germany and Switzerland a child born with teeth was regarded as a witch. According to the missionary Endemann, Asiatic nations would throw a baby with congenital teeth or other malformation into boiling water.

About some there is a tendency to development of pseudoplasms. *Maxillary cysts* are mostly congenital. They are either follicular, that is, the results of dilated dental sacs, or they are periosteal, originating chiefly in the periosteum of the teeth and not of the maxilla.

These cysts may contain bones and teeth. Latterly they have been explained by proliferation of embryonal cells. Or they have been regarded as duplicatures of the external embryonic layer.

Other congenital malformations are *cystomata, myxomata, sarcomata, fibromata,* which originate during the embryonic growth of the pulp of the teeth.

Aberrations from the normal time of the appearance of the teeth as given above are not very rare. Sometimes very late, for instance in rhachitis. At the same time the fontanels will close later than the normal period of fifteen months, and the development of the bones of extremities is also delayed. The lower jaw is small. Thus it is that after a while, when the permanent teeth are expected, they crowd each other and become irregular. Not infrequently has rhachitis developed during fœtal life, and then, sometimes, several dental sacs are merged into each other, and instead of two teeth we have only one. This is a frequent occurrence with regard to the lower incisors, and corresponds with the insufficient development of the lower maxilla in rhachitis.

Teeth will also appear at a later period than normal when the children suffer from chronic disorders, such as anæmia, slow convalescence, etc.

The protrusion of teeth may be premature. When this premature protrusion of the teeth occurs with syphilis or rhachitis, it is the rule that, after the first teeth have appeared, there will be a long interval before those of the next growth make their appearance, say from four to six months. As a general rule, however, premature appearance of the teeth is connected with premature ossification of the bony system in general, and of the fontanels and sutures of the cranium in particular. When this is the case, the upper incisors, as a rule, appear first, undoubtedly in connection with the fact of the premature ossification of the upper part of the cranium. This is a serious occurrence. When premature ossification is congenital, it makes parturition difficult and renders the child idiotic or epileptic. It will have the same influence when it occurs at the age of three or four months. It will

exert a moderate influence of the same kind when it occurs from the eighth to the tenth month. At all events, it is impossible on the part of the brain to develop favorably when its bony capsule does not permit of sufficient expansion of the brain substance.

It is a peculiar fact that even savage nations have made observations which show their fear of such an occurrence. The Makalaka in South Africa are in the habit of observing whether or not the upper teeth come first. In Bohemia it is a popular belief that the child whose upper incisors come first will soon die.

David Livingstone and Fritzsche report that some nations in Central Africa kill the children whose upper incisors protrude before the lower ones.

In considering the morbid processes which have been said to originate in normal dentition, it should not be forgotten that dentition is a physiological process. As a rule, the gums, even when tumefied, have a pale color and show no symptom of inflammation. As a rule, also, there is no fever which can be made out by the thermometer. There is no stomatitis; certainly no thrush, both of which are pathological conditions. It is true that there is a certain amount of itching, even pruritus of the gums, and there is certainly a condition of irritation. There is very frequently a vaso-motor disturbance in the shape of reddened cheeks. But even where this is found, it must not be attributed exclusively to the reflex irritation of dentition, because there are a great many conditions in which the same symptom is present; for instance, pulmonary congestion, pleurisy, pneumonia, meningeal irritation.

It is also true that, now and then, there are slight muscular twitchings; and now and then, when the child is half asleep, the eyes will roll. There may even be slight twitching of the extremities. There is sleeplessness, but we must not forget that peripheral irritability increases from the fifth to the ninth month considerably, and that the inhibitory centers do not perform all their functions as in the adult. Thus it is even possible that, now and then, a convulsion will occur, but so far as I am con-

cerned, I have not seen convulsions dependent upon difficult dentition in the course of the last ten years.

It is also stated that there are eruptions dependent upon normal dentition. Urticaria, lichen, eczema are attributed to its influence. It is very questionable whether these cutaneous affections have anything to do with the momentarily flushed cheeks of which I have spoken. We must not forget that about the time the teeth make their appearance congestion of all the parts of the head occurs uniformly. It is the time at which not only the teeth will protrude, but the brain and the skull will develop to a greater degree than ever during human life. Thus it is, that, in most cases, eczema, urticaria, etc., must be explained by uniform congestion of the parts, and not by nervous or other influences dependent upon dentition only.

It has also been stated, particularly by Vogel, that there is, now and then, conjunctivitis on the same side on which the teeth are protruding, and it is said to be purulent. Strümpel suggests that this purulent conjunctivitis, which he assumes after Vogel, may be, perhaps, the result of contiguous irritation, the irritation having extended from the antrum of Highmore and the nasal cavities, an explanation which seems to be very much strained.

It is also stated that pulmonary catarrh, bronchitis, and broncho-pneumonia are very frequent during, and in consequence of, dentition. It has been said that the catarrh may be the result of the large amount of salivation running out of the mouth upon the chest in such children. With regard to inflammatory diseases of the chest we must not forget that there are several causes which, about the time of dentition, are met with very frequently. It is the time in which children are more exposed to atmospheric influences. It must be remembered that within the first year the mortality among infants is greatest from diseases of the organs of digestion; in the second year from diseases of the organs of respiration, undoubtedly in consequence of the fact that during that period infants are more exposed to atmospheric changes than earlier in life. This is one of the reasons why, at the time of

dentition, not in consequence of dentition, pulmonary diseases are frequent.

There is another cause, and it is this, that rhachitis is certainly on the increase in our country. It has always been more frequent than it has been reputed to be, especially that form which is unattended by any considerable amount of glandular swelling. Even the glandular enlargement need not be visible about the throat, but it is perceptible in the deep-seated cervical glands, and in the lymphatic glands of the mediastinum. These swollen glands give rise to bronchial catarrh, frequently, to acute and chronic broncho-pneumonia, and not infrequently to phthisis even at that early age.

Another ailment which is frequently attributed to dentition is diarrhœa. Is it found in most children who are teething? Certainly not. The large majority of children who are either at the breast or whose artificial food is well selected, do not suffer from diarrhœa, while going through the process of dentition.

The occurrence of diarrhœa has been attributed to several causes. Some have attributed it to swallowing a large amount of saliva and oral secretion which begins to show itself in children of three or four months of age, and continues a number of months. Nobody has ever stated that the copious salivation of the fourth or fifth month gives rise to diarrhœa; still, when the infants are six or seven months old, the diarrhœa is said to be the result of the same salivation.

Others have said that the reputed dental diarrhœa is due to nervous influence showing itself in reflex disturbance of the splanchnic nerves. But the explanation has not been given; still the presumption prevails that this diarrhœa must be of a neurotic character.

It has appeared to me that the fear lest dentition should produce diarrhœa has been very much exaggerated. At all events, the popular belief that there is such a thing as dental diarrhœa has given rise to the practice of not caring for such a diarrhœa, and many an incurable enteritis, and consecutive lymphadenitis and atrophy has been due to the very fact that such a diarrhœa has been

neglected. In all such cases, no matter whether diarrhœa or bronchitis, or consequent diseases are present, it is wrong to fall back without looking for the diagnosis of something more, upon dentition as the cause of these affections. A large number of diseases which have been attributed to dentition owe this erroneous diagnosis to the fact that the diagnostic powers of the practitioner were limited like those of the public with which he had to deal. This much I may add, that the local treatment of swollen gums, which consists of lancing, has fortunately become less common and popular than it was in former times. Although I see a large number of infants in the course of a year, I can state that in not more than two cases have I felt called upon or been induced to lance the gums in the last five years. In a few cases I have done so under the impression that it might do good, inasmuch as the diagnosis of my case was not quite clear. In most cases in which I lanced the gums I found, two or three days later, pneumonia which was quite easily diagnosticated, but which did not develop sufficient symptoms early enough to prevent me from making my mistake.

Is there anything which has not been attributed to the injurious influence of the second dentition? There are many amongst the public this very day (perhaps also amongst the practitioners?) who would be apt to coincide with E. Smith (*Lancet* I, 1869, p. 23), who expresses the conviction that the copious secretion transmitted from the oral mucous membrane is a very serious matter. According to him, the children become pale, thin, restless, appetite irregular, either diminished or exorbitant, bladder incontinent, constipation alternates with diarrhœa, worms are more copiously raised in the intestinal mucus. Thus matters get worse and worse, until the child dies of phthisis. I should say that "phthisis" might and ought to have been diagnosticated before, and perhaps prevented, if the dentition-ridden medical man had known how to look after chronic glandular swellings, or chronic pleurisy or pneumonia, as the possible cause of the fatal termination.

Of 100 deaths occurring in New York City in the course of one year, 29.63 take place in the first; 10.3 in

the second; 4.37 in the third; 2.40 in the fourth; 1.64 in the fifth; 3.20 in the sixth year. Thus in the first six years occur 51.28 per cent. of all the deaths. The whole period from the end of the sixth to the eleventh year gives only 1.50 per cent. of all the deaths.

Thus there is considerable resistance on the part of the child's organism, after it has been fully developed to its seventh and eighth years.

There are some other facts which prove that this time is rather immune than otherwise.

Growth is most rapid in the first few years of life, not only in regards the head, but also the rest of the body. The length of the newborn is 18 inches; that of the adult 66 inches. The increase in the first year is 10 inches; in the second 4 inches; in the third 4 inches; in the fourth 3 inches; in the fifth 3 inches; in the sixth 2 inches; in the seventh, eighth, ninth and tenth, each 1 inch. Thus there is retardation of growth after the completion of the seventh year.

The proportion of the upper part of the trunk, that is the chest, to the lower, in the newborn, is as 1 to 2; in the adult as 1 to 1.618. This normal proportion is attained with the eighth year.

The lumbar portion grows principally until the ninth year; then again between the twelfth and fifteenth, about the time of puberty.

Between the seventh and ninth years there is retardation of the growth of the lower extremities, as also the trunk and the whole body.

In the newborn, the proportion of the upper part of the head, the skull, to the lower parts is 1 to 1; in the adult 1 to 1.618. This stationary proportion is attained with the eighth year.

After all, then, this is the time of the second dentition. Where, now, are the dangers to life?

Still, though not a serious danger, a great and permanent inconvenience and injury may originate between the first and second dentitions. They may result from the fact that the wall between the cavity of a temporary tooth grows thinner and disappears very gradually by premature evulsion of the temporary teeth, particularly

the bicuspids. The permanent teeth are very easily injured inasmuch as they are imbedded between the roots of the temporary ones. The damage done by such action is frequently greater than the result from retardation in falling out, on the part of the temporary. But in the latter case, also, the beauty, position, and number of the permanent teeth can be impaired. Thus at this early time the advice of a professional dentist is frequently required.

There is but one good cause for premature evulsion of the milk teeth, namely, general periostitis or ostitis of the maxilla produced by inflammation of the root of the tooth.

It would be a mistake, however, to believe that we are more mediæval than other nations. The measures for relieving the dangers from the cruel attacks by the ambushing teeth, upon the unsophisticated baby, prove better than anything else how the maternal (and professional?) minds have been impressed by awe-stricken faith down to the second half of the enlightened nineteenth century. According to H. H. Ploss,[1] in different parts of Germany, Austria and Switzerland they resort to the following measures: A trouser button and dried umbilical cord are kept under the pillow. The tooth of a colt a twelvemonth old is worn around the neck at the time of the increasing moon. The paw of a mole—bitten off—is sewed in and worn around the neck. The baby to be licked by dogs. The head of a mouse to be used as the above mole head. Every female visitor gives the baby a hard egg. The baby is carried to the butcher, who touches the gums with fresh calf's blood. The gums are touched with the tooth of a wolf, with the claw of a crab. The baby is supplied with three morsels from the first meal in the new residence after the wedding. Bread from the wedding feast of a newly married couple in good repute. A mass of lindsprouts cut at twelve o'clock on Good Friday. A bone found by accident, under the straw mattress. Mother, when first going to church after confinement, kneels on the right knee first. A man coming to visit, is silently given a coin, touches the gums of the baby three times and—goes to the tavern. So he does.

[1] Das Kind in Brauch und Sitte der Völker, 1876, II vol.

INTESTINAL MALFORMATIONS

The intestine of children is normally longer than that of adults. Up to the ninth, even to the twelfth year, the capacity also is greater than that of the intestine in the adult.

An abnormal length of parts of the intestine may occur anywhere, but particularly in those parts which are attached to the mesentery.

There is a malformation that has been called partial duplication, or reduplication. It is, in fact, not this, but a diverticulum, so-called by Meckel. This is met with sometimes in the newly-born, twenty or thirty centimeters above the ileo-cæcal valve; in the adult one meter, sometimes a little higher or a little lower; occasionally even in the colon, where its aperture is quite large. It extends from two to ten centimeters, or more, in the direction of the umbilicus, to which, now and then, it is attached by a filament. This diverticulum is nothing else but the remnant of the original omphalo-mesenteric duct. Sometimes the whole diverticulum is attached, inside, to the umbilicus, making a cul-de-sac or cloaca. Sometimes the cul-de-sac penetrates the umbilical ring, or it is attached to the peritoneum below the umbilicus, or it terminates in the umbilical ring with a fistulous opening, or it adheres somewhere to the abdominal wall. Sometimes the adhesion to the abdominal wall is only partial, and then meconium will enter the abdominal cavity. This is found mostly on the side not covered by mesentery. In rare cases it is separated from the intestine, and then it is apt to form a cystic tumor. Now and then there is necrotic destruction of the umbilicus, with pyæmia or septicæmia, or a fistula resulting therefrom. Now and then the diverticulum gives rise to twisting of the intestine at any time during later life. Not every cystic tumor found

in the abdominal cavity, however, in or near the intestine, is of the same character. Some of them belong to the class of teratoma (fœtus in fœtu).

Very small cystic tumors have been found in the colon, soon after birth. Most of them appeared to have been developed after dysenteric processes, and to be the results of local extravasations. Some may originate in exudation; some, however, are retention cysts belonging to the class of those which grow out of swelled glands with obstructed ducts, and follow a chronic inflammatory process in the mucous membrane of the large intestine. The localization of the dysenteric process in the lowest part of the intestines explains why such cysts are absent from the small intestines. The only case in that neighborhood, in the newly-born, I know of, has been reported by Dr. Eugene Frankel, of Hamburg, in Virchow's Arch., Vol. 87, 1882, p. 281. It gave rise to very serious symptoms of complete obstruction, and terminated fatally. The specimen dates from 1851, and was taken from a female child after she had died, on the eleventh day. When she was born, and during two days, she ate and defecated normally. Then vomiting set in. The obstruction was complete, food and feculent matter thrown up. Drastic purgatives resulted in evacuations and subsequent diarrhœa, requiring constipating administrations. Two days afterwards again constipation, drastics again, and no effect. At the autopsy the large intestines were found empty, the small intestines inflated with gas; at the lower end of the ileum there was a spherical cystic tumor between mucous and serous membranes of a diameter of 2½ cm. (1 inch), obstructing the lumen of the intestine almost completely, even in the dead body.

A very important malformation of the intestinal canal is partial or complete obstruction, stenosis or atresia. Besides the atresia which can be produced by cystic tumors, as described above, there is now and then a duplication of the mucous membrane, which is apt to produce obstruction like the hymen in front of the vagina, and close the entrance to the cavity either partially or completely. Sometimes the obstruction is so complete, that

nothing is left of the intestine except a filament. Then there is also absence of the corresponding part of the mesentery. This condition has been observed in a few cases, particularly in the duodenum, mostly about the entrance into the ductus communic choledochus, and also in the ileum. It has been regarded as the result, either of fœtal peritonitis, or of the twisting of the intestine in an early embryonic or fœtal period, but it is the result, particularly in the rectum, of actual arrest of development.

I published a rare case of this kind in the *American Medical Monthly,* 1861. It was that of a male infant 39 hours old.

The history of the case was given by the attendants in the following manner: The child had no evacuation of the bowels for the first twelve hours after birth. A medical man was called in, who removed some obstruction by means of his fingers from the anus, and gave an injection, whereon a string-like, hard, solid, whitish mass was removed through the anus. The child then was declared to be all right, and he left. Nevertheless, no regular passage was had, but the patient evacuated a mass like that described, but less in quantity, several times. He commenced vomiting, however, bringing up a black substance, which was afterwards changed into a brownish or yellowish-gray mass by the addition of milk, which the child would readily take from the breast. When the infant was presented he still looked well-developed; no deformity was perceptible on any part of the body. Exhaustion began to show itself, from the somewhat collapsed face and the sunken fontanelle. Abdomen not much inflated; only across it, below the liver, and a little downward to the left, an intestine was both seen and felt. It was inflated with gas, which appeared to be unable to escape. The rectum was very narrow, but could be explored to the length of the fifth finger, and no perfect impermeability found. The fæces removed last were pretty greenish, solid, about a fifth of an inch in diameter, and completely formed. Having no other means of diagnosis ready, the case was declared to be one of stricture of the intestine, somewhere between the colon transversum

and rectum. The last evacuation, however, was subjected to a microscopical examination, and found to contain a uniform mass of cells, of average size, with nuclei and some nucleoli. No fat, nor hair, nor cholesterine, nor large epithelial scales; thus the evacuation was set down as intestinal mucus only, not as meconium. On the next day the substance thrown up from the stomach was submitted to a large microscopical examination, and found to contain, besides milk, some crystals of cholesterine and a large number of large epithelial scales. The case was then put down as one of complete impermeability of the intestine, as there were constituents of meconium above, but not below, a certain point.

Patient died with the symptoms of exhaustion when seventy-two hours old. Post-mortem examination was made nine hours after death, but abdominal cavity only opened. Rectum very narrow, as described above. Above, the colon appeared only about a fifth of an inch in diameter, but could be inflated up to the vermiform process; no air would pass the valve. A tube was then introduced through a small incision above the ileo-cœcal valve, and inflation attempted from above downward; but no air would pass the valve, thus showing a perfect impermeability. The whole colon and rectum have a length of about fifteen inches. Stomach is normal; perhaps a little larger than usual. Duodenum and upper part of the intestine, to a length of about fourteen inches, are very much dilated, and terminate in a very large *cul-de-sac;* no opening being found into the remaining part of the intestine, which all of a sudden become of a decidedly diminutive size, of perhaps a fifth of an inch in diameter. This is the size of the intestine all through its length down to the valve, with the following exceptions. As stated, there is no connection whatever between the dilated upper portion of the intestinal canal and the suddenly contracted part, both of them ending in a *cul-de-sac.* Below this, about two inches from this first impermeability, the contracted intestine again ends in a *cul-de-sac,* after which, to a distance of eight lines, no intestinal cylinder whatever is found, the mesentery hanging free in the abdominal

cavity. Then, again, a small intestinal cylinder, of nine or ten lines in length is found closed on either end. Again, the mesentery without its intestinal appendix for about eight or nine lines. Again, an intestinal cylinder of the same length. Again, absence of intestine for a similar distance. A third intestinal cylinder of the same length, closed on either end, follows this; and again, at last, free mesentery for about half an inch. Then, finally, the intestine fairly begins again, uninterrupted in its lumen, and unchanged as to its diameter of about a fifth of an inch, and measures, down to the ileo-cæcal valve, twenty-two inches. Thus, the whole length of the intestine, including, altogether, two inches of mesentery not accompanied with intestine, is about four feet and a half, exhibiting in its course, besides the dilatation of the upper portion, a nearly equal coarctation of the lumen, the colon being a little larger than the rest, and the rectum not so narrow as the colon itself, two perfect impermeabilities; and beyond these four total interruptions of the course of the intestinal canal, the free intervals being, in the average, eight or nine lines in length.

Liver, spleen, kidneys, and bladder perfectly normal. Both of the kidneys contain beautiful specimens of the so-called uric infarcts.

Cases like the above are more than merely rare. Perhaps there is, besides an important case in Ammon's Atlas, and Küttner's, and Hüttenbrenner's cases, not more than half a dozen on record. In Küttner's case the jejunum ended in a *cul-de-sac;* then there was a piece of intestine, of three inches in length, ending in a *cul-de-sac* on either side; further, a second of the same description; finally, a third one, five inches long. Then, at last, the colon, commencing with a *cul-de-sac* above, and ending in a normal anus.

A similar case was one I saw with Dr. Henry Schweig, nearly thirty years ago. With similar anatomical changes, constant vomiting soon after swallowing food, the baby lived thirty-five days. Some of these patients exhibit a remarkable vitality indeed. A case kindly sent by Dr. Huntington, of New Rochelle, to my college clinic, more

than ten years ago, was heard of when thirty-three days old. How long it survived afterwards, I have not learned.

As already stated, most of the changes occurring in the rectum are due to arrest of development. The posterior end of the alimentary canal forms, about the fourth week of fœtal life, a cloaca with the allantois. In its anterior end are the sexual ducts. The anterior part of the cloaca is open; the posterior end, corresponding with a later formation of the intestine, is closed. The two parts are soon separated, by the canal being bent in at its posterior end, into the urino-genital sinus and the rectum. The first partial septum is the primary perineum. It grows gradually, and then separates the opening of the anus and the sexual organs.

Malformations of the rectum may be of different kinds.

First, the anus is present; atresia of the rectum is far inside. It may have been the result of twisting, and then two *cul-de-sacs* of the intestine may be found in different positions towards each other.

Second, there is no anus. The rectum opens by a thin fistula in the perineum; or in the raphe of the scrotum; or in the vulva. Evidently, in embryonic life the septum was formed too near what was later the sexual opening.

Third, there is no anus. The rectum terminates in a fistula attached to the mucous membrane of the urino-genital organs. In these cases everything was normal except the original perineal septum, and the part of the intestine which should have developed from the cloaca missed its development. There are, sometimes, other malformations connected with this anomaly.

Fourth, there is no anus. Sometimes it is indicated by a dimple. The intestine terminates in the neighborhood of the promontory. Between the perineum and the intestine there is absolutely no remnant, with the exception of a few cases in which a residual filament has been found.

In these cases it is possible to assume different causes.

First.—Inflammation and conglutination.

Second.—Arrest of development, perhaps connected with an excessive absorption of the *pars caudalis* of the spine.

Third.—The primary perineum may have developed

posteriorly to an abnormal degree, thus separating the intestine above from the remnant of the posterior part of the cloaca, which was to become the anus.

Fourth.—There may have been developed a diaphragm, hymen-like, from the part of the mucous membrane, as alluded to when the upper part of the intestinal tract was under consideration.

When the original embryonic abdominal fissure remains patent, the newly-born may have an ileum or colon which is also open.

The vermiform appendix may be absent, or nearly so.

The small intestine, also the large, may be too short, and the difference between the two may be but very small.

There may be *anomalies of position*. The intestine may protrude through the abdominal fissure; through a fissure in the diaphragm in its left half; through the natural openings, the inguinal and femoral rings, and others.

Transposition of the intestine may occur independently or in connection with other transpositions. This anomaly is the result of the fact that the intestine has to go through a series of changes of location before it assumes its natural shape.

The colon ascendens or transverse may be entirely absent.

There are not infrequently small, tumor-like bodies in the walls of the small intestine. Sometimes they have been found at the apex of diverticula. They are the result of a few pancreatic cells separating from the main body at a very early period of embryonic life.

The symptoms of imperforate rectum and atresia ani are as follows: No evacuation, no anus, or the exploring finger gets into a *cul-de-sac* half an inch or an inch above the anus. Sometimes, however, the obstacle is very far above the finger's length. The colon begins to distend, now and then with dulness on percussion. At first the swelling may show itself in the hypochondrium first and extend to the right inguinal region along the lengthened sigmoid flexure. Vomiting at first yellow, afterwards of meconium. Inflation, not always uniform, of the whole

abdomen, pain, dilatation of the external veins, superficial thoracic respiration, elevation of temperature and other symptoms of peritonitis.

Treatment: In view of the fact that the imperforate condition may be apparent, injections ought to be tried often and copiously. If unsuccessful, they ought to be followed by the operation, performed for the purpose of either joining the two unconnected *cul-de-sacs* or drawing the rectum downwards, or if that be impossible, of establishing an artificial anus in the (right or) left side.

TABES MESENTERICA

The names by which diseases are known in modern pathology have come to be derived from their pathological anatomy in the same degree that local diagnosis has been brought nearer perfection. Symptomatic diagnoses and symptomatic terms are becoming rare; though it is true that there has crept into nomenclature an equally unscientific habit, which consists in applying to a newly-observed disease or complex of symptoms the name of their first observer—or inventor. Many formerly accepted as nosological entities have been given up as such; when we speak of dropsy, paralysis, convulsion, neuralgia, epilepsy, or atrophy, we know perfectly well that we have to deal with a symptom, or a number of symptoms, requiring etiological details for their exact recognition, and special and varying indications for the treatment of individual cases. But until a very late period "tabes mesenterica," or "tabes mesaraica," has been accepted as a term applicable to a particular set of symptoms and limited anatomical changes by which it could be easily recognized. The following pages will be dedicated to showing that the pathological anatomy of mesenteric tabes is by no means the same in all cases, and that the term itself ought either to disappear entirely from our indexes or be recognized as merely a convenient expression for a complex of more or less similar symptoms.

Among those, mostly older, celebrities who were of the opinion that imperviousness of the mesenteric glands was a satisfactory explanation of tabes mesaraica, that patients die because the lacteals are no longer able to take up from the food a sufficient supply of nutriment, and that they die of starvation, are Thomas Watson, Cullen, and Bichat. The latter modified the general opinion in this, that he defined tabes (*carreau* of the French) as the en-

gorgement of the glands of the abdomen, mostly occurring between the second and eighth years, painful or painless, complicated with digestive disorders, distention, diarrhœa, and vomiting, which, however, did not result in the non-absorption of chyle except in the later periods of the disease.[1] Cruikshank, as early as 1790, thought this blocking up of the lymphatic circulation very improbable, and Guersant formulated his hesitation in accepting the exclusive obstruction theory by declaring that the very diagnosis of the condition of the glands was always difficult; that the examination of all the viscera often resulted in the discovery of changes which led to the results attributed to glandular disorders exclusively; that he was not aware of a single case of disease of the mesenteric glands not attended with complications; that, moreover, there were many glandular disturbances without nutritive disorders; and, finally, that the mesenteric glands were not the sole roads for the admission of chyle. Besides, in his own reports, and in those of his followers, and in the experience of all those who have compared morbid symptoms during life with the evidences of post-mortem examinations, there are many cases in which, together with the glandular changes, or independently of them, the acute, subacute, or chronic inflammation of the peritoneum, either general or local, and mostly of a tubercular character, was the only anatomical anomaly underlying the symptoms of "mesenteric tabes."

SYMPTOMS

The main symptoms common to every form and case of "tabes mesenterica" are atrophy and tumid abdomen. Emaciation and atrophy reach a degree hardly ever met with in any other morbid condition. The subcutaneous fat disappears rapidly. The skin is thin, flabby, and inelastic; round the limbs it is loose and hangs like a bag; when taken up between the fingers it retains the fold

[1] W. T. Gairdner and Joseph Coats, *Lectures to Practitioners*, London, 1888.

raised in the lifting. In the beginning the muscles can be recognized; afterward even they emaciate to such an extent that their outlines disappear, and those of the bones are distinctly perceptible. The eyes lie deep in the orbits, and have a peculiarly dry and hungry look; the bones of the face, with the thin, flaccid, dry and scaly skin over them, take on a terribly senile expression. The surface is mostly cool, the limbs are cold, the cutaneous veins very distinct and blue, much dilated over the chest and still more so over the abdomen. The voice is thin and tin-like, the cry mostly tearless, the pulse slow (from exhaustion of the heart-muscle), or more frequently rapid, thin, and compressible. The lymph-bodies of the neck and the inguinal region, sometimes also the axilla, are tumefied.

These symptoms are more or less common to all cases. There are many, however, which exhibit numerous variations in important particulars. Appetite may be ravenous or entirely lost. Some begin with little or no diarrhœa, but in all the stools are fetid. The majority, however, commence with a severe form of intestinal catarrh, attended with numerous offensive discharges. The peculiar odor, foul, musty, pungent, ammoniacal, is due in part to acids formed by the fat which has not been absorbed, sulphides, and other products of putrefaction. In the further development of the morbid condition there may be constipation, but diarrhœa is more frequent. It may not be very copious nor the evacuations very numerous. There is tenesmus in some, with but little substance; others are large, and expelled suddenly, in an instantaneous gush. The temperature is in some cases normal or even subnormal, in others elevated; when it is quite high, the cheeks and scleroticæ may become injected. The tumid belly is absolutely painless in some, very sensitive in others; the latter mainly in those who have an elevation of temperature. The large size of the abdomen, with its nets of dilated veins, contrasts fearfully with the atrophied condition of the limbs. It is large enough to press the diaphragm upward and interfere with the functions of both heart and lungs. The nature of the tumefaction,

however, varies: it is tense or flabby, hard or soft, doughy or firm, uniform or irregular. Nodules or lumps of different shapes and sizes may be discovered by palpation. They may be spherical; flat, so that the hand can be run under the cake; superficial, near the abdominal wall; or deep-seated, in close neighborhood to the vertebral column. Gentle percussion will reveal tympanites all over, both on the top of the protruding abdomen while the child is on his back, and in the flanks; or there are one or more areas of relative dullness corresponding with a solid mass discovered by palpation; or there is dullness in both flanks, varying with changes in position, thus indicating the presence of fluid, which, moreover, can be made out by its fluctuation. Great care, however, has to be taken lest the presence of solid tumors in a flank give rise to the diagnosis of fluid, or lest intestines containing gas which have been glued to the abdominal walls disguise entirely through their lymphatic percussion-sound the presence of ascites.

Other symptoms may be present, such as œdema, through thromboses in small veins; extensive dullness belonging to fatty liver; albuminuria and the usual microscopic changes of the urine encountered with nephritis; local inflammations of the abdominal surface connected with abscesses which are occasionally, though rarely, the final stages of certain forms of peritonitis; and cough depending on tubercular disease of the lungs.

The variety of symptoms belonging to "tabes" points distinctly to different morbid processes. The gradual beginning, slow and feverless course, with but little disturbance of the bowels and other organs; the connection with a severe form of enteritis, continuation of diarrhœal discharges during the beginning and growth of tumidity, and moderate or high temperatures during the course of the morbid process; and the tumidity of the abdomen, with emaciation following chronic cough and repeated attacks of catarrh, and terminating either in fatal exhaustion or in acute peritonitis, appear to prove that there are several distinct forms of "tabes," depending on different causes and attended with varying anatomical alterations.

TABES MESENTERICA

PATHOLOGY

Former essays in this work, particularly those of Dr. Ashby on scrofulosis and my own on tuberculosis and phthisis, have explained the changes taking place in the lymph-bodies. Therefore only such brief remarks will be made here as refer directly to the mesenteric glands. Most of the first changes occurring in them are of an inflammatory nature; they are secondary in character; indeed, the primary changes are mostly neoplasmatic, and particularly sarcomatous. As in other glands, the inflammation may be a simple one and uncomplicated, or suppurative, or fibrous, or caseous, or tubercular. Simple adenitis is occasioned by any kind of irritation. Like an eczema of the head or a nasal catarrh which lights up adenitis of the neighborhood, a simply intestinal catarrh, with diarrhœa from any cause whatsoever, produces it. The first change consists in dilatation of the blood vessels, with reddening, softening, and succulence of the tissue, endothelial changes in the lymph-spaces, and new formation of cells. Afterwards the red discoloration is replaced by a grayish-white color, now and then interrupted by small blood-points which will turn into pigment, and the difference between the cortical and medullary substances fades or disappears. At the same time the capsule gets tense over its swelled contents. These are the cases which are amenable to a complete recovery. But suppuration, induration, or necrosis of the tissue is often met with. The latter is a frequent occurrence in typhoid fever, in which the lymph-bodies of the abdomen play a similar part to what we observe both more frequently and more extensively in the glands of the neck, under the influence of diphtheria.

Suppuration of inflamed glands is more frequent near the surface than in the abdominal cavity, where they are less exposed. Still, it does occur there, though mostly in putrid and septic processes. Caseous and calcareous degeneration is noticed in a certain number of instances.

Fibrous induration of lymph-bodies is of frequent occurrence in every region of the body. It is the usual result

of repeated irritation. The constant hyperæmia of a chronic intestinal catarrh or of frequent acute attacks precludes the return to normal circulation. Then the substance of the glands becomes hard, dense, and white, the hyperplastic connective tissue compresses and atrophies the cells of the parenchyma, the capsule becomes thick and indurated, and the organ retains nothing at all of its former shape, size and function. In this condition when the change has gone beyond cell-proliferation, and new tissue has been fully organized, it is no longer amenable to treatment.

The tubercular form of inflammation is very seldom of a primary occurrence. In it the diseased gland is enlarged, nodulated, and contains small round cells, or flat epitheliod cells with large nuclei, and frequently giant cells. The caseous and tubercular forms, while it was Virchow's original inclination to distinguish between the two, are considered identical, or mostly so, by Schüppel, Rindfleisch, Orth, Cornil, and Koch.

Though it is rarely of a primary character, tuberculosis of glands, both mesenteric and others, is frequent; but to render a gland tubercular there must be an absorbing surface accessible to the virus and ready to admit it. A healthy mucous membrane absorbs no poison. It requires an open wound, such as a chronic eczema, or a chronic bronchial catarrh, to permit of a free access to the neighboring gland. Thus it is that the glands of the neck and the tracheal and bronchial glands are so very liable to become tubercular. The mesenteric glands are less exposed. It is true that the tubercular poison may pass the stomach undisturbed, but it is certain that tubercular enteritis and adenitis seldom result from it directly. Indeed, even the diarrhœas of phthisical patients, who swallow their own bacilli constantly, are not so often of a tubercular nature as they are the mere result of the local irritation produced by the presence of copious pulmonary discharges on the intestinal mucous membrane.

Only when the local irritation has persisted for some time and produced erosions has a virus an opportunity to

locate and fasten itself in the injured epithelial layer. In that case the tubercular invasion may lead to serious results though the lesions of the surface have healed.

Thus it becomes evident not only why it is that a primary tuberculosis of the intestine, and the secondary tuberculosis of the mesenteric glands, by the introduction of tuberculous food, may take place, but also why they are relatively rare. Indeed, the cases which appear to be conclusive are by no means so. For, while we may suspect that infected meat or milk has occasioned a tuberculosis, that very case may have been infected either through a wound of the lips, mouth, or throat, or by simultaneous inhalation. Thus the suspicion that a case is one of intestinal contagion is more readily entertained than it can be proved. Schottelius[2] fed ten families, consisting of one hundred and thirty persons, on tuberculous meat, which was taken raw sometimes, for two years; in eleven years none of them died of tuberculosis. Thus, while there is no doubt as to the occasional occurrence of tubercular infection by meat or milk, the cases must be well weighed before they are decided affirmatively.

Besides the simple secondary hyperplasia of the mesenteric glands resulting in obstruction, and the tubercular infiltration terminating in the same disturbance of function—besides its infectious character—there is a third condition which leads to the symptoms called "tabes mesenterica," viz., chronic tubercular peritonitis. It is quite frequent, but its symptoms may vary in duration and severity. While the child is emaciated, sometimes to a fearful extent, the abdomen is tumid, elliptic, its surface shining, the surface-veins dilated, the umbilicus expanded and flattened. There is sometimes ascites; sometimes hard and circumscribed tumors, or the intestinal convolutions, may be distinctly felt or seen. This tumid condition is even liable to persist when tubercular meningitis makes its appearance in the course of time. There may be colic and diarrhœa, or they may be absent. The temperature may be normal. Slight changes in the afternoon ought to be ascertained by inserting the instrument into the rectum. This con-

[2] Virchow's Archiv, vol. xci.

dition may last many months, even a year; it is capable of vast improvement, and may terminate in recovery, though with a low standard of vitality. This capability of recovery, with which the experienced practitioner and pathologist has long been acquainted, has surprised the surgeons, now and then, who opened the abdomen under a mistaken diagnosis, found tubercular peritonitis, sewed up again, and concluded that when the patient recovered it was because, and not in spite of, their uncalled-for operation. At the present time, however, we are justified in the belief that only those cases of chronic peritoneal tuberculosis will have a chance which are local, and not the result of general tubercular infection.

Diagnosis.—In estimating the size and tumidity of a child's abdomen, we must not lose sight of the fact that it is normally larger in proportion than that of the adolescent or the adult. The child's pelvis and chest are less developed, its liver large. The shape of the abdomen is tun-like, its vertical length one-third of the length of the body, while in the adult the proportion is one-fifth. A high degree of tumidity may be due to constipation, mainly that form which originates in oversize of the sigmoid flexure, or in expansion of the intestine depending on muscular weakness. The main cause of the latter is rachitis, the first principal features of which, when developed at an early date, are costiveness, meteorism, and flabby muscular texture. Other causes are flatulence depending on improper food and fermentation-processes in the bowels, or insufficient peristalsis, or the presence of scybala; also the presence of ascites depending either on cirrhosis or perihepatitis or generalized peritonitis, the first of which is the less frequent cause; or oversize of abdominal organs, such as the liver or bladder; also either cystic (urachus or echinococcus) or solid tumors. Among the latter fibroma, enchondroma, myxoma, and lipoma are quite rare and therefore not of clinical importance; carcinoma is not uncommon, but sarcoma is more frequent. There were, up to 1884,[3] forty-three cases of sarcoma of the kid-

[3] A. Jacobi, *Sarcoma of the Fœtal and Infant Kidney,* Transact. Internat. Congress, Copenhagen, 1884.

ney on record. Tubercular disease and tubercular tumefaction are very much more common. It is true that isolated tubercular tumors, mainly those of the mesenteric glands, are quite rare, but they do occur, uncomplicated or, mostly, complicated with other lesions of an inflammatory character. This complication of glandular enlargement with peritonitis may lead to very serious results, even beyond the tubercular infection. A girl of two and a half years, of healthy family, who previously suffered from aural discharges and measles, and afterwards from anæmia and general malaise, was taken with abdominal pain and distention, constipation, and vomiting of mucus and purulent material. She died after an illness of three days. The autopsy revealed caseous mesenteric and retroperitoneal glands of the size of pigeon's eggs, bending upon itself and gangrene of the sigmoid flexure, peritonitic adhesions along the descending colon, the sigmoid flexure, and the rectum, and complete obstruction, by compression, of the ileum.[4] Similar occurrences are not at all rare, though mostly not so striking as the one just related. Indeed, adhesions between the intestines themselves, or the intestines and the parietal peritoneum, or peritonitic exudation with hemorrhages, or infiltrations of the omentum which result in hard nodulated tumors located above the umbilicus, are quite common, and form large masses together with the infiltration of the gland themselves. Such peritonitic exudations may be either simply inflammatory or tubercular, small or large, hard or soft, local or generalized to such an extent as to fill the whole abdomen.

The diagnosis of tubercular peritonitis, or peritoneal tuberculosis, is apt to be quite difficult. There are many chronic cases which cannot be differentiated from non-infectious peritonitis and other inflammatory processes. Besides, many of the caseous tuberculizations are small, and thereby inaccessible to an accurate physical examination. They, and the rare cases of primary tuberculosis of spleen, liver, bile-ducts, peritoneum, and intestines, are to be inferred rather than diagnosticated. But there are

[4] Th. Pauli, *Jahrb. f. Kinderheilkunde*, 1889, xxix. 77.

cases of tumid belly with atrophy of both an acute and a chronic character, in which the nature of the affection can be made out with some degree of certainty. When the distention of the stomach appears after an intestinal catarrh, when it continues after diarrhœa has ceased in frequency, the stool either improving in character or remaining offensive, when the temperature remains high and the symptoms (occasionally) exhibit a "typhoid" character, with (now and then) delirium and frequently a dry tongue, the existence of an acute attack of tubercular peritonitis is probable. This diagnosis is rendered the more probable by the presence of some other symptoms. Among them are cough, sometimes slight, short, and hacking, sometimes moist and frequent; the presence of pulmonary symptoms or dulness over the manubrium sterni or below one or both of the clavicles, pointing to swelling of the tracheal or bronchial glands; a concomitant history of tuberculosis in the family; and a more intense degree of emaciation than the brief duration of an intestinal catarrh would justify. Still, mistakes are possible even then. The frequent complication of peritoneal tuberculosis with fatty liver and parenchymatous nephritis may obscure the clear comprehension of the case. "Scrofulous" glands occurring round the neck may be, and mostly are, non-tubercular, being the result of non-infectious irritation of the scalp or nasal cavities; the tumefaction of the inguinal glands is too frequent to be of much account.

Prognosis.—The prognosis is always uncertain except in the very worst cases. It is absolutely fatal when the "tabes mesenterica" means peritoneal and glandular tuberculosis complicated with, or depending on, generalized tuberculosis; when the temperature is permanently high, and exhaustion extreme; when diarrhœa remains copious and offensive, the heart very feeble, and the intra-abdominal exudation has resulted in very extensive induration. A case occurring in a healthy family, in a child that does not suffer from cough or other pulmonary complication, but develops its emaciation and tumid abdomen after a protracted, though uncomplicated, diarrhœa, furnishes a more favorable prognosis. For in such the diagnosis of

a mere—non-infectious—hyperplasia of the mesenteric glands can be made with great probability. In such, even large indurations will be absorbed gradually. When the diagnosis of chronic peritoneal tuberculosis has been made, the case is less promising; still, in it the possibility of recovery, or partial recovery, is not excluded. Indeed, the results of laparotomies, such as have been alluded to before, hold out a certain amount of hope even in those cases in which the diagnosis could be made with perfect accuracy.

Treatment.—A healthy infant or child cannot fall sick with any of the symptoms of "tabes mesenterica." Thus prevention consists in taking all the measures calculated to preserve the general health of the baby. Foremost among them is the selection of proper food: all the rules and regulations detailed in other parts of this work, which refer to the raising on breast-milk and appropriate artificial food, must be conscientiously obeyed; farinaceous substances allowed in but moderate quantities; casein, which is a frequent irritant of the intestinal mucous membranes, limited to its proper percentage; and fat administered in no greater quantity than is contained in the natural nutriment of the nursling. Weaning is to take place at the legitimate time, which has mostly arrived when a few teeth have made their appearance. Good air and attention to the condition of the skin (cool bathing and friction, protection by warm clothing, and avoidance of draughts) aid in enabling the young to resist injurious influences.

The early symptoms of rachitis indicate a thorough anti-rachitical treatment (animal food, phosphorus, and iron), and diarrhœa, no matter from what cause, must be relieved immediately. Again I insist upon the danger incurred by allowing the catarrhal or inflammatory irritation of the mucous membrane to remain unchecked; for it is because of this that the neighboring glands begin to swell, or that bacteric invasion takes place. But not diarrhœa alone is connected with hyperæmia and its dangers; constipation also may be both the result and a cause of extensive congestion and irritation. Sometimes glandular

swelling may appear without an apparent cause. In a healthy family the thirteenth baby, after having been subject to habitual costiveness, was laparotomized because of intussusception. Thus it happened that the mesenteric glands could be leisurely inspected and examined; they were swelled to the size of beans and hazel-nuts.

To prevent the tubercular form, cow's milk and meat must not be administered unless exposed to boiling heat. It is true that there are not many cases of infection by these agents, but the few ought to be avoided. Cream, buttermilk and cheese cannot be submitted to the same preventive measure, and must be used with some caution. The different forms of scrofula ("erethic" and "torpid") must be treated according to the methods discussed in other essays; it is in them that animal foods, malt, iron, cod-liver oil, and cereals without or with milk, are indispensable. Whenever possible, a change of climate ought to be advised. Local tuberculosis in glands or in bones must be extinguished by an operative procedure; and a chronic eczema should be made to heal.

In chronic cases, in which changes in the mesenteric glands can be safely diagnosticated and the existence of tuberculosis excluded, iodides largely diluted may be administered for a long time. The potassium, sodium, and iron salts have their own indications, and may be combined. They are particularly demanded in patients who have previously suffered from the torpid, or adipose, form of scrofula. They may be used externally, in baths regularly given. It is here that natural springs, such as St. Catherine's and Kreuznach, can be employed to advantage. In the tubercular form arsenic ought to be administered in small doses for weeks or even months. Fat (cream, cod-liver oil) does better here than in the simple hyperplastic form, but in every instance we ought to remember that indurated mesenteric glands absorb but a small quantity. Whenever enteritis remains active, the eroded or ulcerated mucous membranes require antifermentative treatment. In that chronic form small doses of calomel are less efficient than bismuth, with or without resorcin, and small doses of opium. Naphthalin and salol

may be tried, but generally are not well tolerated. Nitrate of silver, one-fortieth to one twentieth of a grain every two or three hours, may be given for a week. Counter-irritants have a less happy effect than warm applications (moist or dry) and warm bathing. As may be judged from the remarks I made on laparotomy in connection with peritoneal tuberculosis, it cannot be recommended as a remedy until many more unbiased observations shall have been gathered. In ascites paracentesis must not be performed unless urgently required, for many a case has been absorbed without any surgical interference.

CASE OF SEPSIS IN A NEWBORN INFANT

G., MALE, 862 Park Avenue, was seen at 9 p. m., April 5, 1905, with Dr. Baran. Is the third child of the family. No miscarriage. First child was an eight months baby; died on the second day. Mother had been sick and under treatment for several months previously. Second child was delivered by Dr. Baran, and is in good health. No family disease, particularly no hemophilia.

History.—No written records were kept. The following history was elicited from the physician: Nothing was noticed until the fourth day. Then heavy uric acid infarctions were discharged. That lasted until the eighth day. It recommenced on the ninth and lasted to the tenth day. Urine was pale on the eleventh. No examination was made. Quantity fair. Circumcision on the eighth, with no accident. Purpuric spots of small size were seen on the extremities on the ninth day.

Hematuria appeared on the twelfth and continued. On that day a consultant was called in. He found what has been described, and both kidneys swollen. Is reported to have diagnosticated tumors of both kidneys.

The cord fell off on the fifteenth day, April 4th. Was seen by me on the sixteenth, April 5th, 9 p. m. Air of room good; window had been kept open; bedding clean; plumbing appears to be in order. Mother in fair health; sitting up; has no fissures in her nipples. No history of tuberculosis, or syphilis. Baby still weighs nearly six pounds; is said to have lost considerably. Mouth and nose normal; lips dry; somewhat fissured in the corners. Ears appear negative. No diarrhœa. No malformation. Purpuric spots, small and large; some with slight elevation of the surface, over chest and epigastrium; some on face, shoulders, arms, fingers. Some painful livid elevations (suggesting the presence of pus in the deeper tissue). Icteric discoloration not noticeable in gaslight; is reported

to be trifling. The liver large, as usual at that age. The spleen was not felt; percussion negative. The right kidney was not felt. The left kidney felt like the size of a hen's egg, hard and smooth. Respirations about 60; pulse 200; temperature 104.5° F. Heart negative. Umbilical stump has some bloody oozing; is covered with some boracic acid, with which it has been dressed all along. The condition of the child appeared to warrant no close examination of the lungs, nor of the blood; no vein being in view or accessible under the circumstances. The baby died the next day.

Autopsy at 9 p. m., six hours after death. Surface as described in the living; some of the spots paler; some more livid. A moderate amount of serum, tinged with blood, in the pericardium. On it numerous petechiæ. Heart negative; thymus small, negative. Four of the lobes of the lungs have disseminated hemorrhages; some quite superficial, pleural and subpleural; some infarctions, mostly triangular of $\frac{1}{2}$-$\frac{2}{3}$ cm. in depth. Some atelectatic places in both sides posteriorly. Peritoneum holds a few ounces of blood-tinged serum, and shows a few petechiæ on the abdominal wall. Both costal pleuræ covered with petechiæ, and a few extensive extravasations. Liver as large as normal; negative. Umbilical vein and ductus Arantii, normal; not ulcerated. Spleen small; negative. Stomach exhibits circumscribed blood points in the mucous membrane. Many extend down to the submucous tissue. These changes are mostly found in the pyloric part.

Umbilical stump large; slightly eroded; covered with a scab of coagulum and boric acid. The pelvic connective tissue is black with blood. Both adrenals small; rather more so than normal.

Left kidney enlarged to almost twice its size; dislodged downwards from 4 to 5 cm.; capsule penetrated with blood; some clots between capsule and kidney; no open blood vessel found; capsule also thickened with fat. The upper part of the kidney forms a black, almost uniform-looking mass, which so swells the tissue that fetal lobulation becomes indistinct. The right kidney is similarly changed, but to a far less degree. Section of the left kidney ex-

hibits some small uric acid infarctions which are still held in the pyramids.

A few points are of unusual interest:

1. Uric acid was discharged in large quantities from the fourth to the eighth day; then again from the ninth to the tenth. Small hemorrhages, with or without secondary nephritis, are not very rare after uric acid infarction, but the suspicion that the foreign bodies might have caused the hematuria was soon dismissed.

2. It is certain that almost every floating kidney found in early age is congenital. As this baby had been lying down all the few days of his life, the increase in size should not be charged to the dislodgment of the left kidney.

3. The diagnosis of intra-abdominal tumors, until it be quite positive, should be suspended even in infants and children in whom intestinal contents are rarely misleading. Besides, what we feel inside is exaggerated by the mass at least of abdominal wall which has to be grasped on both sides of the questionable body. The left kidney *was* enlarged by hemorrhage, and was abnormally accessible, and the tumor of a kidney might be suggested by the findings. Still, very few tumors of a kidney ever bleed. Carcinoma does bleed sometimes; sarcoma very rarely; calculi in later life; tuberculosis not in the newborn; cysts and hydronephrosis not at all.

4. The bacteric cause of this sepsis is not known; nor can we know the mode of its invasion. The amniotic liquor and the milk and lochia of the mother should not be accused as long as she was well and other causes cannot be found. The skin exhibited so many changes that its condition one or two weeks previously can only be guessed. The lips were sore at a late date. The umbilical stump was sore and bleeding. The cord had not fallen off before the fourteenth day; invasion is quite possible during that long time of the cutting of the cord (even the very tissue of the cord, unchanged, may admit microbes, or toxins); and boracic acid is probably not a sufficient antiseptic to be applied as a protection to a vulnerable surface like that of the navel.

CATALEPSY IN A CHILD THREE YEARS OLD

Fannie C., aged three years; admitted to Mount Sinai Hospital, New York, September 4, 1879. Some weeks previous to her admission she suffered from headache, for which she was given castor oil. Diarrhœa then set in, and continued; at her admission her pulse was 136, respiration 30, and temperature 103¾° F. The tongue was red at its edges; the spleen was enlarged; she had roseola, very slightly tympanites, and diarrhœa. These symptoms of her typhoid fever continued for some time, with a temperature ranging from 105° down to 101° F. She coughed a good deal.

September 10th. It was recognized that she had whooping-cough, and she was removed from the ward.

16th. It was noted that the diarrhœa was better, and on the 17th she was without fever. On the 23rd her pulse was stronger, and it was hoped that she would then go on to recovery. On that day, however, a slight spasm of the eyelids was noticed. She coughed but little, but cried a great deal. There were râles with slight dulness at the right apex. At 5 p. m. she urinated quite freely, the twitching continued, and her pulse was 102 and weak. She spoke only a little, but cried a good deal during the next few days.

24th. She had passages which contained some undigested milk. Her appetite was good, and she took milk, soup, egg, etc.

25th. At 10 a. m. there was a good deal of twitching of the lids, and also the eyeballs turned upward, tonically; occasionally there was divergent strabismus; but in the night she slept with her eyes closed.

When the arms were lifted up they would remain in any position in which they were placed. When she was directed, in a loud voice, to drop the arms she would

slowly do so. Her legs were in a similar condition, and would remain in the position in which they were placed. The fourth finger, taken separately, remained extended or flexed when placed in either position. The arm could be partly extended, partly flexed with some force, and remained in that position. Still there was some voluntary action left; for when her arms and hands were in a natural position, she would attempt to take a penny from the bedclothes. Her muscular action in general was very deficient. When she was set up in bed, her head fell forward, and then, again, when the arm was lifted vertically, it would remain in that position for minutes, and then slowly come down. During the last three days she passed a large quantity of urine, with a specific gravity of 1020. Her extremities were very cold, and she was indifferent to everything about her; but when she was aroused by strong impressions, even the twitchings of the eyelids would, for a moment, cease.

27th. The patient was a little stronger and sat up in bed. She held her head erect while being fed. The twitching of the muscles persisted. When the extremities were placed forcibly in the cataleptic position, reduction was attended with little pain. The lower extremities were less abnormal than the upper ones. She could stand and walk two or three steps. Sensibility to contact, pain, and temperatures entirely lost. A needle could be run through the skin without eliciting any evidence whatever that it produced pain; tickling the soles of the feet yielded only slight reflex movements; the patella tendon reflex was greatly diminished; her eyes were staring, and her appetite was ravenous.

28th. Easily awakened from sleep; one passage from the bowels; answered questions; anæsthesia and analgesia persistent; conjunctivæ, eyeballs, eyelashes could be touched without giving rise to twitching; sight good; appetite ravenous, and swallowing easy. Pennies occasionally taken from the bedclothes; bowels more constipated than they were yesterday.

29th. Pulse 88; respiration 26; temperature 97° F. Less twitching of the eyelids; patient appeared brighter,

but anæsthesia and analgesia persisted, and the arms were strongly cataleptic; appetite continued ravenous; the pupils were equal, and responded to light; the urine was passed in large quantity, and had a specific gravity of 1020.

30th. Pulse 84; respiration 30; temperature 98° F. Two stools; a small ulceration existing upon one arm began to extend; the patient was very cross; the Schneiderian membrane was very sensitive; slight touch produced sneezing.

October 1st. Pulse 92; respiration 22; temperature 99° F. The cataleptic position of arm was sustained one minute; there was no twitching of the eyelids, and the patient appeared brighter; anæsthesia and analgesia remain unchanged. When an arm was flexed a good deal of strength was required to extend it. Urinated once or twice every hour.

2d. Loss of sensation complete; surface of body and extremities warmer, quantity of urine less, and strength of patient increased.

3d. When an arm was extended or flexed it dropped at once. Reflex movements on pricking with needles.

4th. Pulse 84; temperature 99° F. Four passages from the bowels, for which tinct. opii camphorata was given; anæsthesia and analgesia as before. Four more passages.

6th. Cataleptic position held out one minute. Three passages from the bowels, and opium was increased.

7th. Slept well. Passed a large quantity of urine; slight reflex movements on tickling and pricking the feet. The opium was suspended, and camphor and whiskey given.

8th. Less diarrhœa, and surface warmer. Ulceration on arm looked better. Again Schneiderian membrane and conjunctiva gave reflex movements on tickling.

9th. Patient brighter; anæsthesia and analgesia as before; arm and fingers retained cataleptic position forty-five seconds; urine 1015; no albumen. Pulse 76; respiration 18; and temperature 99° F. A good deal of strength was required, on the part of the attendant, to overcome the cataleptic position while it lasted.

13*th.* Pulse regular; surface warmer; feet still cold; called for drink frequently. Cataleptic condition unchanged.

14*th.* Sat in a rocking-chair.

15*th.* Asked for chamber. On tickling, no reflex; no patella reflex. Cataleptic condition persisted to a slight degree; no twitching of the eyelids.

After this time the general condition of the patient improved, and at about the 20th of October the cataleptic symptoms had entirely disappeared. She was still in bed November 5th, but sat up occasionally; her appetite was no longer ravenous; urine less copious.

The child recovered, but remained anæmic and weak longer than patients recovering from typhoid fever are liable to do.

The only case of catalepsy in a child which has come to my notice besides the one reported by me occurred in a boy of thirteen, who suffered from chorea magna during the space of two years before he died in an insane asylum. His attacks of chorea were very violent indeed, interrupted by intervals of several weeks, in which his convulsive efforts and his psychopathic condition would improve, and would alternate sometimes with brief attacks of catalepsy, with but partial consciousness, diminished or destroyed will power, and the waxy flexility, all of which symptoms were present in my other case, and are claimed to be those of the morbid condition under consideration.

The literature of the subject is by no means inconsiderable, but the cases observed during childhood are but few in number. In his paper, published in Gerhart's *Handb. d. Kinderk.*, vol. v. l. p. 186 *et seq.*, Monti quotes but eleven cases met with in children, male and female in about equal numbers, of from five to fifteen years, the average age being nine years. I know of no case previously reported of a child of three years; in it all the symptoms, psychic indolence, normal or abnormal temperature, cold surface, anæsthesia, analgesia, *flexibilitas cerea,* and diminished patellar reflex (the latter is frequently found intact) were found combined. The increase

of urine during a good part of the catalepsy was a remarkable feature, such as is seen in hysteria of both adults and children. But while it contained no sugar, and nothing abnormal, except large quantities of phosphates, it had the, in children, unusual spec. grav. of 1015-1020.

CONCERNING THE NEGLECTED CAUSES OF INFANT MORTALITY IN THE CITY OF NEW YORK

To the Editor of the Medical Record:

The paper of Dr. Rogers on "Neglected Causes of Infant Mortality in New York," read before the Medical Society of the County of New York, September 14th, has been published in your number of October 1st. The discussion on the same paper, which took place in the same Society in the adjourned stated meeting of October 12th, I find reported in your number of November 16th. Now, Mr. Editor, I take the liberty of addressing you on the same subject, begging your pardon for so doing, inasmuch as I might have had an opportunity of discussing the paper for its merits or faults before the members of the Society. But it so happened that I could not be present at either of those meetings; and therefore, as my name has been mentioned in connection with the subject, and, moreover, as I take a deep and personal interest in the topic discussed, I ask you to publish a few remarks which, perhaps, may be found available.

Dr. Harris speaks of the paper in anything but a commendatory manner. He says that "the discourse itself fails to supply the groundwork that is requisite for a proper discussion of the subject. It deals with the most important questions in an *ex cathedrâ* style; it deals largely in denunciations; and many of its statements are incorrect, its use of statistics is inaccurate, its deductions are unjust, and its arguments, like its style, are calculated to do harm." These are severe imputations, and, if true, every lover of scientific facts and public welfare has to be sorry for the publication of the essay in a scientific journal, and a number of secular papers which I have been told have been supplied with long and elaborate ex-

tracts right after the paper had been read before the Society. However, Mr. Editor, I do not mean to blame you for the literal publication of Dr. R.'s paper, no matter whether Dr. Harris is wrong or right. Every one who would undertake to underestimate the importance of your publishing it would certainly be quieted by the vote of thanks to the editor of the New York *Medical Record,* moved by the author of the paper himself.

After the discussion had taken place I was told by good authority that "never a paper was riddled like this." That may be, as far as the discussion went; still, a large portion of the paper, I find, has not been discussed at all. Thus, if this undiscussed portion is beyond fault and blame, Dr. Rogers may take his share of the blame and still rest on his laurels. Nobody, it appears, touched a number of subjects brought forward by the author, and still they are of a nature to require discussion. Maybe that they are unimpeachable or that the discussion appeared either useless or untimely in such a connection.

My reason for interfering with the natural death of the paper of Dr. Rogers is partially a personal one; more, however, am I compelled to address you from a feeling of duty toward the medical public and the County Medical Society. If, as I hope to show, the paper was unworthy of the Society or any member thereof, such a fact ought to be stated and proved; and if I have been mentioned as the author of (part at least of) the "Rules for the Management of Infants," which Dr. Rogers attempts at ridiculing, I believe I have a right to defend my views. I assume this right for the further reason that Dr. Stone is reported, on page 427, to have, as it were, tried to excuse the existence and publication of those "Rules." I shall try my hand at no excuse, but shall explain and justify.

I should not express my correct opinion if I did not emphasize the fact that I consider Dr. Rogers' lecture on "Neglected Causes of Infant Mortality" a remarkable paper. The pathological effect of heat, the importance or non-importance of malarial effluvia, the efficacy of disinfectants, the sprinkling of streets, a discourse on the proper food for infants and on the "Rules for the Man-

agement of Infants," the physiology of infant digestion, the physical history and the theory of the articles and mode of dressing, the comparison of cow's and condensed milk, ventilation, "canards," the Infant Hospital, and grand-jury presentments on private nurseries—all in one paper, read in a single meeting and published, with the publicly voted thanks of the author, in a small part of a single number of the New York *Medical Record*—I must confess that I stand aghast at the historical fact that all these subjects can be discussed in one dictatorial, prophetical, sneering article. If all these themes can be discussed with this particular air of an almost religious persuasion, in a single paper, subjects each of which has strained the minds of acute and learned authors for many years, I expect the rest of the sciences and arts (say, astronomy, theology, law, Nicolson pavement, fire escapes, and tubarian pregnancy) thoroughly exhausted in the next to appear. And why not? The doctor spends half an hour in the Infant Hospital and knows it all by heart, while I must confess, Mr. Editor, that after I had spent many an hour, on twelve or fifteen different days in the course of a month, in the same institution, I felt almost unwilling and not thoroughly enabled to write the report required by and promised to the Commissioners of Charities and Correction. The doctor finds in literature the report of an infant perishing while being fed on plain arrowroot, and he concludes that he and Divine Providence in their wisdom ought to prescribe cow's milk. The doctor learns that the Board of Health emphasizes, because it is "the fashion," the pernicious influence of malarial effluvia, and from this fact he "more than suspects" that these aërial causes are overrated by the authorities.

It is my intention, Mr. Editor, to confine my remarks especially to that part of Dr. Rogers' paper which is meant to controvert the rules for the management of infants. It has been stated publicly that I was the author. Now, most of the nine rules are mine, some of them verbally. It was the intention—mine and that of others—that these rules should be spread on handbills and through the newspapers "among the poor and the working classes,"

as directions from the Board of Health. I have good reason to believe that some objection was made to them, not, however, from a scientific point of view; nevertheless they were spread in the well-known form, through the papers, without my doing anything in the matter, and I know they have done some good. As these rules were not the result of a whim, but of study, experience, and scientific facts, and as every one of them has been attacked and ridiculed by Dr. Rogers on the pretence of their being unscientific and injurious; as, further, physiology, chemistry, and literature have been pressed into the service of the reviewer, I hold it my sacred duty to explain and to refute. I hold it also my sacred duty to investigate the physiological knowledge of a medical man who sneers at every thing and every fact he has not done or stated. If I shall succeed in proving, as I mean to do in a short review, that Dr. Rogers has stated his imagination as facts, his wishes as chemistry, and his mistakes as physiology, I think I shall have done my duty and nothing else.

Before applying to my task, Mr. Editor, let me allude to some specimens of Dr. Rogers' physiology, in order to show the manner of his reasoning and the thoroughness of his views. The doctor speaks, on page 337, of "solar heat as the cause of disease and death," which "ought to be studied in, first, its relation to our annual infant mortality, and, second, in its destructive effect upon the adult and upon the lower animals," on the latter of which he promises future elucidations. Now, Mr. Editor, I do not see why the effect of a single agent, with mostly well-known qualities, why solar heat should act on different principles in the infant or in the adult or in the brute animal. These qualities can be imagined to show minor differences, according to the bodies acted upon, but their physical effects must necessarily be the same. The doctor states himself that the depression of the vital forces produced by heat is equally applicable to feeble adults as to infants. But let us see how, according to Dr. Rogers, heat destroys the life of our infants: First, by directly depressing their vital forces. Second, by producing harassing and exhausting cutaneous diseases which torture and

"poison to death" the already enfeebled frame of "the little sufferer." Third, by its deteriorating effect upon much of the food habitually given to the infant and young child, whether taken from its mother's or other breasts or from the markets. Fourth, by the generation of malarial agents. The latter Dr. Rogers thinks but little of as a cause of death, because it is "the fashion" of the Board of Health and others to exaggerate it. The third may be obviated, I believe, unless the heat of the summer interferes more with the wholesome nature of the food "taken from the mother's breast" than I am aware of, or Dr. Rogers is able to prove. The second sounds more sentimental than scientific, is more apt to touch feminine hearts with the "poisoning to death" the "little sufferers," and the "enfeebled frame," than it will convince the medical reader of the truth of the assertion that children are killed by solar eczema, or strophulus, or any kin form of dermatitis from the same cause. And the first injury and death by "direct depression of the vital forces" reminds me of a certificate of death I had the intense pleasure of seeing a number of years ago, which stated the cause of death in a given case to be "deficiency of life."

Physiological experiments and physical science happen to prove a little more than Dr. Rogers appears to be willing to teach. In a temperature of 104°, animals, unless they are given water and food, will die within two or four hours. Their own temperature would first sink, then rise up to 113°, and death would set in after the symptoms of languor, sleepiness, convulsions, sometimes tetanic, and coma would have made their appearance (Obernier). Such are the symptoms when the high temperature is combined with moisture (Delaroche), the animal temperature being apt to rise beyond the external temperature.

By moderate increase of temperature all organic processes, especially those of the nerves, are stimulated and excited, but, beyond a certain limit, the physiological functions are disturbed. It requires but a few degrees above the normal temperature of the blood to destroy the functions of nerves, muscles, blood corpuscles, and glandular cells, in consequence of partial coagulation of the soluble

albuminous substances (myosin and others) contained in the fluid constituents of the tissues. This occurrence takes place at 104° in fish, at 120°-122° in mammalia, at 127° in birds.

Such degrees of temperature, however, are not observed under common circumstances. But the *modus operandi* of heat is regulated exclusively by its physical qualities, the principal one of which is expansion—expansion of everything, both inorganic and organic. Expansion of the air we inhale results in the lessened supply of oxygen to the lungs in the deficient oxygenation of the blood, in retention of carbonic acid and other excrementitious matter, in the getting up of poisonous symptoms, first of an excitant, then of a depressing order. In fact, we observe a number of cases, depending on heat only, which look very much like uræmia. For every one of my professional readers remembers cases of death with no signs of hæmorrhage or inflammation of the brain to be found on the post-mortem table; they are positive proofs of the fact that in many of them the cerebral symptoms are but secondary to the primary disintegration of the blood. Moreover, we do know that in many of such cases of *coup de chaleur* the lungs are the first to be affected.

Expansion of the blood vessels will result in local hyperæmia and in generally retarded and feeble circulation, in œdematous effusion and consecutive paralysis of the muscular tissue.

Expansion of the blood itself and the gases contained in it must interfere with the nutrition of the body as a whole, and of every single organ.

Above 80° of atmospheric temperature the radiation of animal heat from the surface is stopped, the normal and requisite refrigeration of the system does no longer take place from this source, and this prerequisite for normal metamorphosis is gone.

Thus, Mr. Editor, the effects of heat on the animal system might be counted up to some greater length. I might do so from the usual stock of physiological knowledge at the disposal of every fairly informed medical man; but what I have said will be deemed sufficient to

prove that Dr Rogers might have improved upon his etiological explanations.

To what extent the "Rules for the Management of Infancy," if spread amongst the population, could have been beneficial, I must leave to the profession to judge. In my original copy they read as follows—I print them here for comparison with those copied in Dr. Rogers' paper:

If you nurse your baby:

Do not nurse your baby oftener than every two or three hours.

Do not nurse a baby of more than six months oftener than five times in twenty-four hours.

When thirsty in the meantime, give it cold water; in hot weather mix a teaspoonful of whiskey with a tumblerful of water.

If you cannot nurse your baby:

You cannot bring it up without milk.

But the milk (cow's milk) must not be given pure, nor with water.

Boil a teaspoonful of barley, ground in the coffee mill, with a gill of water and a little salt for fifteen minutes, then add half as much boiled milk and a lump of loaf sugar, and give it lukewarm from a nursing bottle.

Bottle and mouthpiece always to be kept in water when not in use.

Babies of five or six months, half barley water and half boiled milk, with salt and loaf sugar.

Where the bowels are costive, take farina instead of barley flour.

Where they are very costive, take oatmeal gruel, strain it before mixing with milk.

When you have but half enough breast milk, use the same food. Give the food and the breast alternately, so that your milk has time to get fit for your baby to take.

You may give beef tea or beef soup mixed with your barley or farina or gruel to babies of five months and older. When ten or twelve months old, a piece of rare beefsteak every day to suck on.

No child under two years ought to eat from your table.

Summer complaint:

When babies throw off and purge, give nothing to eat and nothing to drink for at least four or six hours. After that you give a few drops of whiskey in a teaspoonful of ice water now and then, but *no more,* until you have seen the doctor.

Stop giving milk at once.

Give no laudanum, no paregoric, no soothing syrups, no teas.

When you see the doctor, trust in him and not in the women. They do not know better than you do yourself.

Thus I do not deserve any credit for the second "rule," as appearing in Dr. Rogers' paper. It is evidently added by some thoughtful mind, and reads as follows: "Use light flannel covering of chest and bowels at all times, and other clothing to suit the change of weather." Dr. Rogers is indignant at such an advice and flings at it the following "neglected" physiology:

1st. Nature's means of preventing the overheating of the blood and structures of the body is the evaporation of perspiration from the surface.

2d. Woollen fabrics directly oppose the process of cooling. Therefore they oppose Nature, are unscientific and inhumane.

3d. The true condition of an infant in very hot weather is perfect nudity.

4th. As a compromise it may endure a covering of the lightest *linen* or well-worn *cotton* fabric, which readily becomes moistened by the perspiration, *and thus* by evaporation acts as a cooling wet sheet.

I state at once that his further advice of sponging the children from head to foot in tepid water during the hot season cannot be objected to. It is a fact that such advice has not been given in the "Rules," which, however, were not meant to contain *all* the rules necessary or available in the management of infants. Nor are the doctor's rules all-comprehending and thoroughly satisfactory. For I must confess that I should not feel capable of sustaining his order that the child, at all ages, "were allowed an unrestrained run to iced Croton water" as a drink. My criticism would be as long as Dr. R.'s paper if I should

attempt at here ventilating this question, but I may be permitted to ask why the surface, which needs cooling by all means, should be sponged with tepid and the stomach be drowned in ice-cold water.

But we have to deal with " Rule No. 2 " and its criticiser. To the doctor's first sentence I take no exception. Those objections, however, which I entertain to the rest will become apparent by the following considerations and their comparison with Dr. Rogers' autodidactic ideas on perspiration, evaporation, flannel, and linen " or " cotton:

The purpose to be obtained by dressing consists in *the regulation of the normal cooling process,* the radiation of heat. This purpose is obtained in cold weather by moderating and equalizing the motion of the atmosphere near the surface of the body, and further by the low conducting property of many of the materials used as wearing apparel. But these are not the only physical conditions which determine the differences of the action and value of our clothing. I allude to the hygroscopic qualities of different articles.

Equal weights of wool, cotton, and linen harbor different quantities of water; wool more than cotton and twice as much as linen. Moreover, linen allows the water it contains to evaporate much sooner than wool.

Thus the perspiration of the surface is slowly soaked up by flannel, is slowly and uniformly evaporated on the outside of the flannel, and leaves the skin nearly dry. No perspiration collects on the skin; but little evaporation takes place on the skin itself; no sudden change in its temperature is observed. Nothing is more dangerous than these sudden changes of the temperature of the surface; and my professional readers will admit that cases of bronchitis and pneumonia, not to speak of intestinal catarrh, are never more frequent than during the very hottest season. It is not the perspiration which results in sickness, but the rapid refrigeration taking place on the very surface of the skin in consequence of rapid evaporation. Flannel covering the human surface acts like another cutaneous integument for the protection of the original one.

Linen is not so hygroscopic as flannel. It does not soak

up and retain, for a slow and uniform evaporation on its own surface, the perspiration of the skin. Moreover, evaporation takes place more rapidly from linen, and therefore, it cools more suddenly than flannel or cotton also. For this reason it is worn in summer. It is agreeable and comfortable for the moment, and when you have a good reason for believing in the constancy of the weather and the high temperature and the absence of wind or draught. As soon as, by a sudden change of temperature or by a draught, evaporation will take place on the skin as well as on the linen, the cooling process is too rapid and results in disease. Therefore, many people with common sense will compromise between flannel and linen, and select cotton in the hot season, as it modifies the extreme qualities of either. Whoever is subject to copious perspiration will not be satisfied with cotton, but select flannel to cover his surface.

Much of the comfort and advantage obtained by our articles of dressing depend on their permeability by the atmosphere. Flannel is nearly twice as permeable as linen. Now add to this that this permeability by air is interrupted by soaking the articles in water, and remember the fact that linen is so easily soaked. If you do you find an explanation for the uncomfortable sensation and the unwholesome consequences of a wet linen sheet on your body. It is the same sensation which is felt on rendering the skin impermeable by shellac or india rubber, or noticed even by expert swimmers after they have been in water for hours. Perspiration is checked and congestion to internal organs—lungs, liver, and intestines—commences. The use of the oil-silk jacket, too, in internal diseases appears injudicious, for the moistness of the skin is not the result of increased cutaneous action, but it is due to local condensation and consecutive suppression of perspiration from the impermeability of the covering.

The sudden refrigeration of the wet skin and the wet linen is dangerous because of the sudden diminution of the body's temperature. Pettenkofer has studied the effects of wet feet, with the following result: If you get your woollen stockings wet to the amount of only 1½

ounces of wool, the amount of heat necessary to dry this small quantity, which must be supplied by the system unless you change your stockings at once, would be sufficient to melt half a pound of ice or to heat half a pound of water from 32° to 212°.

I hope, Mr. Editor, Dr. Rogers will look at his linen *or* cotton theory with a little less satisfaction than before. At all events, even they differ greatly in their qualities; and, further, a fabric which "becomes readily moistened by the perspiration" will no longer, "thus by evaporation," act as a cooling sheet, nor will flannel henceforth "check perspiration and directly oppose Nature."

I have tested Dr. R.'s physiology in some important points, and it has appeared that there was something "neglected" in his solar-heat and flannel theories. I have now to turn my attention to some other "rules," three of which have attracted the good or ill will of the critic. Now, No. 9 is approved of. The advice given to a mother to send for a doctor in case of necessity evidently strikes him as good and practical, "as it is just what the parents would do in any case." I hope the parents will ring the bell of a practitioner with a tolerable stock of physiology.

Rule No. 3 is an abomination in itself. No matter whether that printed on page 339 or the one proposed by me is in question, the doctor is disinclined to obey it, because "a model mother and estimable lady," who, not having breast milk enough for the baby, fed her child on Winslow's soothing syrup instead of additional nourishment, had "the absurd impression" that infants ought to wait two hours before taking another meal, and kept the infant hungry until the doctor, who was sent for as Rule No. 9 ordains, told her that the fact of the baby having taken food an hour and a half before had nothing to do with the child's desires. And thus the child's "colic" was cured at once.

An infant is entitled to a sufficient supply of food. Therefore, if breast milk is secreted in insufficient quantity, artificial food has to be given. If the baby is hungry it will cry, surely. But when the baby does cry it is not always from hunger. To the contrary, the causes of a

baby's crying are very numerous, so numerous, indeed, that many an author has thought it worth his while to write elaborate articles on that subject. Nothing is more customary than to mistake every crying spell of an infant for the expression of hunger, and nothing more common than that the mouth of an uneasy, frightened, annoyed, pinched, pin-stuck, rachitic, wet, dirty, sore, or feverish baby is closed with the nipple. Nothing more common than that the thirst of an infant is made the pretext for feeding it as if an adult who requires water, and asks for it, was satisfied with corned beef or beef tea.

The cases where babies have to wait for their meals too long are certainly the exception; those where they are fed too frequently, the rule. If a mother has not got enough for her baby, if the baby has to go to sleep half-satisfied, it will awake and cry and require the breast, and certainly is entitled to it. But this is altogether wrong, as the supply itself ought to be made satisfactory. It is the more wrong as direct injury will follow the too frequent sucking. Mr. Thomas Ballard has written a book[1] to present his theory of the cause of the diseases of infants and puerperal women, in which he states that in his opinion a large portion of the diseases of young infants—viz., affections of the skin (erythema and urticaria from gastro-intestinal disturbance), thrush, nervous disorders of all kinds, and intussusception of the bowels—are due to "fruitless sucking." One mode of fruitless sucking is the nursing from empty or incompetent mammary glands. And whoever knows that "the excitation of the nerves of taste produces an abundant reflex secretion of gastric juice and also a flow of bile and pancreatic juice in the bowels" (Brown-Séquard), will admit that Dr. Ballard is right in many respects. And, moreover, it is a well-known fact that, the whole alimentary canal being a single and coherent tract, motory efforts of the upper portion give rise to peristaltic action in the lower. Thus the ali-

[1] "A New and Rational Explanation of the Diseases peculiar to Infants and Mothers, with obvious suggestions for their prevention or cure." By Thomas Ballard. London, 1860, pp. 128.

mentary organs of a baby who, no matter whether to its satisfaction or dissatisfaction, is fed too frequently, will never be at rest, and, no matter whether the consistence and constituents of the food are correct or not, the very existence of increased peristaltic motions gives rise to diarrhœa and consecutive disorders. Thus if there be a child that claims more food than the mother's breast can afford to give, it will not suffice to give it possession of the nipple to drink from it thin milk and muscular exhaustion, but the indication is to so add artificial nourishment to the natural one that the baby will have enough each time, and after each meal will require a normal time for rest and digestion.

The normal time for rest between meals and for the digestion of a satisfactory meal in a young infant experience shows to be from two to three hours. Habit may change this to a certain extent. You may prolong the intervals, for instance, in the night, or you may shorten them by compelling the infant to take food whenever it shows any sign of uneasiness. A child may have "colic," not from hunger, as in Dr. Rogers' case, but from flatulence depending upon the incomplete digestion of the too copious food, and scream. It will be fed to stop its crying, and oil is thrown into the fire. Such things are so thoroughly known as, unfortunately, the common rule that I save my readers further remarks on my part. But I insist upon the fact that the "desires" of the infants are generally either no desires or their character is misunderstood; that, more than heat and hunger and changes of temperature together, overfeeding, too frequent feeding, is the cause of the large majority of the digestive and consecutive disorders of infants. I have to stop here, because the further elucidation might fill a volume. Therefore, a rule *is* necessary and ought to exist for timing the intervals in which infants are to be fed, provided the food is normal and in sufficient quantity. A rule may have its exceptions, but it is given for the most possible good of the largest possible number.

It will hardly be denied that irregular feeding is mostly overfeeding; that it may and will result in vomit-

ing, catarrh of stomach and intestines, subsequent congestion and swelling of the mesenteric glands, flatulence, enlargement and hypertrophy of stomach, with all the consequences of impaired digestion; for the rest of the physical and mental functions need no particular illustration. But this is not all. If there is danger in irregular feeding and overfeeding (simply because a child has or appears to have the desire) to its physical welfare, there is just as great a danger to its moral development. The time and mode of feeding infants is the first means of their training, their education; in fact, education has to begin with the first day of life. It is not true that there is plenty of time in later life to commence education, for the groundwork of all our education, all our morals, is habit. The attentive observer, professional or unprofessional, is aware of the facility and rapidity with which bad habits are contracted, and how soon infants will learn how much they can gain by screaming and naughtiness, or whether they can influence their attendants by the expression of their desires or caprices. The preparatory stage of mental actions, the function of the senses, is to a considerable degree developed with the moment of birth, and the old "nihil est in intellectu quod non antea fuerit in sensu" requires early attention to the first simple rule—regularity and punctuality in the management of the newborn or young infants in order to develop their "intellect" and morals on a sound basis. I hope, however, to discuss at some other time the question of the necessity of early training and of the beginning of infant education on the very first day of life, in connection with the peculiarly rapid and interesting development of the concourse and centre of the sensory and all other nerves—the brain. My readers will pardon me, therefore, for dropping this subject here and directing their attention to the "delectable" (cf. *Medical Record,* page 341) physiology displayed in Dr. Rogers' criticism on "Rule No. 4."

A number of questions, commencing with "we wish to know," and followed by "let us see" (p. 340), I shall answer after having examined, in a few words, Dr. Rogers' fitness for the place of criticising apostle of infant

diet. "Let us see." Dr. Rogers—who, by the bye, is still clinging to the antiquated theory of Liebig's, of exclusively heat-making and exclusively tissue-building materials, proteinous substances being the first, and amylum amongst the latter—declares "barley to be a vegetable substance very poor in plastic or building material." This is ludicrously wrong, as the doctor might have learned from any text-book on organic chemistry or physiology in the hands of a first-course student of medicine. I quote from one. There are (in 1,000 parts):

Albuminous substances: In wheat, 135; barley, 123; rye, 107; oatmeal, 90; Indian corn, 79; rice, 51.

Amylum: In rice, 823; Indian corn, 637; wheat, 569; rye, 555; oatmeal, 503; barley, 483.

Fat: Indian corn, 48; oatmeal, 40; barley, rye, wheat, rice, but little.

Salts (principally phosphates): Barley, 27; oatmeal, 26; wheat, 20; rye, 15; Indian corn, 13; rice, 5.

Potassa is mostly found in wheat, magnesia in wheat and Indian corn, lime in oatmeal and barley, iron in barley, phosphoric acid in barley and wheat. From these figures Professor Moleschott (of Zurich, Switzerland; Turin and Florence, Italy) concludes that amongst all the vegetable substances fit for digestion and assimilation, and the support of the human organism, none is more so than barley. It is true he had not read Dr. Rogers' assertion, based upon "experience, physiology, and common sense" (p. 340), that "barley is a vegetable substance poor in plastic or building material." From his investigations Professor Moleschott arrives at the conclusion that eleven hundred grammes of barley (thirty-six ounces) are sufficient to sustain a hard-working adult man. I will add at once a very important advantage of barley over the rest of the above-mentioned vegetables, which is this: that it bears the removal of the husk after grinding better than any other. The large proportion of the proteinous substances in wheat and rye is deposited in the inner layer of the husk, which generally is not used (Payen). It is different in barley, where the protein is spread in equal

proportion through the whole grain. Thus the husk can be removed, the consistence finer, without diminishing the nutritive value of the constituents. Evidently the results of modern chemistry and "physiology" have now and then confirmed the "experience and common sense" of olden times, for even old Van Swieten (iv., p. 644) speaks of "potus nutriens dilutus, ut *hordei vel avenæ* decoctum, tertia parte lactis recentis admixti."

"Let us see" further. Dr. Rogers says that "barley contains *dextrin,* a substance which even in the adult is difficult of digestion, and, *a fortiori,* must be so in an infant" (p. 340). And again he emphasizes dextrin as "indigestible." Physiology says, to the contrary, that fresh saliva has the faculty of transforming starch and dextrin into sugar. The transformation of dextrin into sugar is so rapid, indeed, that hardly any dextrin is ever found unchanged below the duodenum. Moreover, the existence of dextrin, not only of such as is performed in the food, but also that which is transformed from starch, is both so important and so easily influenced that the facility of stomach digestion greatly depends on it. The experiments of Maurice Schiff, of Florence,[2] prove that the formation of gastric acid, especially lactic acid, principally devolves on dextrin.

Again, Dr. Rogers assures us that the casein of barley is "insoluble." What this means we are at a loss to understand. For physiology teaches that the cellulose of the casein of the leguminosæ, and of the albuminate of the cerealiæ, are rendered soluble by fine grinding and dissolved by cooking, and that both the casein and the albuminate are digested in the gastric juice. In fact, the casein is probably nothing else, according to the investigation of F. Hoppe, but an albuminate of potassa.

Further, Dr. Rogers, speaking of some observations of Guillot's concerning artificial feeding, alludes to substituting "for the milk some farinaceous substance, made fluid by boiling arrowroot, gum arabic, rice, or some simi-

[2] "Leçons sur la Physiologie de la Digestion, faites au Muséum d'Histoire naturelle de Florence." 2 vols., 1868.

lar substance in water." Where the similarity is to be found between arrowroot (amylum, mostly) and gum arabic, Dr. Rogers is surely unable to determine. Physiologists know that gum is not absorbed, or in a very small quantity only, and that the lining membrane of the intestine is simply covered and smoothed by it. But still Dr. Rogers has the naïveté to assure us that Dr. Guillot "was struck with the uniform presence in the bowels of a jelly-like substance. Upon analysis this substance was found to be nearly pure starch." I confess that I also am "struck" with the novelty of the fact that gum, when introduced into the intestine and analyzed, is recognized as pure starch. It requires an innocent mind, and one not spoiled by chemistry, to believe it.

From the supposed results of Dr. Guillot's experiments, made on sick children, while Dr. Rogers speaks of the diet of the healthy, he concludes that "it would therefore appear that the infant, whose salivary apparatus and whose teeth are not developed, has neither his gastric, nor duodenal, nor other intestinal glands ready to digest the starchy substances of a farinaceous diet." From this remark it is evident that Dr. Rogers believes that the reason why amylum is not digested by the gastric, or duodenal, or intestinal glands—they being not "ready" yet—must be sought for in the tender age. But, as far as I know, these glands have neither in the infant nor in the adult anything to do with the digestion of starch. Physiology sustains me in this opinion. And here again it is the doctor who makes a serious mistake; for it is more than doubtful that anywhere the intestine contributes to the digestion of starchy material. To the contrary, whatever amylum has not been transformed into sugar by saliva, either in the mouth or in the stomach, is thus changed by the pancreatic juice.

The secretion of the pancreas has three distinct functions:

1. Transmutation of albuminous substances into peptone.
2. Changing fat into an emulsion fit for absorption.
3. Transformation of starch into sugar.

The fact that a writer of Dr. Rogers' experience and knowledge is not acquainted with this fact does not disprove the results of Claude Bernard's and others' experiments. The pancreatic juice is, in fact, much more efficient than saliva; it digests amylum as well raw as cooked; and while for an immediate action it requires a temperature of 95°, a lower temperature will not be an impediment to its efficacy. Even the presence of bile and acid gastric juice cannot stop its action.

"The salivary secretion of the child is little or nothing." Which of the two it is—"little" or "nothing"—Dr. Rogers does not say; but in order to carry his point, he appears to believe "nothing," and reasons accordingly. But the fact is, that it is "none" in very young infants under four months; the youngest infants in whom saliva has been found being forty-one days old. After that period there is plenty. Thus the pancreas in very young infants, pancreas and salivary glands in infants over four months, perform the function of transforming into dextrin and sugar such amylum as will be introduced, in limited quantities, into the system of an infant. The physiological effect of the saliva, as it is shown in the transmutation of amylum into sugar, is due to a substance—first, I believe, isolated by Cohnheim—called *ptyalin*. It acts rapidly and on proportionately large masses, like a fermenting agent, not only as long as the mixture is alkaline, but also when it gets slightly acid. Thus its action is not interrupted by the normally acid secretion of the stomach. Ptyalin is found in all the salivary glands of man (not in the parotid of the dog), and it is not decomposed by acting on the substances undergoing digestion, exactly like the rest of fermenting agents.

Thus, there can be no doubt in any unprejudiced mind that a reasonable amount of amylum will be digested in the salivary and pancreatic secretions of the infant. It requires an unusual straining of logic to deny it, just as it manifests a singular desire for levelling nature, which is so much in the habit of diversifying and multiplying, to look upon barley, arrowroot, rice, gum arabic, and other "farinaceous" substances as similar or equivalent.

In consequence of such a "deep-rooted delusion" (p. 341), Dr. Rogers, in order to present the most forcible aspect of his pleading, relates the case, reported by Routh, of a woman who succeeded in systematically killing her sixth child by feeding it on nothing but "the best arrow-root that could be procured." Neither the physiology of infant digestion nor the "Rules for the Management of Infants" claim any blessing or advantages for unmitigated amylum poisoning; and the somewhat malicious unction with which the case has been reproduced speaks for (or against) the reasoning of a man in whose good-will I have the courage to believe, and "whose heart is in the case" (p. 344), unpolluted by physiology and chemistry.

Now, Mr. Editor, I believe I have tried your patience long enough; but, for a consolation, I think I have done, at last, with the author of "Neglected Causes of Infant Mortality." I "exonerate our respected friend, however, for his utterances of manifest falsehoods, for he undoubtedly supposed that the sources for his data were reliable" (*v.* Dr. Rogers on p. 343, first column). But I do not exonerate him for contradicting himself on his own ground, and, moreover, committing the same sins for which he blames the Board of Health, and the "Rules." For instance, he protests against such "loose direction" as "a little salt" and "a lump of sugar," and complains at not receiving any instructions how much a little salt to a pint of food would be, or how big "a lump of sugar" must be added. This is all very well. But then a man who has nothing but blame to express and nothing but fault to find, must not, "of course, recognize the appropriate addition of water to the milk of cow, and the addition of a proper amount of sugar, especially the sugar of milk, and of common salt, and of lime or other alkalies." For he exposes himself to retaliation by being questioned about what is the "appropriate addition of water," or the "proper amount of sugar," of "common salt," of "lime," and of "other alkalies," and which alkalies he means. Moreover, the very same writer, who first protests against "loose instructions," and, secondly, has nothing but loose instructions to give, has the ingenuity, or the weakness, to in-

sist upon the "freshest and most natural milk," without any addition or admixture. Nor do I see more consistency in the fact that one and the same writer should absolutely insist upon the Infant Hospital to have milk which not even should be transported, and on the other hand assures us that "no thinking being need be told that the very mixing of the milk is the only true way to secure an average good milk," and that "there certainly never was any material transported into a city of a more desirable character for the food of infants than the Orange County milk and cream supplied by . . . and . . . and . . . and several smaller parties." You will permit me, Mr. Editor, not to copy the names and firms of those business men; they might feel like sending me a Christmas present if I, though involuntarily, gave them "a lift."

If I meant to go on, there would hardly be an end to the list of mistakes, incongruities, and "fallacies" which have slipped into Dr. Rogers' paper. There may be a good many good points in the essay, but Dr. Harris says its *animus* is mischievous; Dr. Castle asserts its facts are misrepresented; and I say its physiology is rather imaginary, its chemistry tolerably antediluvian, and the whole effort "a lamentable failure" (*vide* Rogers, "neglected," etc., *Medical Record,* p. 343).

Finally, Mr. Editor, I beg your pardon for once more addressing you for a special purpose. A criticism is naturally mostly of a negative character. I have tried, though, to alternate my negative expositions and some positive facts, not believing myself justified in trespassing too much, and to no use, upon your space and your readers' time. As I have repeatedly blamed Dr. Rogers' paper for its absolute barrenness, as far as its scientific value is concerned, I request the privilege of being permitted to lay before your readers, in your next number, such facts and opinions concerning the diet of infants and children as have given rise to part of the "Rules for the Management of Infants."

Yours truly,

A. Jacobi.